# Preservation of Veins and Timing for Vascular Access

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# Hemodialysis VA

- A sound long-term dialysis access is designed to maximize patient quality of life, improve survival and prove cost-effective

Davidson I et al, J Vasc Access 2007

# Type of VA and economic benefits

- An increase in AVF to a target of 66% would result in significant economic savings and additional life years gain

| Demographic Group | US Hemodialysis Incident Population 2003[a] | | | Vascular Access Cost Savings for Current Life-Years, Discounted | |
|---|---|---|---|---|---|
| | *n* | % of Total | % with Diabetes | Per Person | Total (Millions) |
| All | 93,276 | 100 | 45 | $ 9030 | $843 |
| Age (yr) | | | | | |
| 0 to 44 | 11,939 | 13 | 29 | $ 5430 | $ 65 |
| 45 to 54 | 13,716 | 15 | 49 | $ 7930 | $109 |
| 55 to 64 | 19,471 | 21 | 58 | $ 9340 | $182 |
| 65 to 74 | 22,920 | 25 | 52 | $ 9320 | $214 |
| 75+ | 25,230 | 27 | 34 | $11,570 | $292 |
| Gender | | | | | |
| male | 50,546 | 54 | 42 | $ 6840 | $346 |
| female | 42,730 | 46 | 48 | $12,040 | $515 |
| Race | | | | | |
| white | 59,457 | 64 | 45 | $ 8520 | $506 |
| black | 27,617 | 30 | 43 | $10,950 | $302 |
| other/unknown | 6202 | 7 | 53 | $ 9740 | $ 60 |
| Cause of ESRD | | | | | |
| diabetes | 41,940 | 45 | 100 | $ 8970 | $376 |
| hypertension | 26,553 | 28 | 0 | $ 9190 | $244 |
| glomerulonephritis | 7023 | 8 | 0 | $ 3530 | $ 25 |
| other | 17,760 | 19 | 0 | $10,780 | $191 |

Schon D et al, Clin J Am Soc Nephrol 2007

# Type of VA and QoL

- In a US study patients with persistent AVF use reported greater physical activity and energy, better emotional and social well-being, fewer symptoms, less effect of dialysis and burden of kidney disease and better sleep compared with patients with persistent CVC use

Wasse H et al, Clin J Am Soc Nephrol 2007

# Type of VA and patients' survival

| Author, Data, Design[b], Sample Size | HR Relative to Fistula (95% CI) | |
|---|---|---|
| | Graft | Catheter |
| Polkinghorne *et al.* (18), New Zealand, longitudinal, $n = 3912$ | 1.55 (1.15 to 2.07) | 2.31 (1.60 to 3.32) |
| Astor *et al.* (6), CHOICE, longitudinal, $n = 616$ | 1.2 (0.8 to 1.8) | 1.5 (1.0 to 2.2) |
| Pastan *et al.* (19), southeast US, cross-sectional, $n = 7497$ | NA | 1.4 (1.1 to 1.9) |
| Xue *et al.* (20), Medicare elderly claims, longitudinal, $n = 66{,}595$ | 1.16 (1.08 to 1.24) | 1.70 (1.59 to 1.80) |
| Port *et al.* (21), DOPPS, longitudinal, $n = 17{,}245$ risk from catheter use in facility >28% compared to <7% | NA | 1.23 |
| Dhingra *et al.* (5), DMMS, longitudinal, $n = 5507$ | | |
| with diabetes | 1.4 (1.1 to 1.8) | 1.5 (1.2 to 2.0) |
| without diabetes | 1.1(0.9 to 1.3) | 1.7(1.4 to 2.1) |

Schon D et al, Clin J Am Soc Nephrol 2007

# Vascular access in HD patients: A modifiable risk factor for bacteremia and death

- Use of dialysis catheters was associated with increased bacteremia and death rates (HR=5.4 and 2.8 vs. AVF respectively). Results were similar for tunneled and untunneled catheters

Thomson PC et al, Q J Med 2007

# Hemodialysis Vascular Access

The Achilles heel remains

Schwab SJ, Kidney Int 2007

# Type of VA in incident patients: results from the DOPPS

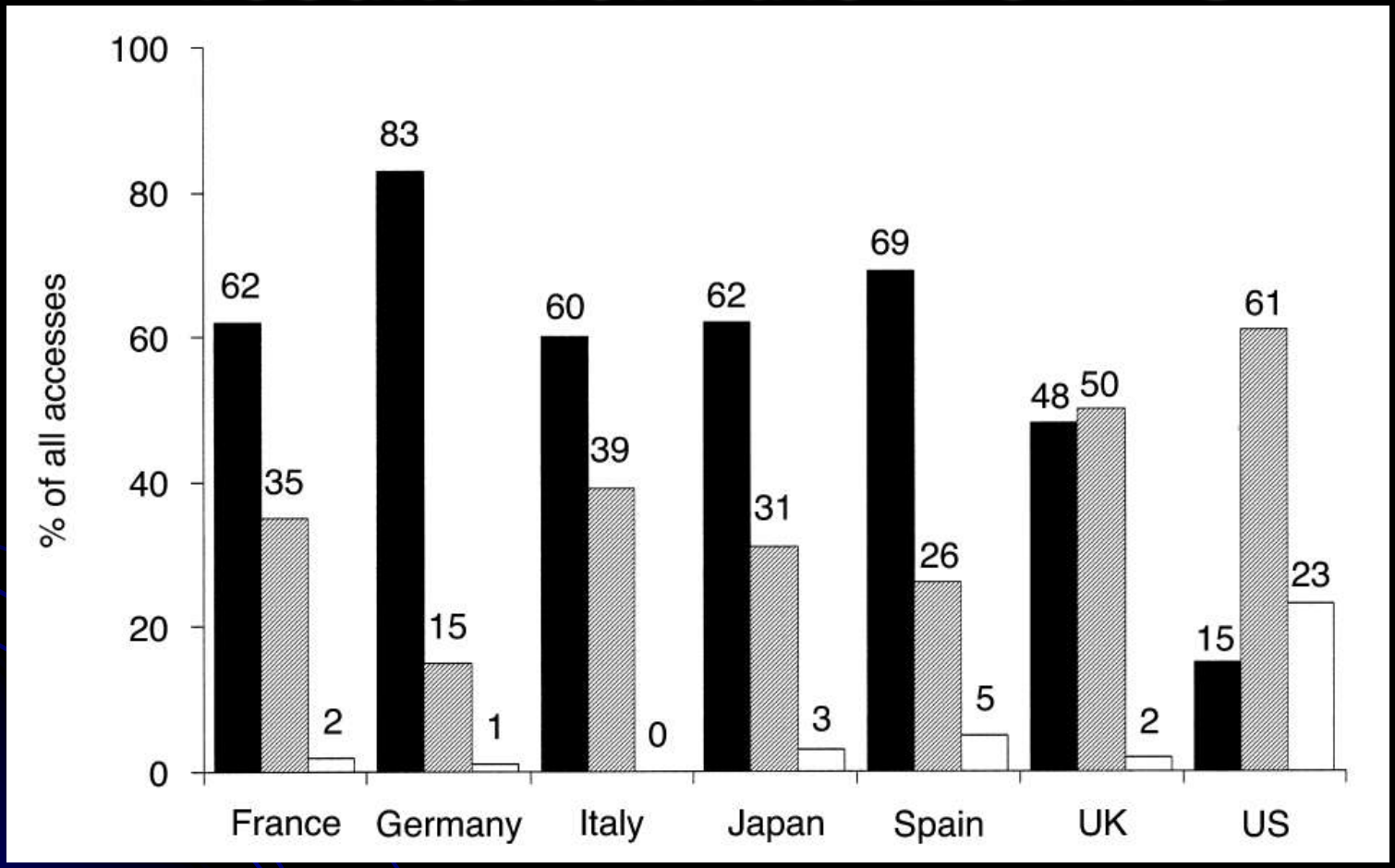



**Fig. 1. Proportion of incident patients who commenced hemodialysis via an arteriovenous (A-V) fistula (■), A-V graft (□) and catheter (▩; either cuffed or uncuffed) in participating countries ($N$ = 3674).** Analysis in-

Rayner H et al, Kidney Int 2003

# Guidelines

- K/DOQI
- EBPG
- VAS
- National guidelines

- But real life differs from guidelines

# Adherence to Guidelines

- An Italian multicenter study about compliance with guidelines (K/DOQI and EBPG) found the lowest level of compliance for Timing of VA creation (only 30%)

**Table 6.** Compliance with guidelines in force (K/DOQI and/or European Best Practice Guidelines)

| Parameters | (%) |
|---|---|
| Determination of iron deficiency:measurement of ferritin and TSAT | 75 |
| Cut-off value for introduction of erythropoietin stimulating agents | 62 |
| Target Hb values >11 g/dl | 50 |
| PTH target values | 48 |
| Assessment of renal function | 70 |
| Timing of creating of vascular access | 30 |

Locatelli F et al, Nephrol Dial Transplant 2008

# Steps towards a functioning VA

- Nephrology referral
- Patient information and education – Vein preservation
- Patient's acceptance and informed consent – modality choice
- Surgical referral
- Surgical evaluation, vein mapping and planning
- VA creation
- Maturation
- (Revision)
- Cannulation

# Nephrology referral

- In a US study the patients with nephrology follow up and a predictable progression toward ESRD started dialysis using AVF 46%, AVG 19% and CVC 35%
- Without nephrology follow up 2% AVF, 10% AVG and 85% CVC

Friedman AL et al, Adv Ren Repl Ther 2000

# Nephrology referral and adequate care

- 3,000 US patients
- Infrequent nephrology consultations (inadequate care) resulted in 51% increased risk for no permanent VA

Avorn J et al, J Clin Epidemiol 2002

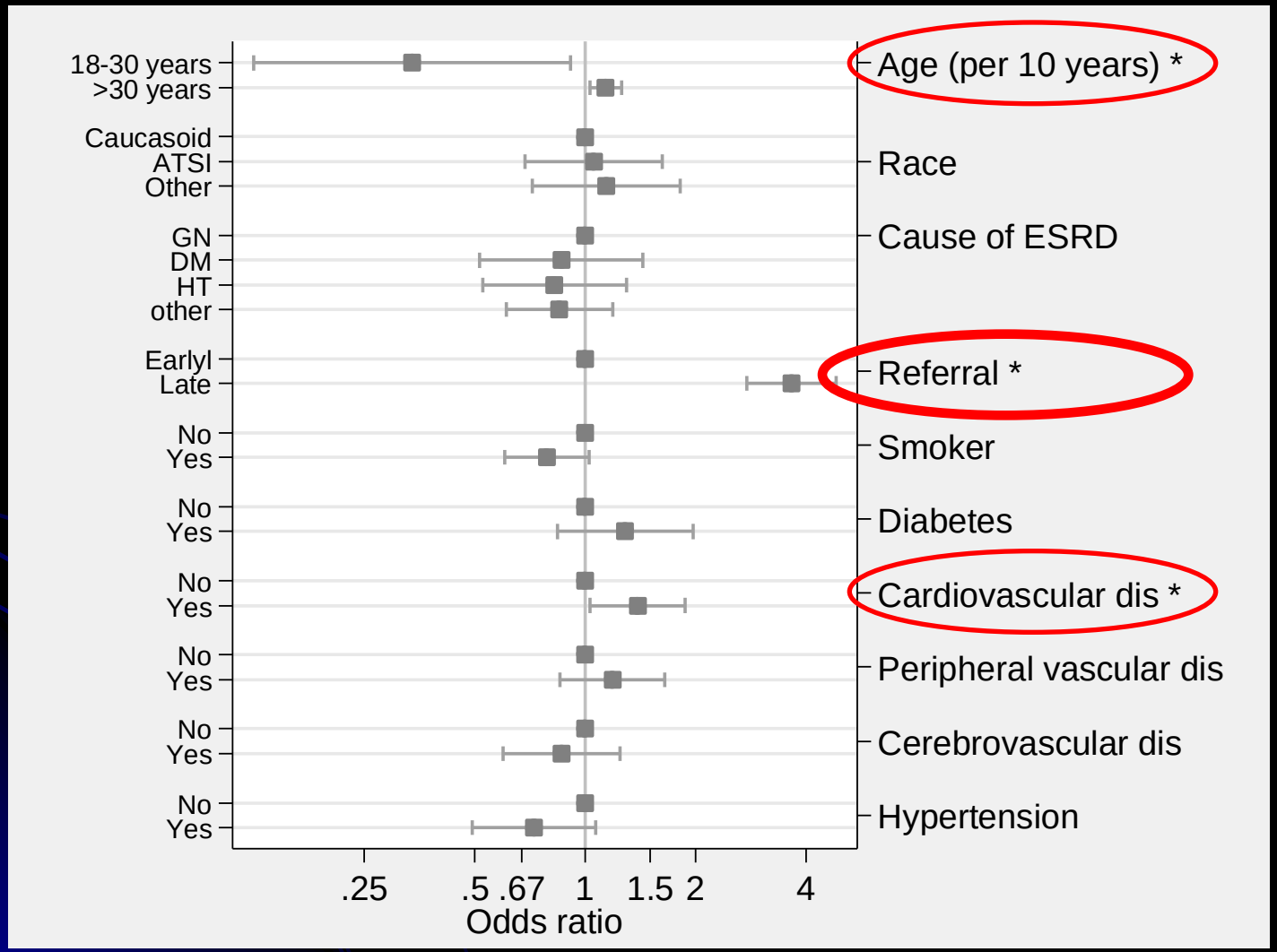
# Nephrology referral

- Late referral not only substantially increases the likelihood of dialysis catheter use at the initiation of HD, but also is associated with prolonged catheter use

| | AV access vs. CVC | | AVF vs. AVG as first access |
|---|---|---|---|
| | Initiation | 6 m. after | |
| First referral to nephrologist (months before HD initiation) | | | |
| <1 | 1 | 1 | 1 |
| 1-4 | 5.14 | 1.63 | 1.11 |
| 4-12 | 3.22 | 1.28 | 2.18 |
| >12 | 8.88 | 3.56 | 1.76 |

Astor BC et al, Am J Kidney Dis 2001

# Risk factors for CVC




Moist LM et al, Am J Kidney Dis 2007

# Preservation of Veins

- Forearm and upper Arm veins suitable for placement of VA should not be used for venipuncture or for the placement of iv catheters, subclavian catheters or peripherally inserted central catheter lines (PICCs)

K/DOQI guidelines, Am J Kidney Dis 2006

# Preservation of Veins

- An early plan for venous preservaion should be a substantial part of predialysis care and education in any CKD patient regardless the choice of treatment modality *(both arms, dorsum of the hand preferred)*
- Nurses and medical staff should be involved in vein preservation. Every patient with CKD should have a declared plan for preserving potential access sites

EBPG on VA, Tordoir J et al, Nephrol Dial Transplant 2007

# Preservation of veins

- Veins must be preserved in all patients with declining renal function
- And those undergoing renal replacement therapy with haemodialysis, peritoneal dialysis and renal transplantation
- Whenever a central venous catheter is needed, the placement of a subclavian vein catheter must be avoided, as it is usually complicated by subclavian vein stenosis, which has serious implications for future vascular access of HD patients

VAS Guidelines 2002

# Preservation of Veins

- Subclavian route has to be prohibited even for pace-makers or implantable devices

Pengloan J, Blood Purif 2002

- PICCs are also associated with a high incidence of upper extremity venous thrombosis (11-85 %)

- Long-term catheters should not be placed on the same side as a maturing AV access, if possible

K/DOQI guidelines, Am J Kidney Dis 2006

# Preservation of Veins

- Avoid i.v. infusion or venipuncture in forearm and upper arm veins of both arms whenever possible

VAS Guidelines 2002

- When unavoidable venipuncture should be performed in the dominant arm or alternatively rotation of puncture site/sides could be used
- CVC preferably in the right jugular vein
- Femoral veins for certain infusions

Premru V, Blood Purif 2002
Malovrh M, Nephrol Dial Transplant 2003

# Preservation of veins

- If the patient is hospitalised: Place sign “no venipuncture” over his or her bed or consider handing out a “Medic Alert bracelet or card” to the patient
- Preferred site for venipuncture  are the dorsal veins of both hands

VAS Guidelines 2002

# Preservation of Veins

- The preservation of veins is a challenge which involves patients, nephrologists, surgeons, radiologists, nurses and other healthcare professionals (and students too)
- Policies of aggressive preservation of the patients' vein capital should be implemented early, based on education and cooperation
- The programmes should be primarily focused on the patients themselves

# Patient related determinants of type and timing of VA

- Education of patients about vein preservation increased the possibility for a AVF by twofold (OR=1.96)
- Patient sharing in decision making increased the possibility by 50% (OR=1.5)
- Patients who took the lead in decision making were twofold more likely to have a usable permanent access (OR=2.37)

Stehman-Breen C et al, Kidney Int 2000

# Timing of VA creation

Objective

- Patients starting dialysis with a well-functioning permanent VA, preferably an AVF
- No unnecessary procedures - VA surgery is clearly undesirable in patients who will never start dialysis either because their CKD will never progress to ESRD or they will die before needing dialysis

# Steps towards a functioning VA

- Nephrology referral
- Patient information and education – Vein preservation
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# Timing of VA creation

- A fistula should be placed at least 6 months before the anticipated start of HD treatments. AVF is the preferred VA
- A graft should be placed at least 3 to 6 weeks before initiation of HD. AVG is an acceptable VA

K/DOQI guidelines, Am J Kidney Dis 2006

# Timing of VA creation

Potential chronic haemodialysis

(HD) patients should be ideally referred to the

nephrologist and/or surgeon for preparing vascular access when they reach the stage 4 of their CKD (GFR < 30 ml/min/1.73m2) or earlier in case of rapidly progressive nephropathy or specific clinical conditions such as diabetes or severe peripheral vascular disease (Evidence level III)

EBPG Guidelines, Nephrol Dial Transplant 2007

# Timing of VA creation

- When GFR<20-25 mL/min the patient should choose dialysis modality
- When GFR<10-15 mL/min patients who chose HD should be seen by a surgeon well trained in VA surgery within 6-12 months before anticipated need for dialysis

VAS Guidelines 2002

# Surgical referral and time before VA creation: a country and hospital specific case

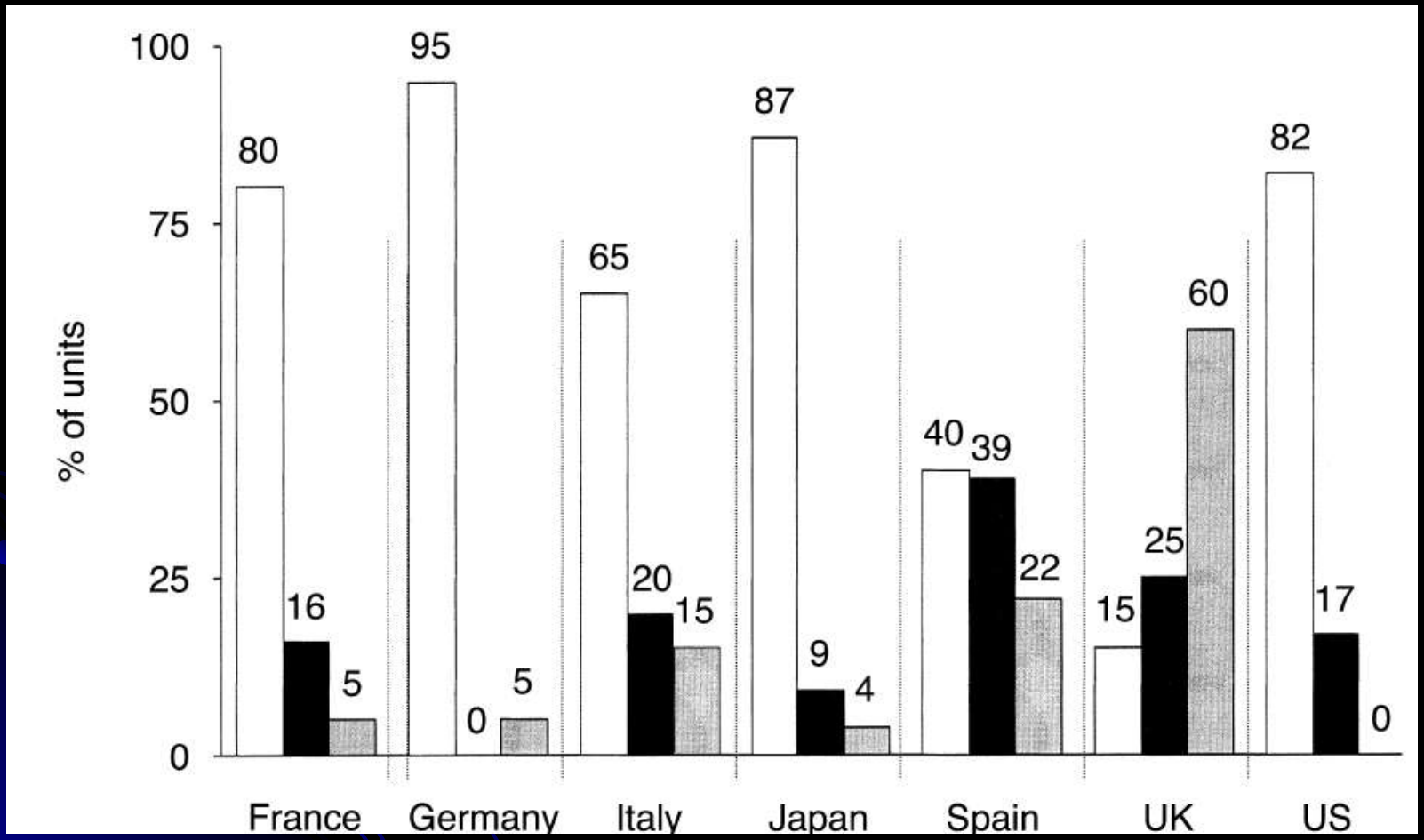



**Fig. 3. Usual time between referral and surgical creation of a permanent access reported by dialysis facility nurse managers or medical directors.** Symbols are: (□) 0 to 2 weeks; (■) 2 to 4 weeks; (▩) >4 weeks. Numbers in

Rayner HC et al, Kidney Int 2003

# Surgical referral

- From the DOPPS results it was shown that a short time between surgical referral and VA creation (<2 weeks) resulted in a 76% higher probability of the patient starting HD with a permanent access

Pisoni RL et al, Kidney Int 2002

# Special populations: Elderly

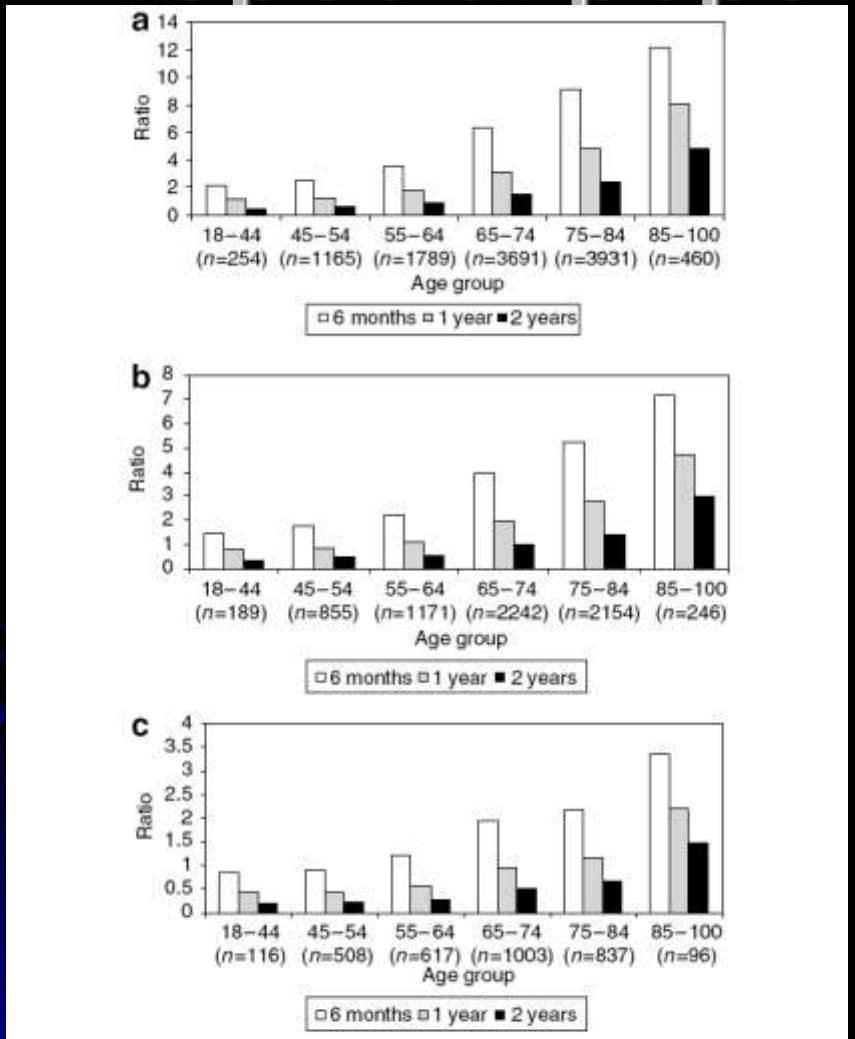



**Figure 3 | Ratio of unnecessary to necessary permanent access surgeries at different theoretical referral eGFR thresholds by age and length of follow-up.** (**a**) Referral threshold eGFR < 25 ml/min/1.73 $m^2$. (**b**) Referral threshold eGFR < 20 ml/min/1.73 $m^2$. (**c**) Referral threshold eGFR < 15 ml/min/1.73 $m^2$.

- No "one size fits all"
- In a US study elderly patients would have been more likely to undergo unnecessary procedures (5:1 for >85 years vs. 0.5:1 for <44 years)

O'Hare et al, Kidney Int 2007

# Special populations: Elderly

- A recent meta analysis regarding elderly patients showed that elbow fistulas had lower failure rates and AVGs were equal to AVFs
- Therefore, these differences should be considered during surgical planning.
- Initial use of proximal autologous AV upper arm fistulae or the more liberal use of AVGs is justified in elderly patients

Lazarides M et al, J Vasc Surg 2007

# Special populations: Elderly

- However, elderly incident patients >67 years exhibited the lowest 1-year mortality if their initial VA was an AVF

Xue JL et al, Am J Kidney Dis 2003

# Multidisciplinary approach

- A formal process with a multidisciplinary approach, a fistula coordinator and an effective partnership between nephrologists and VA surgeons could lead to the

**Fistula First and Catheters Last**

Lacson E et al, Am J Kidney Dis 2007

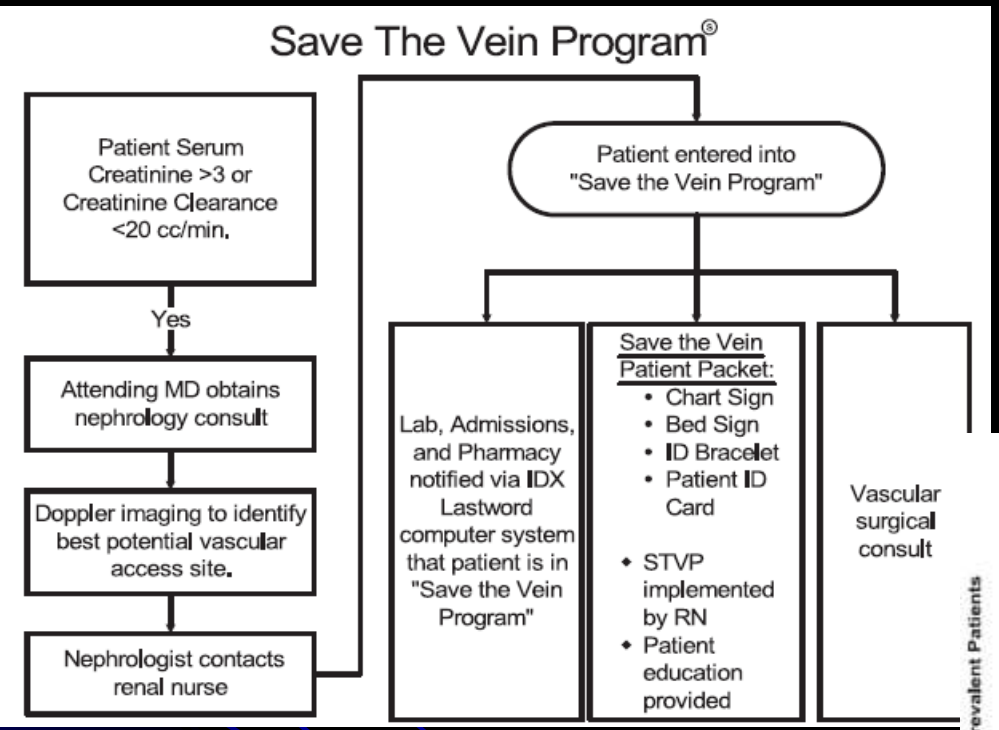
# CIMINO initiative (multicenter – multidisciplinary)

- Adherence to current guidelines
- Preoperative duplex examination
- Salvaging of failing and failed AVFs
- Nurse coordinator

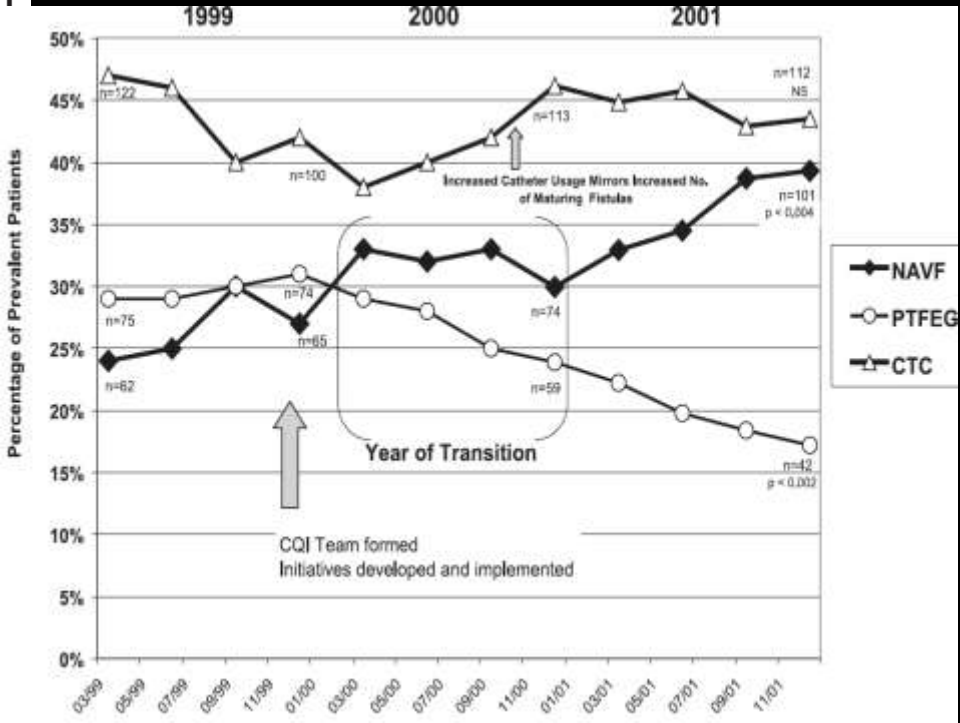
- Resulted in an increase in prevalent AVF use and the increase was quicker the centers involved in the CIMINO initiative

Huijbregs H et al, Nephrol Dial Transplant 2007

# A multidisciplinary experience in implementing K/DOQI Guidelines for VA




Increase in native AVF and dramatic reduction in morbidity (hospitalization rate from 98 to 79% VA related admissions from 67 to 53%) In less than 2 years




Ackad A et al, Nephrol Dial Transplant 2005

# Multidisciplinary approach

- Brescia MJ, Cimino JE, Appel K, Hurwich BJ. Chronic hemodialysis using venipuncture and a surgically created arteriovenous fistula.

  N Engl J Med 1966; 275: 1089-1092.

# VA creation

- Poor planning does not justify poor access

D'Cunha PT and Besarab A, Cuur Opin Nephrol Hypertens 2004

# Hemodialysis Vascular Access

The challenge for all of us

## Turning the Achilles' Heel to a well functioning Life line