Online Only Appendix

Characteristics of the included studies

Electronic searching identified 3,964 citations and 1 study was identified from reference lists (Figure 1). We excluded 3,898 citations on title and abstract or detailed review. We could include 67 articles published between 1985 and 2011 (62 studies), reporting data on 363 comparisons in 586,337 participants (eTable 1 and eTable 2). Forty-four articles (n=550,938) were from North America,[1-44] 15 (n=8,838) from Europe,[45-59] 4 (n=3,315) from Asia,[60-63] 2 from Australia and New Zealand (n=3,777),[64, 65] and 2 (n=19,469) were based on an international study.[66, 67] The median study size was 527 participants (range 17 to 220,157). Nineteen articles were published from the same data sources: the HEMO study[2, 3], the US Renal Data System[1, 8, 11, 13, 14, 18, 28, 40, 43], the Canadian Organ Replacement Registry[26, 29], the Dialysis Outcomes Practice Pattern Study[6, 7, 66, 67], and the Fresenius Medical Care data-base[21, 22]. Four publications included potentially duplicative cohorts, which we included separately in sensitivity analyses[6-8, 29]. The median follow-up was 18 months (range, 1 to 144 months). Nine studies (n=1,623) included only persons needing complex surgical procedures (vessel transposition or femoral vascular access),[13, 15, 23, 42, 48, 51, 59, 61, 63] two (n=97) included only HIV-positive persons[12, 16] and one (n=418) included children aged 12 to 17 years.[13] Access type was determined at cohort entry, which ranged between 0 and 90 days after hemodialysis initiation in 14 registry studies.[1, 8, 11, 13, 14, 18, 26, 28, 29, 40, 43, 47, 49, 65] Three study authors provided clarification or additional unpublished data (eTable 3). We could include 209 unique comparisons in summary analyses (n=545,441), and 62 in sensitivity analyses (n=446,621). Eight studies (19 comparisons; n=25,376) compared catheters and arteriovenous accesses combined; we included 6 comparisons in the analysis of catheter versus graft as the proportion of grafts was >60%,[2, 13] and 13 in the analysis of catheter versus fistula as the proportion of grafts was <5%.[24, 26, 48, 51, 54, 56] Fifteen studies[8, 10, 12, 19, 23, 30, 31, 39, 41, 42, 44, 49, 60, 61, 63] reported data on arteriovenous access patency (eTable 4). However, information reported was variable and insufficient to produce pooled summary statistics. Four studies[8, 12, 23, 42] reported adjusted data and the remainder provided only crude comparisons. Survival plots or one to five year access survival probabilities were reported by all but three studies.[39, 44, 49] Eleven studies[8, 10, 12, 19, 23, 30, 42, 44, 49, 61, 63] reported significantly grater patency rates for fistulas then grafts, and two reported non-significant differences.[31, 39]

Appendix Tables

Appendix Figures

eFigure 1: Secondary outcomes: summary estimates for the risk of fatal infections, nonfatal infections, cardiovascular (CV) events, and hospitalization associated with the type of vascular access in persons on hemodialysis

eFigure 2: Meta-regression analyses for the association between all-cause mortality and use of central venous catheters compared to fistulas or grafts, and for the association between all-cause mortality and use of arteriovenous grafts versus fistulas in persons on hemodialysis

Legend: P values for subgroup interaction (effect modification); I2 indicates I^2 statistics; adjustment was considered adequate if at least age, sex, diabetes and cardiovascular disease were accounted for; "Months since 1st dialysis" indicates the interval between hemodialysis commencement and study entry; insufficient data were available for other pre-specified subgroup analyses

eFigure 3: Cumulative meta-analysis for the association between all-cause mortality and use of central venous catheters versus fistulas or grafts, and for the association between all-cause mortality and use of arteriovenous grafts versus fistulas in persons on hemodialysis

Note: We pooled the estimates reported by Polkinghorne et al[65] for the comparison of catheters versus fistulas (3 estimates) and for catheters versus grafts (3 estimates), according to the time spent on hemodialysis when patient were registered; we also pooled the estimates reported by Foley et al[14] for the comparison of catheters versus fistulas and for catheters versus grafts (each with 3 estimates), according to whether the patient has only a catheter, a catheter with a maturing fistula or graft

eTable 1: Study Characteristics

Study ID	Publication Year	Country	Data source	Study start year	Followup (years)	No. of Participants	Age (years)	Male sex (%)	Diabetes (%)	Cardiovascular disease (%)	Eligibility criteria for study entry
Abbott et al.[1]	2003	USA	National registry and survey	1996	2.3	933	-	-	-	-	Medicare eligibility
Allon et al.[2]	2006	USA	HEMO Study (randomized controlled trial)	1995	2.8	1826	57.6	43.8	44.6	80.1	Age <=80 years; no severe comorbidity or Vascular Access problems or scheduled living transplant
Allon et al.[3]	2003	USA	HEMO Study (randomized controlled trial)	1995	2.8	1846	58.0	44.0	45.0	80.1	Age <=80 years; no severe comorbidity or Vascular Access problems or scheduled living transplant
Astor et al.[4]	2005	USA	CHOICE Study (prospective)	1995	3.0	616	58.7	54.2	54.4	46.4	Age >17 years
Ayzac et al.[45]	2009	France	Single hospital center, France	2005	1.0	664	69.5	63.1	-	-	None specified
Bachleda et al.[46]	1999	Czech Republic	Single hospital center, Czech Republic	1986	12.0	418	44.4	53.8	-	-	None specified
Basaran et al.[60]	2003	Turkey	University Hospital	1982	3.0	2950	38.2	58.9	-	-	None specified
Basel et al.[63]	2011	Turkey	Single hospital center	2003	2	147	53	-	52	45	Complex Vascular Access surgery*
Bonomo et al.[5]	1997	USA	Single hospital center, OH	1989	2.0	94	61.0	100.0	62.8	11.7	Males only
Bradbury et al.[6]	2009	USA	DOPPS I and II (prospective)	1996	1.0	4532	62.5	56.3	53.5	-	Incident hemodialysis patients
Bradbury et al.[7]	2007	USA	DOPPS I and II (prospective)	1996	1.0	4802	-	56.3	53.5	51.8	Incident hemodialysis patients
Chan et al.[8]	2007	USA	National registry and survey	1996	3.0	462	-	-	43.3	-	Age >= 65 years with a fistula or graft in use at the time of Dialysis Morbidity and Mortality Study interview
Churchill et al.[9]	1992	Canada	Canadian Hemodialysis Morbidity Study (prospective study)	1988	1.0	347	-	63.7	18.4	31.7	Not on erythropoietin
Coburn et al.[10]	1994	USA	Single hospital center, RI	1988	5.0	81	-	-	-	-	None specified
Colville et al.[64]	2006	Australia	Single hospital center, Perth	2002	1.0	25	-	-	-	-	Hemodialysis patients with confirmed blood stream infection
Dhingra et al.[11]	2001	USA	National registry and survey	1994	2.0	5344	59.2	50.7	43.6	44.5	Age >=15 years; no functioning kidney transplant; no training for self-care
Di Iorio et al.[47]	2004	Italy	Regional Registry	2001	2.0	2201	62.3	52.2	-	-	Prevalent hemodialysis survivors
Ekbal et al.[48]	2008	UK	Two hospitals, UK (retrospective)	2006	1.5	146	78.0	60.9	-	-	Age >70 years, complex Vascular Access surgery*
Elseviers et al.[49]	2003	EU	Multinational registry and survey	1998	1.0	1380	64.0	56.0	-	-	Age >=15 years on hemodialysis for at least 6 months
Eustace et al.[12]	2005	USA	University Hospital	1990	1.5	60	37.8	73.0	3.3	-	HIV+, with/without history of IV drug abuse
Fadrowski et al.[13]	2006	USA	National registry and survey	1999	1.0	418	15.6	53.0	-	-	Prevalent children (12 to 17 years), complex Vascular Access surgery*
Foley et al.[14]	2009	USA	National registry and survey	2005	1	220157	63.6	56	52.8	34	Age >=18 years; national registry
Fong et al.[15]	1992	Canada	University Hospital	1985	5.0	197	49.0	-	10.0	-	Complex Vascular Access surgery*
Funiakova et al.[50]	2004	Slovenia	Single hospital center, Spain	1999	1.2	80	60.5	48.8	-	-	None specified
García Cortés et al.[51]	2005	Spain	Single hospital center, Spain	2000	2.0	32	80.7	37.5	40.6	31.3	Age >75yrs, complex Vascular Access surgery*
Gorski et al.[16]	2002	USA	Single hospital center, NY	1990	1.5	37	41.0	62.0	-	-	HIV+, same surgeon
Hazinedaroglu et al.[61]	2004	Turkey	University Hospital single center	1999	0.5	30	58.9	20.0	-	-	Complex Vascular Access surgery*
Hoen et al.[52]	1998	France	Multicenter prospective study	1994	0.5	985	60.0	60.4	12.1	-	On hemodialysis for >30 days, no bacteremia in last 30 days
Inrig et al.[17]	2006	USA	University Hospital	1996	0.3	106	56.5	46.2	54.7	-	Age >=18 years admitted with bacteremia
Ishani et al.[18]	2005	USA	National registry and survey	1996	3.2	2311	62.2	53.0	54.5	22.5	Incident with Medicare coverage
Kherlakian et al.[19]	1986	USA	Single hospital center, OH	1977	5.0	200	51.5	51.5	25.0	30.5	Initial access procedure only considered
Klevens et al.[20]	2005	USA	Multicenter prospective study	1999	3	8751	-	-	-	-	None specified
Krzanowski et al.[53]	2011	Poland	Single hospital center	2010	1	213	57.4	59	-	-	None specified
Lacson et al.[21]	2009	USA	Multinational dialysis provider	2003	1.0	78420	61.4	53.0	51.9	-	None specified
Lacson et al.[22]	2009	USA	Multinational dialysis provider	2007	1.0	79545	61.6	54.2	53.0	-	None specified
Lee et al.[23]	2007	USA	University Hospital	2000	1.0	110	55.5	51.7	56.3	-	Complex Vascular Access surgery*

Study ID	Publication Year	Country	Data source	Study start year	Followup (years)	No. of Participants	Age (years)	Male sex (%)	Diabetes (%)	Cardiovascular disease (%)	Eligibility criteria for study entry
Lorenzo et al.[54]	2004	Spain	Multicenter prospective study	1996	1.0	538	65.0	62.0	43.0	-	None specified
Maraj et al.[24]	2002	USA	Single hospital center, PA	1990	1.0	32	54.0	44.0	-	-	Infective endocarditis
McCarthy et al.[25]	2000	USA	Single hospital center, MI	1983	1.0	17	63.0	76.4	35.2	100.0	Infective endocarditis
Metcalfe et al.[55]	2003	UK	Multicenter registry based study	1997	1.0	526	64.7	-	-	-	Incident hemodialysis patients
Moist et al.[26]	2008	Canada	National registry	2001	5.0	14809	67.8	58.9	44.5	27.5	Age >18 years, hemodialysis as first form of dialysis
Ng et al.[67]	2011	International	DOPPS I and II (prospective)	1996	0.6	2635	62.5	56	56	52	In-center incident hemodialysis patients >=18 years who received at least 1 year of pre-dialysis follow-up
Ocak et al.[56]	2011	Netherlands	Prospective national cohort study	1997	2	1109	51	58	23.5	-	Prospective multicenter study of incident dialysis patients (NECOSAD)
Oliver et al.[27]	2004	Canada	Ontario provincial database	1994	1	5924	60	63	46	-	Fistula or graft created 3 years before or within 1 year of starting hemodialysis
Ortega et al.[57]	2005	Spain	Single hospital center, Spain	1996	6.0	96	-	-	-	-	Age >18 years, >1 month pre-dialysis care, no diabetes as diagnosis
Pastan et al.[28]	2002	USA	National registry	1998	1.0	7403	58.3	48.4	-	21.2	Prevalent hemodialysis patients
Perl et a.[29]	2011	Canada	National registry and survey	2001	5	31100	68	59	47	35	Registration in the national registry and data availability
Pflederer et al.[30]	2008	USA	Single hospital center, IL	2004	2.0	710	-	-	-	-	None specified
Pisoni et al.[66]	2009	International	DOPPS I and II (prospective)	1996	8.0	16834	-	-	-	-	In-center hemodialysis patients >=18 years
Polkinghorne et al.[65]	2004	AUSNZ	Multinational registry	1999	3.0	3752	61.0	61.0	35.0	39.0	Age >=18 years
Qasaimeh et al.[62]	2008	N. Jordan	Multicenter prospective study	2004	1.0	188	-	51.6	31.9	-	None specified
Schild et al.[31]	2008	USA	University Hospital	1997	10.4	1700	52.0	60.2	38.8	-	None specified
Shariff et al.[32]	2004	USA	Single hospital center, NC	2001	1.0	51	-	-	-	-	Vascular Access infection diagnosed or retrospectively suspected
Stevenson et al.[33]	2002	USA	Multicenter prospective study	1998	3.0	238^	-	-	-	-	None specified
Taylor et al.[34]	1993	USA	Single hospital center, WA	1970	3.0	1897	49.0	54.5	17.5	-	Only surgeries for treatment of infection analyzed
Taylor et al.[35]	2002	Canada	Multicenter prospective study	1998	0.5	1760^	-	-	-	-	Adult hemodialysis patients from Hospital-based (non-intensive care) units
Taylor et al.[36]	2004	Canada	Multicenter prospective study	1998	0.5	186	57.0	-	39.2	-	Adult hemodialysis patients requiring HD for > 1 month
Thomson et al.[58]	2007	UK	Multicenter retrospective study	2004	1.5	265	63.5	51.3	22.3	-	None specified
Tokars et al.[37]	2001	USA	Multicenter prospective study	1997	0.5	796	59.9	-	-	-	Age >=18 years from 7 centers
Troidle et al.[38]	2007	USA	Multicenter prospective study	2003	0.1	72	64.0	53.0	-	-	Vascular Access related bacteremia
Wada et al.[39]	1996	USA	University Hospital	1989	0.1	162	-	-	-	-	None specified
Wasse et al.[40]	2008	USA	National registry and survey	1999	4.0	4854	63.3	53.9	51.0	32.9	Age >=18 years
Weale et al.[59]	2007	UK	Single hospital center, UK	2000	1.5	185	-	-	-	-	Complex Vascular Access surgery*
Winsett et al.[41]	1985	USA	University Hospital	1974	2.0	508	-	-	-	-	Initially successful procedure
Woo et al.[42]	2009	USA	Single hospital center, CA	1998	6.5	358	-	-	-	-	Complex Vascular Access surgery*
Xue et al.[43]	2003	USA	National registry	1995	3.0	66595	75.0	49.3	37.9	-	Initial Vascular Access of incident >=67 years
Zibari et al.[44]	1988	USA	University Hospital	1981	1.0	230	52.0	44.0	-	-	None specified

Legend: Cardiovascular disease includes coronary artery disease, heart failure, peripheral vascular disease or cerebral artery disease as defined in the primary studies; Patient N (^): estimated from patient-year-at-risk or dialysis-run-per-year from two studies; Complex surgery (*): advanced arteriovenous access surgery (e.g., vein transposition or interventions at the groin or thorax sites)

eTable 2: Comparisons extracted from each study

Study ID	Publication Year	Separate data from incident patients (*)	Separate data from diabetic patients	Comparisons				Outcomes	Only crude data	Time varying exposure (^)
				Catheter vs. Fistula	Catheters vs. Graft	Catheter vs. Fistula or Graft	Graft vs. Fistula			
Abbott et al.[1]	2003	✓		✓			✓	Nonfatal cardiovascular events		
Allon et al.[2]	2006		✓	✓	✓	✓		Mortality (all-cause, cardiovascular events, infections)		✓
Allon et al.[3]	2003			✓			✓	Infections (fatal and nonfatal)		✓
Astor et al.[4]	2005	✓		✓			✓	Mortality (all-cause, infections)		✓
Ayzac et al.[45]	2009			✓			✓	Nonfatal infections		
Bachleda et al.[46]	1999						✓	Nonfatal infections	✓	
Basaran et al.[60]	2003						✓	Nonfatal infections	✓	
Basel et al.[63]	2011						✓	All-cause mortality; nonfatal infections		
Bonomo et al.[5]	1997						✓	Nonfatal infections		
Bradbury et al.[6]	2009	✓		✓	✓		✓	All-cause mortality		✓
Bradbury et al.[7]	2007	✓		✓	✓		✓	All-cause mortality		
Chan et al.[8]	2007	✓	✓				✓	All-cause mortality		
Churchill et al.[9]	1992	✓					✓	Nonfatal infections		
Coburn et al.[10]	1994						✓	Nonfatal infections	✓	
Colville et al.[64]	2006			✓	✓		✓	Nonfatal infections	✓	
Dhingra et al.[11]	2001		✓	✓			✓	Mortality (all-cause, cardiovascular events, infections)		
Di Iorio et al.[47]	2004			✓	✓		✓	Mortality (all-cause, cardiovascular events, infections)		
Ekbal et al.[48]	2008					✓		Mortality (all-cause, infections); nonfatal infections	✓	
Elseviers et al.[49]	2003			✓			✓	Nonfatal infections		
Eustace et al.[12]	2005			✓	✓		✓	Nonfatal infections	✓	
Fadrowski et al.[13]	2006					✓	✓	Non fatal infections, hospitalizations		✓
Foley et al.[14]	2009			✓	✓		✓	All-cause mortality; fatal infections; major cardiovascular events		
Fong et al.[15]	1992						✓	Fatal and nonfatal infections	✓	
Funiakova et al.[50]	2004			✓				Hospitalizations	✓	
García Cortés et al.[51]	2005	✓				✓		All-cause mortality; nonfatal infections	✓	
Gorski et al.[16]	2002						✓	Nonfatal infections	✓	
Hazinedaroglu et al.[61]	2004		✓				✓	Nonfatal infections	✓	
Hoen et al.[52]	1998			✓			✓	Nonfatal infections		
Inrig et al.[17]	2006				✓			Mortality (all-cause, infections)		
Ishani et al.[18]	2005	✓		✓			✓	Nonfatal infections		
Kherlakian et al.[19]	1986			✓	✓		✓	Nonfatal infections	✓	
Klevens et al.[20]	2005			✓	✓		✓	Hospitalizations; nonfatal infections	✓	
Krzanowski et al.[53]	2011			✓	✓		✓	All-cause mortality; nonfatal infections	✓	
Lacson et al.[21]	2009			✓			✓	All-cause mortality; hospitalizations		
Lacson et al.[22]	2009			✓			✓	All-cause mortality		✓
Lee et al.[23]	2007						✓	Fatal infections	✓	
Lorenzo et al.[54]	2004	✓				✓		All-cause mortality		
Maraj et al.[24]	2002					✓		Fatal infections	✓	
McCarthy et al.[25]	2000			✓			✓	Nonfatal infections	✓	
Metcalfe et al.[55]	2003	✓		✓				Hospitalizations		✓
Moist et al.[26]	2008	✓		✓				All-cause mortality		
Ng et al.[67]	2011			✓	✓		✓	Hospitalizations; nonfatal infections; major cardiovascular events		✓
Ocak et al.[56]	2011					✓		All-cause mortality; fatal infections; major cardiovascular events		
Oliver et al.[27]	2004						✓	All-cause mortality; nonfatal infections; hospitalizations		
Ortega et al.[57]	2005	✓		✓				Hospitalizations		✓
Pastan et al.[28]	2002		✓	✓	✓		✓	Mortality (all-cause, infections)		
Perl et a.[29]	2011					✓		All-cause mortality		

Study ID	Publication Year	Separate data from incident patients (*)	Separate data from diabetic patients	Comparisons				Outcomes	Only crude data	Time varying exposure (^)
				Catheter vs. Fistula	Catheters vs. Graft	Catheter vs. Fistula or Graft	Graft vs. Fistula			
Pflederer et al.[30]	2008						✓	Nonfatal infections	✓	
Pisoni et al.[66]	2009			✓			✓	All-cause mortality; nonfatal infections; hospitalizations		
Polkinghorne et al.[65]	2004	✓		✓			✓	Mortality (all-cause, infections)		
Qasaimeh et al.[62]	2008			✓	✓		✓	Nonfatal infections	✓	
Schild et al.[31]	2008						✓	Nonfatal infections	✓	
Shariff et al.[32]	2004			✓	✓		✓	Nonfatal infections	✓	
Stevenson et al.[33]	2002			✓			✓	Nonfatal infections	✓	
Taylor et al.[34]	1993						✓	Nonfatal infections	✓	
Taylor et al.[35]	2002			✓			✓	Nonfatal infections		
Taylor et al.[36]	2004			✓			✓	Nonfatal infections		
Thomson et al.[58]	2007			✓				All-cause mortality; nonfatal infections		
Tokars et al.[37]	2001			✓			✓	Nonfatal infections		✓
Troidle et al.[38]	2007			✓	✓		✓	Fatal infections	✓	
Wada et al.[39]	1996						✓	Mortality (all-cause, cardiovascular events, infections)	✓	
Wasse et al.[40]	2008	✓		✓			✓	Mortality (all-cause, cardiovascular events)		
Weale et al.[59]	2007						✓	Nonfatal infections	✓	
Winsett et al.[41]	1985						✓	Nonfatal infections	✓	
Woo et al.[42]	2009						✓	All-cause mortality; nonfatal infections	✓	
Xue et al.[43]	2003	✓		✓	✓		✓	All-cause mortality		
Zibari et al.[44]	1988						✓	Nonfatal infections	✓	

Legend: Incident patients (*): patient entered the study at dialysis commencement; time varying exposure (^): the exposure (type of vascular access) was updated during follow-up to account for possible switches in vascular access type in the same patient

eTable 3: Study Investigators who provided additional data

Study reference	Data provided
Wasse et al[40]	Clarification about model adjustment
Foley et al[14]	Confidence intervals of the relative risks for cardiovascular events and infection
Polkinghorne et al[65]	Rationale for pooling the relative risks for mortality stratified by time between surveys and dialysis start

eTable 4: Items used to classify quality domains of included articles (n=67)

Reviewers addressed two questions for each quality domain to define the risk of bias. The risk of bias for each domain was defined as *low* if the answer was 'yes' for both questions; *moderate* if only one was 'yes' and the other 'no' or 'unclear'; and *high* if neither was 'yes' (both answers were 'no' or 'unclear').

Extent to which the study population represents the source and target populations (participation bias):

1) Were participants recruited consecutively, randomly or according to stratified methods?
2) Was enrolment based on pre-specified eligibility criteria?

Extent to which the groups under comparison derive from the same source population (selection bias):

1) Was the exposure defined as the access planned (access intended) as opposed to the access in place prior to the study (access achieved)?
2) Is it reported whether participants were eligible to different forms of access, i.e. whether patients with catheters could have received a graft or a fistula, those with a graft have could have received a fistula, and those with a fistula could have received a graft?

Adequacy and completeness of follow-up (attrition bias):

1) Were losses to follow-up treated as censored observations (as opposed to missing)?
2) Were losses to follow-up reported and comparable across exposure level?

Outcome definition and classification (measurement bias):

1) Was outcome defined in the same way across exposure levels?
2) Was event adjudication based on formal and pre-specified procedures?

Other prognostic factors of interest (confounding bias):

1) Were at least age, sex, diabetes and cardiovascular disease considered for adjustment?
2) Was confounding measured in the same way across exposure levels?

Appropriateness of the analysis and results reporting (analysis bias):

1) Was the analytical method appropriate with respect to the chosen outcome (i.e., logistic regression for risk at pre-specified time, count models for rates and survival analysis for time to event data) and the exposure (i.e., standard models built on initial access or updated access types - time varying exposure)?
2) Were model-building strategies described, including methods for correlated data, and results adequately reported?

eTable 5: Data on patency of arteriovenous grafts and arteriovenous fistulas

Study ID	Publication Year	Unassisted fistula patency at 1 to 5 years				Unassisted graft patency at 1 to 5 years				Assisted fistula patency at 1 to 5 years				Assisted graft patency at 1 to 5 years				Statistical testing reported	Survival plots reported	Relative risks of access failure for graft vs. fistula (95% Confidence Intervals)	Adjustment performed	Notes
		1	2	3	5	1	2	3	5	1	2	3	5	1	2	3	5					
Basaran et al.[60]	2003									0.87		0.78		0.82		0.39						Whether patency rates are unassisted or assisted was not stated
Basel et al.[63]	2011	0.84	0.67			0.52	0.31			0.90	0.74			0.65	0.41			P<0.005 for both assisted and unassisted survival	✓			Tabulated data reported
Chan et al.[8]	2007																		✓	1.48 (0.952, 2.29) in non-diabetics; 1.48 (0.76, 2.89) in diabetics	✓	Elderly patient (>65 years)
Coburn et al.[10]	1994	0.90	0.86			0.70	0.49			0.90	0.86			0.87	0.64			P<0.001 (unassisted); P<0.02 (assisted)				
Elseviers et al.[49]	2003																			4.1 (2.22, 7.56)		One-year risk of thrombosis but no patency data
Eustace et al.[12]	2005									0.31	0.26			0.35	0.11				✓	1.89 (0.71, 5.26)	✓	HIV+ patients; maturation failure 0.37 (fistulas) vs. 0.14 (grafts)
Hazinedaroglu et al.[61]	2004	0.87				0.37												P<0.05	✓			Femoral fistulas and grafts
Kherlakian et al.[19]	1986											0.64				0.50		P<0.05	✓			Six-week risks of thrombosis 12% (fistulas) vs. 4% (grafts); after six weeks 17% vs. 21%
Lee et al.[23]	2007																	P=0.03 (excluding primary failure); P=0.97 (including primary failure)	✓	Assisted excluding primary failure 2.01 (1.05, 3.82); including primary failure 0.99 (0.61, 1.62)	✓	People with previously failed fistulas; primary failure 44% vs. 20%; analyses for unassisted and assisted patency excluding and including primary failure reported
Pflederer et al.[30]	2008	0.58	0.44			0.18	0.05			0.97	0.94			0.66	0.54			P<0.001	✓			Non transposed fistulas vs. graft; primary failure risk 0.24 vs. 0.11
Pflederer et al.[30]	2008	0.53	0.37			0.18	0.05			0.71	0.66			0.66	0.54			P<0.001				Transposed fistulas vs. graft; primary failure risk 0.19 vs. 0.11
Schild et al.[31]	2008																	P=0.111	✓			No patency rates
Wada et al.[39]	1996																	Non significant				Only thrombosis (at 48 hrs post-op.) event numbers reported
Winsett et al.[41]	1985			0.72				0.39			0.86	0.84			0.73	0.70			✓			
Woo et al.[42]	2009	0.65			0.48	0.42			0.14	0.72			0.57	0.67			0.19	P<0.0001 for both assisted and unassisted survival	✓	Unassisted 2.13 (1.56, 2.86); assisted 1.69 (1.23, 2.38)	✓	Transposed fistulas vs. upper-arm loop grafts;
Zibari et al.[44]	1988																	P<0.0001				Event free times (fistula's longer than graft's) compared using t test

eTable 6: Search Strategies

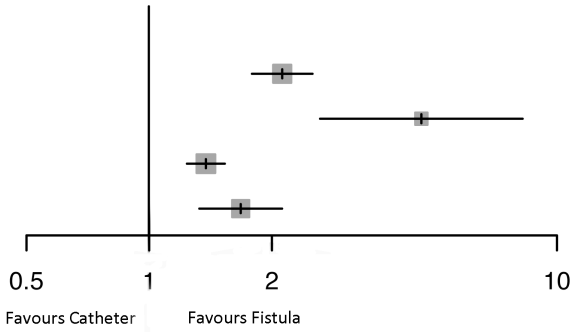
MEDLINE (1946 to September 25)

1. exp Renal Dialysis/
2. renal dialysis.tw.
3. 1 or 2
4. hemodialysis.tw.
5. haemodialysis.tw.
6. 3 or 4 or 5
7. exp peritoneal dialysis/
8. 6 not 7
9. Catheters, Indwelling/
10. indwelling catheter*.tw.
11. 9 or 10
12. Catheterization, Central Venous/
13. central venous catheter*.tw.
14. 12 or 13
15. Arteriovenous Fistula/
16. Arteriovenous Shunt, Surgical/
17. (vascular adj3 access).tw.
18. (hemodialysis adj3 access).tw.
19. (haemodialysis adj3 access).tw.
20. (arteriovenous adj3 fistula$).tw.
21. (arteriovenous adj3 shunt$).tw.
22. (arteriovenous adj3 graft$).tw.
23. 11 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22
24. exp Epidemiologic Studies/
25. exp Case-Control Studies/
26. exp Cohort Studies/
27. exp Longitudinal Studies/
28. exp Follow-Up Studies/
29. exp Cohort Effect/
30. exp Retrospective Studies/
31. exp Prospective Studies/
32. exp Cross-Sectional Studies/
33. observational stud$.tw.
34. (case control or cohort$ or longitudinal or follow-up or retrospective or prospective or cross sectional).tw.
35. 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34
36. 8 and 23 and 35
37. limit 36 to humans

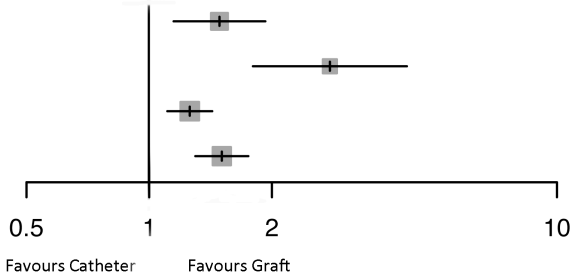
EMBASE (1974 to September 25)

1. renal replacement therapy/ or hemodialysis/
2. renal dialysis*.tw.
3. hemodialysis.tw.
4. haemodialysis.tw.
5. 1 or 2 or 3 or 4
6. exp peritoneal dialysis/
7. 5 not 6
8. exp indwelling catheter/
9. indwelling catheter*.tw.
10. exp central venous catheterization/
11. catheter*, central venous.tw.
12. 8 or 9
13. 10 or 11
14. exp arteriovenous fistula/
15. exp arteriovenous shunt/
16. (vascular adj3 access).tw.
17. (hemodialysis adj3 access).tw.
18. (haemodialysis adj3 access).tw.
19. (arteriovenous adj3 fistula$).tw.
20. (arteriovenous adj3 shunt$).tw.
21. (arteriovenous adj3 graft$).tw.
22. 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21
23. exp epidemiology/ or exp epidemiological data/
24. exp case control study/
25. exp cohort analysis/
26. exp longitudinal study/
27. exp follow up/
28. exp retrospective study/
29. exp prospective study/
30. exp cross-sectional study/
31. observational stud$.tw.
32. (case control or cohort$ or longitudinal or follow-up or retrospective or prospective or cross sectional).tw.
33. 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32
34. 7 and 22 and 33
35. limit 34 to humans

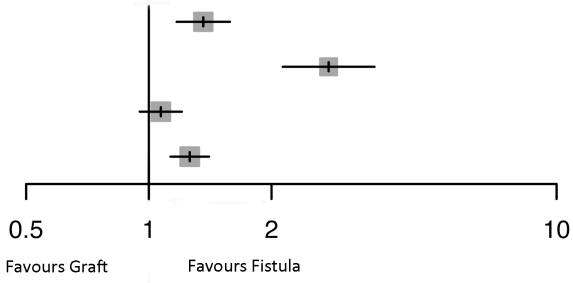
Outcome	No. of Participants	No. of Cohorts	Risk Ratio	RR	95% CI	I2	P
Fatal Infections	229824	11		2.12	[1.79; 2.52]	0	0.818
Nonfatal Infections	14947	19		4.66	[2.63; 8.26]	96.4	<.001
CV events	232236	9		1.38	[1.24; 1.54]	0	0.464
Hospitalizations	54660	6		1.68	[1.33; 2.12]	98.9	<.001



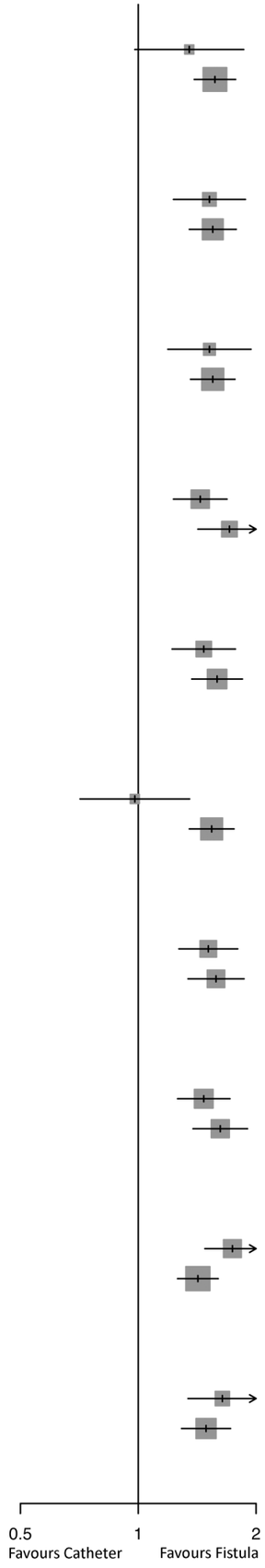
Fatal Infections	235	11		1.49	[1.15; 1.93]	25.6	0.233
Nonfatal Infections	13121	17		2.78	[1.80; 4.29]	91.9	<.001
CV events	234819	8		1.26	[1.11; 1.43]	0	0.569
Hospitalizations	56734	4		1.51	[1.30; 1.75]	45.4	0.139

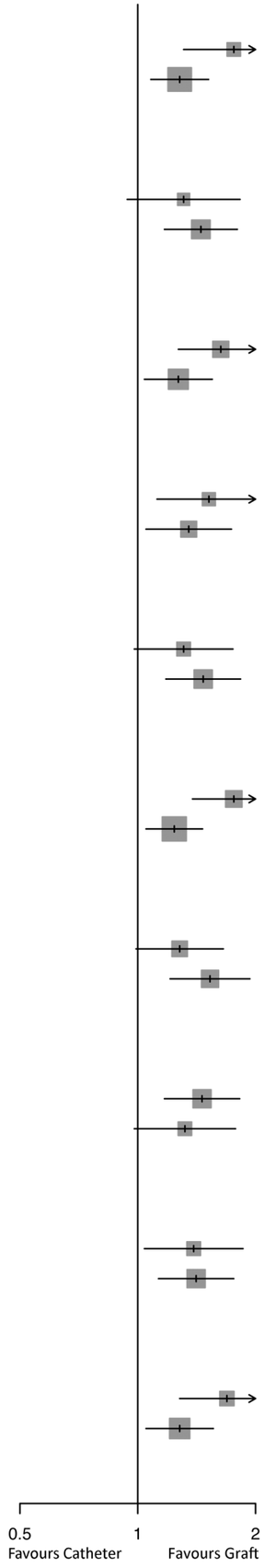


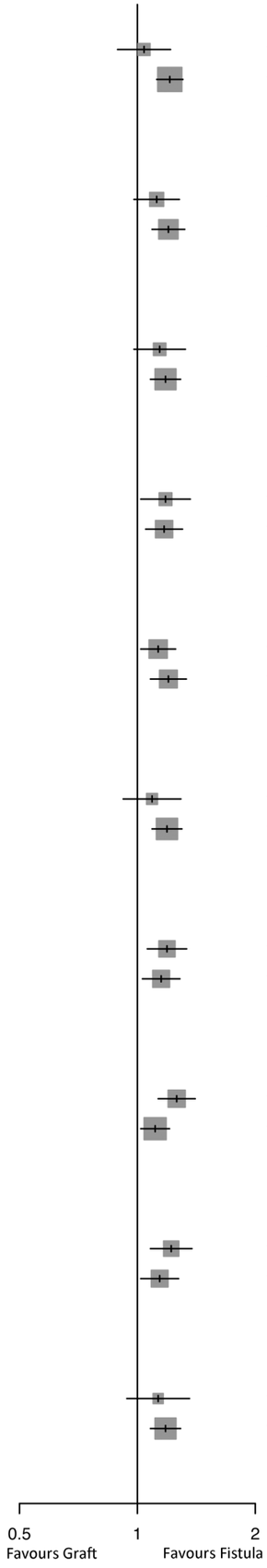
Fatal Infections	242135	11		1.36	[1.17; 1.58]	0	0.784
Nonfatal Infections	24790	35		2.76	[2.13; 3.58]	84.7	<.001
CV events	232862	8		1.07	[0.95; 1.21]	0	0.524
Hospitalizations	72126	4		1.26	[1.13; 1.40]	94.5	<.001

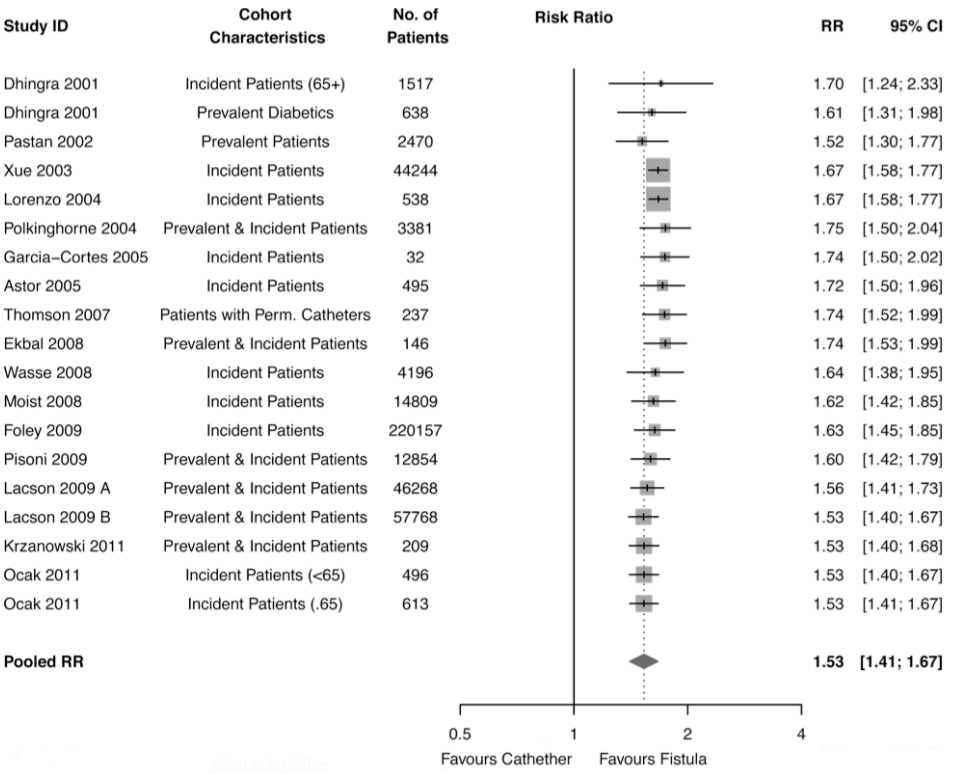


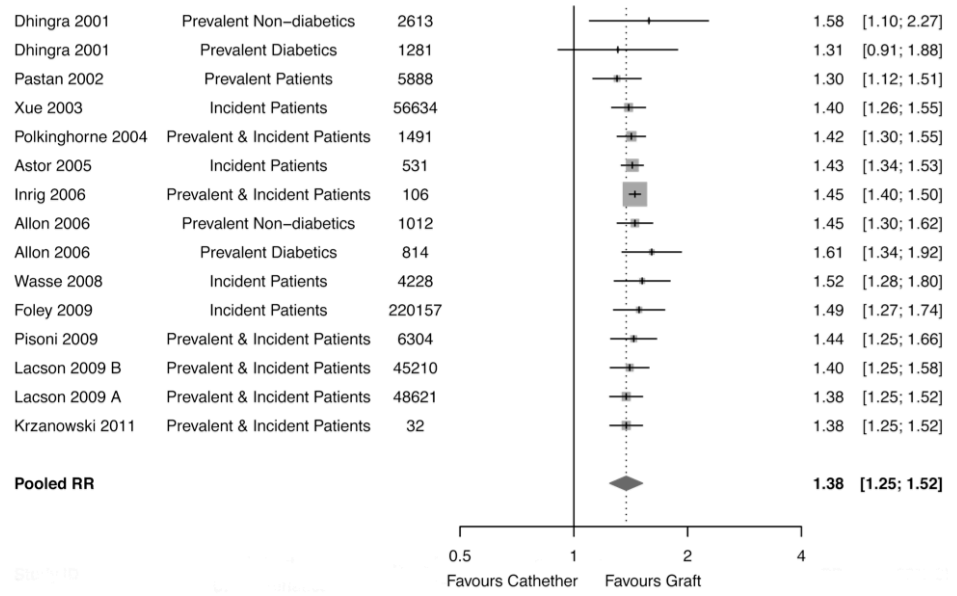
Covariate	No. of Participants	No. of Cohorts	RR	95% CI	P	I2	No. of Participants	No. of Cohorts	RR	95% CI	P	I2	No. of Participants	No. of Cohorts	RR	95% CI	P	I2
Access definition																		
time varying access	58263	2	1.35	[0.98; 1.86]	0.349	79.3	47567	4	1.76	[1.31; 2.36]	0.069	87.3	58051	3	1.04	[0.89; 1.22]	0.078	73.3
initial access	352596	16	1.57	[1.39; 1.77]			347323	10	1.28	[1.08; 1.52]			339997	13	1.21	[1.12; 1.31]		
Adjustment																		
inadequate	148695	6	1.52	[1.23; 1.88]	0.89	84.6	150571	4	1.31	[0.94; 1.83]	0.588	86.6	140820	6	1.12	[0.98; 1.28]	0.39	71.48
adequate	262164	12	1.55	[1.35; 1.78]			244319	10	1.45	[1.17; 1.80]			257228	10	1.20	[1.09; 1.32]		
Age (years)																		
60 or younger	5616	5	1.52	[1.19; 1.94]	0.87	84.7	12245	7	1.63	[1.27; 2.09]	0.105	86.35	13031	7	1.14	[0.98; 1.33]	0.639	83.1
older than 60	405243	13	1.55	[1.36; 1.77]			382645	7	1.27	[1.04; 1.55]			385017	9	1.18	[1.08; 1.29]		
Diabetes (%)																		
40 or less	63342	2	1.44	[1.23; 1.69]	0.143	81.41	68054	5	1.52	[1.12; 2.06]	0.518	83	45539	5	1.18	[1.02; 1.37]	0.967	84.4
more than 40	344901	14	1.71	[1.42; 2.06]			320948	8	1.35	[1.05; 1.74]			346073	10	1.17	[1.05; 1.30]		
Followup (years)																		
1 or shorter	151288	5	1.47	[1.22; 1.77]	0.53	84.6	156459	5	1.31	[0.98; 1.75]	0.495	86.69	152675	6	1.13	[1.02; 1.25]	0.46	71.84
longer than 1	259571	13	1.59	[1.37; 1.85]			238431	9	1.47	[1.18; 1.83]			245373	10	1.20	[1.08; 1.33]		
Men (%)																		
50 or less	46746	3	0.98	[0.71; 1.35]	0.92	76.97	64454	5	1.76	[1.38; 2.24]	0.024	71.1	33395	3	1.09	[0.92; 1.29]	0.294	83.89
more than 50	364113	15	1.54	[1.35; 1.76]			330436	9	1.24	[1.05; 1.46]			364506	12	1.19	[1.09; 1.30]		
Months since 1st dialysis																		
3 or more	288031	7	1.51	[1.27; 1.80]	0.708	76.8	290801	6	1.28	[0.99; 1.65]	0.286	83.97	257450	6	1.19	[1.06; 1.34]	0.666	72.14
less than 3	122828	11	1.58	[1.34; 1.86]			104089	8	1.53	[1.21; 1.93]			140598	10	1.15	[1.03; 1.28]		
Prevalent patients																		
Included	136707	9	1.47	[1.26; 1.71]	0.354	75.31	111849	9	1.46	[1.17; 1.82]	0.546	83.39	255428	6	1.26	[1.13; 1.40]	0.065	65.02
Excluded	274152	9	1.62	[1.38; 1.90]			283041	5	1.32	[0.98; 1.78]			142620	10	1.11	[1.02; 1.21]		
Publication year																		
2004 or earlier	52788	6	1.74	[1.48; 2.05]	0.047	67.4	326983	5	1.39	[1.04; 1.86]	0.945	79.61	44726	7	1.22	[1.08; 1.38]	0.333	83.24
2005 or later	358071	12	1.42	[1.26; 1.60]			67907	9	1.41	[1.13; 1.76]			353322	9	1.14	[1.02; 1.27]		
Sample size (N)																		
5000 or smaller	10134	9	1.64	[1.34; 2.01]	0.437	84.65	8182	6	1.69	[1.28; 2.23]	0.095	87.29	6521	7	1.13	[0.94; 1.36]	0.664	83.13
larger than 5000	400725	9	1.49	[1.29; 1.72]			386708	8	1.28	[1.05; 1.56]			391527	9	1.18	[1.08; 1.29]		

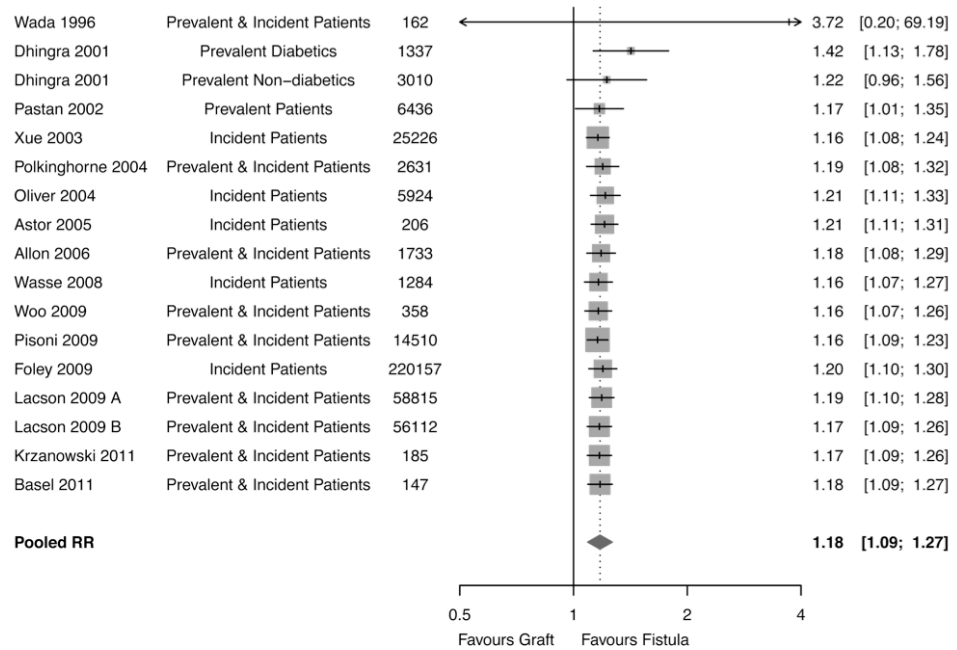







Study ID
Cohort Characteristics
No. of Patients
Risk Ratio
RR
95% CI
Dhingra 2001 Incident Patients (65+) 1517 1.70 [1.24; 2.33]
Dhingra 2001 Prevalent Diabetics 638 1.61 [1.31; 1.98]
Pastan 2002 Prevalent Patients 2470 1.52 [1.30; 1.77]
Xue 2003 Incident Patients 44244 1.67 [1.58; 1.77]
Lorenzo 2004 Incident Patients 538 1.67 [1.58; 1.77]
Polkinghorne 2004 Prevalent & Incident Patients 3381 1.75 [1.50; 2.04]
Garcia−Cortes 2005 Incident Patients 32 1.74 [1.50; 2.02]
Astor 2005 Incident Patients 495 1.72 [1.50; 1.96]
Thomson 2007 Patients with Perm. Catheters 237 1.74 [1.52; 1.99]
Ekbal 2008 Prevalent & Incident Patients 146 1.74 [1.53; 1.99]
Wasse 2008 Incident Patients 4196 1.64 [1.38; 1.95]
Moist 2008 Incident Patients 14809 1.62 [1.42; 1.85]
Foley 2009 Incident Patients 220157 1.63 [1.45; 1.85]
Pisoni 2009 Prevalent & Incident Patients 12854 1.60 [1.42; 1.79]
Lacson 2009 A Prevalent & Incident Patients 46268 1.56 [1.41; 1.73]
Lacson 2009 B Prevalent & Incident Patients 57768 1.53 [1.40; 1.67]
Krzanowski 2011 Prevalent & Incident Patients 209 1.53 [1.40; 1.68]
Ocak 2011 Incident Patients (<65) 496 1.53 [1.40; 1.67]
Ocak 2011 Incident Patients (.65) 613 1.53 [1.41; 1.67]
Pooled RR 1.53 [1.41; 1.67]
0.5
1
2
4
Favours Cathether
Favours Fistula


Dhingra 2001 Prevalent Non−diabetics 2613 1.58 [1.10; 2.27]
Dhingra 2001 Prevalent Diabetics 1281 1.31 [0.91; 1.88]
Pastan 2002 Prevalent Patients 5888 1.30 [1.12; 1.51]
Xue 2003 Incident Patients 56634 1.40 [1.26; 1.55]
Polkinghorne 2004 Prevalent & Incident Patients 1491 1.42 [1.30; 1.55]
Astor 2005 Incident Patients 531 1.43 [1.34; 1.53]
Inrig 2006 Prevalent & Incident Patients 106 1.45 [1.40; 1.50]
Allon 2006 Prevalent Non−diabetics 1012 1.45 [1.30; 1.62]
Allon 2006 Prevalent Diabetics 814 1.61 [1.34; 1.92]
Wasse 2008 Incident Patients 4228 1.52 [1.28; 1.80]
Foley 2009 Incident Patients 220157 1.49 [1.27; 1.74]
Pisoni 2009 Prevalent & Incident Patients 6304 1.44 [1.25; 1.66]
Lacson 2009 B Prevalent & Incident Patients 45210 1.40 [1.25; 1.58]
Lacson 2009 A Prevalent & Incident Patients 48621 1.38 [1.25; 1.52]
Krzanowski 2011 Prevalent & Incident Patients 32 1.38 [1.25; 1.52]
Pooled RR 1.38 [1.25; 1.52]
0.5
1
2
4
Favours Cathether
Favours Graft


Wada 1996 Prevalent & Incident Patients 162 3.72 [0.20; 69.19]
Dhingra 2001 Prevalent Diabetics 1337 1.42 [1.13; 1.78]
Dhingra 2001 Prevalent Non−diabetics 3010 1.22 [0.96; 1.56]
Pastan 2002 Prevalent Patients 6436 1.17 [1.01; 1.35]
Xue 2003 Incident Patients 25226 1.16 [1.08; 1.24]
Polkinghorne 2004 Prevalent & Incident Patients 2631 1.19 [1.08; 1.32]
Oliver 2004 Incident Patients 5924 1.21 [1.11; 1.33]
Astor 2005 Incident Patients 206 1.21 [1.11; 1.31]
Allon 2006 Prevalent & Incident Patients 1733 1.18 [1.08; 1.29]
Wasse 2008 Incident Patients 1284 1.16 [1.07; 1.27]
Woo 2009 Prevalent & Incident Patients 358 1.16 [1.07; 1.26]
Pisoni 2009 Prevalent & Incident Patients 14510 1.16 [1.09; 1.23]
Foley 2009 Incident Patients 220157 1.20 [1.10; 1.30]
Lacson 2009 A Prevalent & Incident Patients 58815 1.19 [1.10; 1.28]
Lacson 2009 B Prevalent & Incident Patients 56112 1.17 [1.09; 1.26]
Krzanowski 2011 Prevalent & Incident Patients 185 1.17 [1.09; 1.26]
Basel 2011 Prevalent & Incident Patients 147 1.18 [1.09; 1.27]
Pooled RR 1.18 [1.09; 1.27]
0.5
1
2
4
Favours Graft
Favours Fistula

Contributions: Drs. Ravani, James, and Strippoli had full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis. Study concept and design: Ravani, James and Strippoli; Literature search and articles retrieval: MacRae, Tai, Ravani and James; Data extraction and classification: Oliver, Quinn, MacRae, Tai, Pannu, Thomas, James and Ravani; Consensus on disagreements: James, Strippoli and Ravani; Data set up, analysis and interpretation: Ravani, James, Palmer and Strippoli; Manuscript drafting: Ravani, James, Palmer and Strippoli; Critical revision of the manuscript for important intellectual content and final approval: Ravani, James, Palmer, Oliver, Quinn, MacRae, Tai, Pannu, Thomas, Tonelli, Hemmelgarn, Manns, Craig and Strippoli; Obtained funding: Ravani, Strippoli and James; Study supervision: Strippoli. Drs. Ravani, Strippoli and James had full access to all of the data and had the final responsibility to submit the manuscript for publication.

Reproducible research statement: Study protocol, statistical code, and data set: available from Dr. Ravani (pravani@ucalgary.ca) and Dr. Strippoli (Giovanni.Strippoli@diaverum.com).

Appendix References

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