Epidemiology of CKD in Children

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CKD Course
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Aim & Plan

- Causes of CKD in children
- Incidence & prevalence & risks for progression

- Plan
  - 1990-2000
  - ItalKid Project
  - ESPN Registry, NAPRTCS 2008 Annual reports
  - Data from Turkey

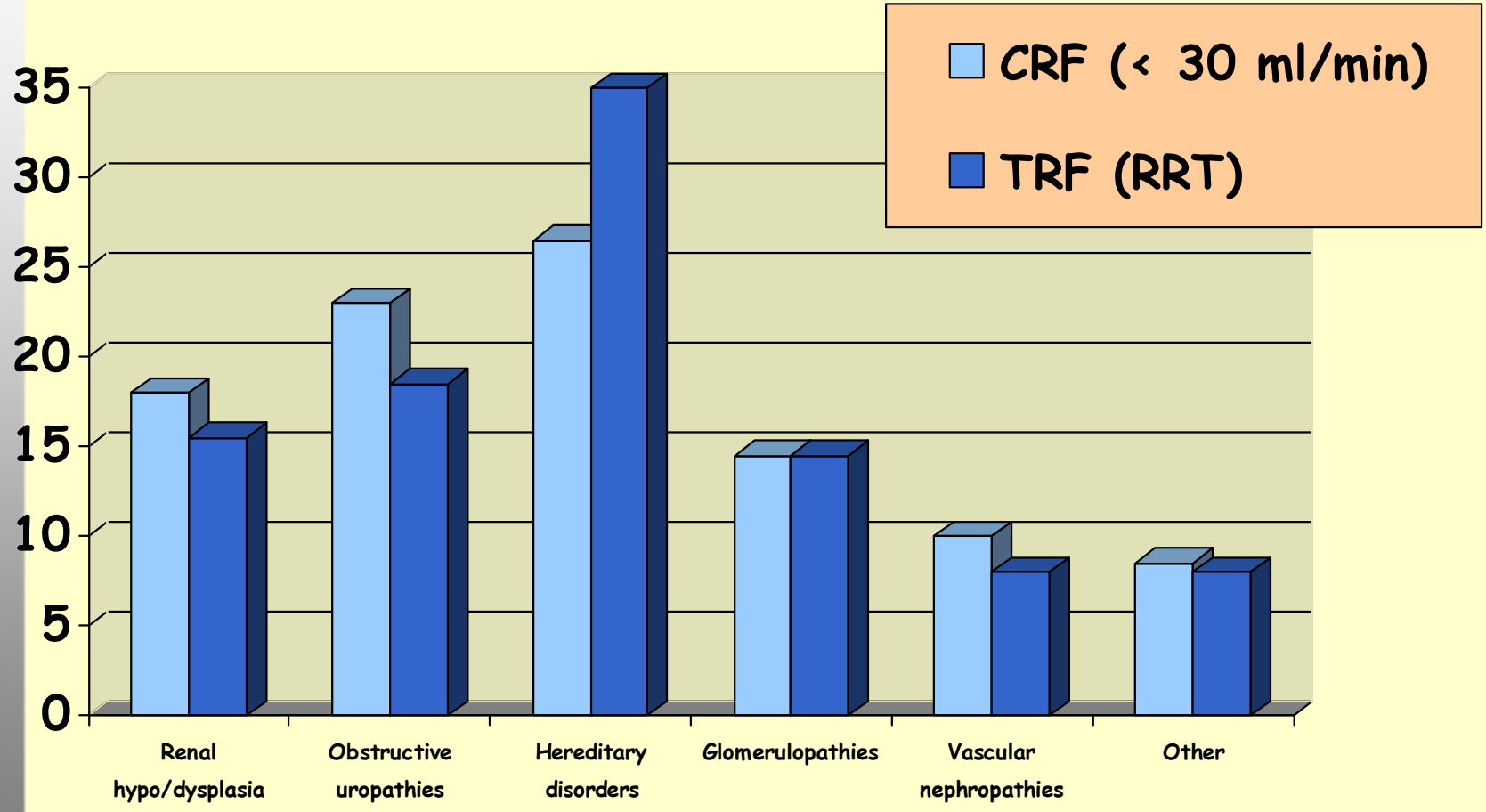
K/DOQI stages of CKD

Stage	Description	GFR (ml/min/1.73 m^2)
I	Kidney damage with normal or increased GFR	≥90
II	Kidney damage with mild decrease in GFR	60-89
III	Moderate decrease in GFR	30-59
IV	Severe decrease in GFR	15-29
V	Kidney failure	<15 (or dialysis)

Am J Kidney Dis 2002;39:S1-266.

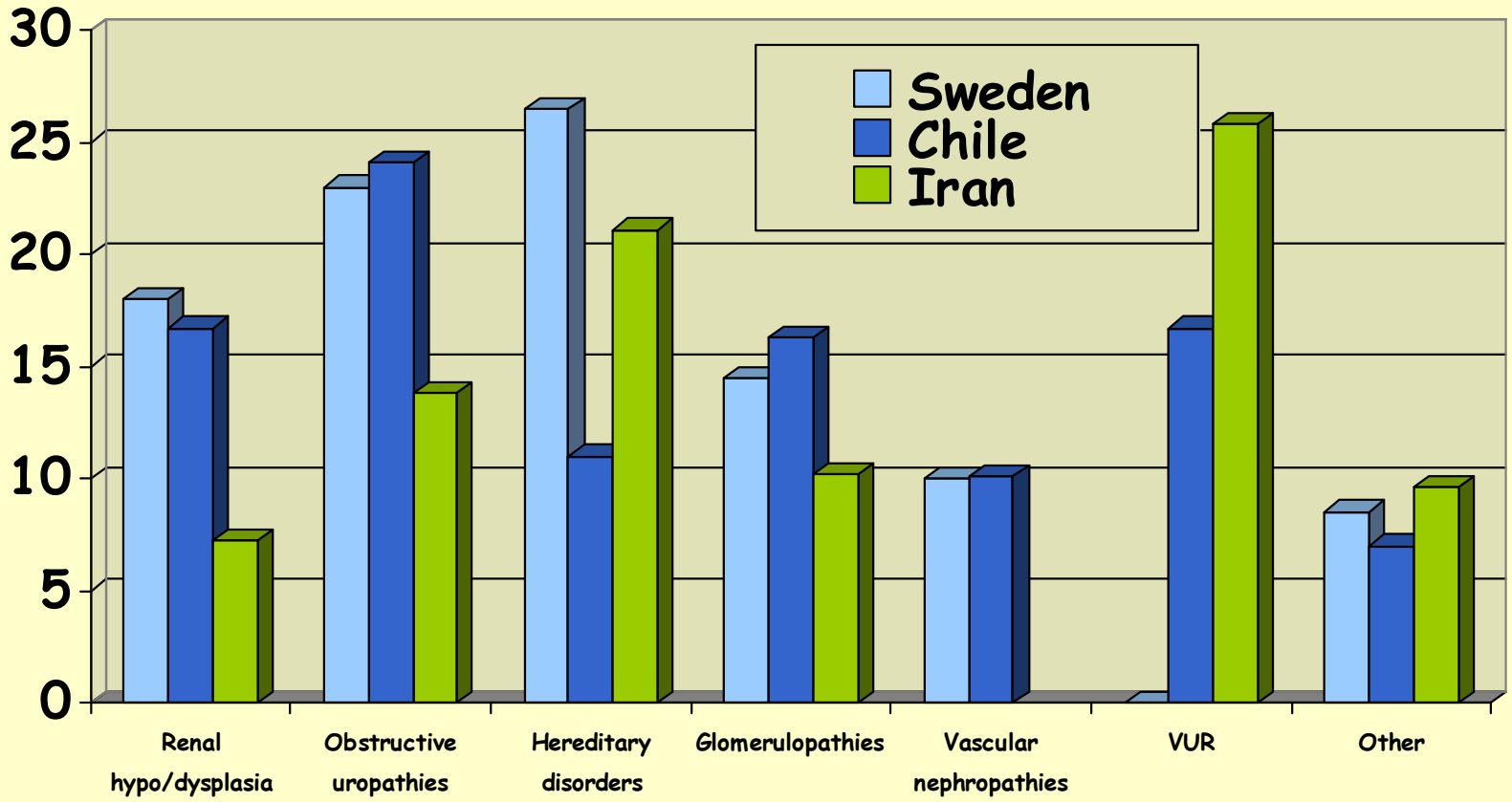
Year of publication	Country	Period	Study design	Definition	N	M/F
1995	Turkey	1979-1993	Single center	GFR <50	459	1.2
1997	Sweden	1986-994	Nationwide	GFR <30	118	1.6
1999	Chile	1996	Nationwide	GFR <30	227	1.0
1999	India	NA-1 year	Single center	Cre > 2 mg/dl	48	2.2
2001	Iran	1991-1999	Single center	GFR <30	166	1.3
2002	Japan	1998	Nationwide	ESRD	105	1.9
2003	Nigeria	1985-2000	Single center	GFR <30	45	1.6

Primary renal diseases in children; Sweden 1986-1994



- Esbjörner et al. Pediatr Nephrol 1997; 11: 438-442.

Country	n	Incidence	Prevalence
Sweden (1986-1994)	118	7.7	25.0
Chile (1996)	227	5.7	42.5
Iran (1991-1999)	166	NA	NA



- Esbjörner et al. Pediatr Nephrol 1997; 11: 438-442.
- Lagomarsimo et al. Pediatr Nephrol 1999; 13: 288-291.
- Madani et al. Pediatr Nephrol 2001; 16: 140-144.

Epidemiology of Chronic Renal Failure in Children: Data From the ItalKid Project

Gianluigi Ardissino, Valeria Daccò, Sara Testa, Roberto Bonaudo, Aldo Claris-Appiani, Emanuela Taioli, Giuseppina Marra, Alberto Edefonti and Fabio Sereni

Pediatrics 2003;111;e382-e387
DOI: 10.1542/peds.111.4.e382

The lack of population-based information means that the epidemiology of childhood CRF is often based on renal replacement therapy data,[7] but the vast majority of children with renal impairment (particularly congenital abnormalities) reach ESRD when they are far beyond pediatric age and are therefore not included.

ItalKid Project

- Population based registry in 1990
- Covered the entire country, 16.8 million children
- Inclusion criteria
  - Creatinine clearance of 75 ml/min/1.73 m^2
    - for children < 1 year: Serum Cre > mean sCr + 3 SD;
  - Age younger than 20 years at the time of registration

ItalKid Project

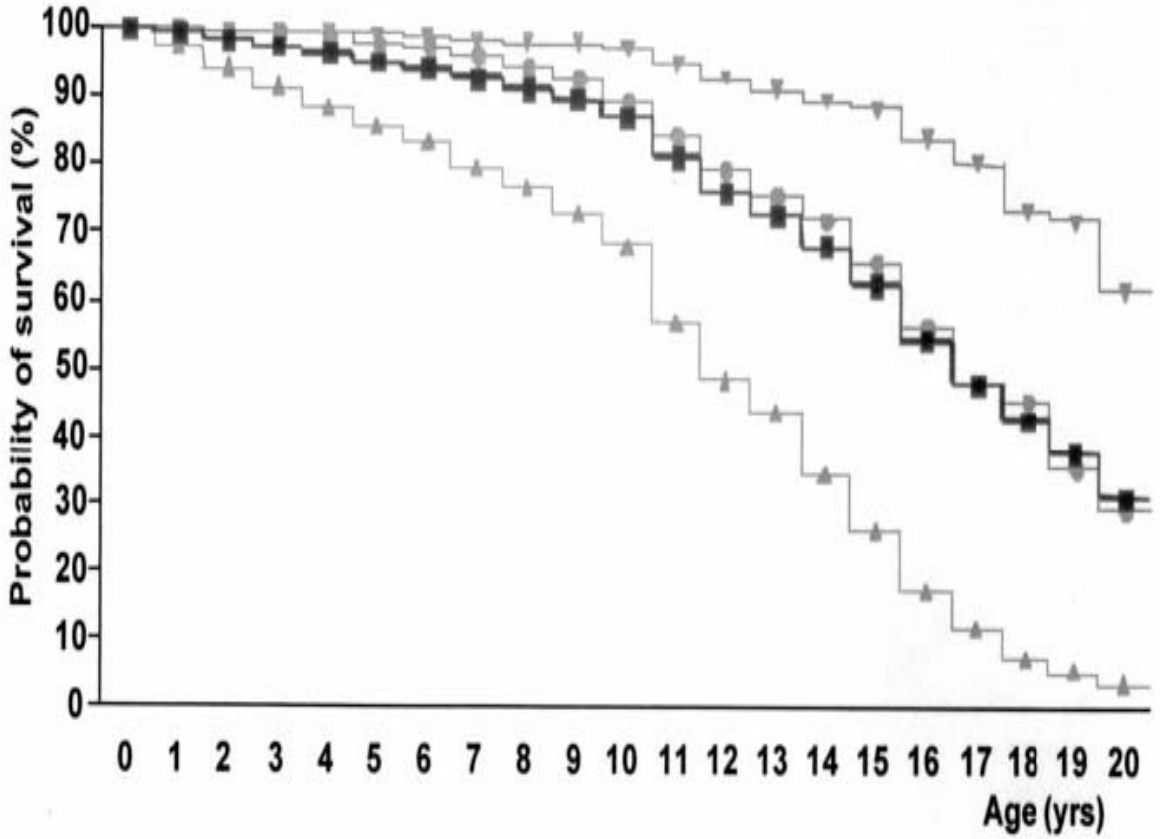
- In 10 years, 1.197 pts. have been registered.
- M/F:
  - 2.03 for the population as a whole
  - 1.72 when the pts. with PUV were excluded.
- The mean age at registration: 6.9 ± 5.4 years
- The mean Ccr at registration: 41.7 ± 20.5 mL/min/ 1.73 m^2
- The mean incidence (1995–2000): 12.1 cases pmarp (8.8–13.9).
- The point prevalence (January 1, 2001) 74.7 cases pmarp

TABLE 1. Primary Cause of CRF in Children*

	All Registered Patients		Patients Reaching ESRD	
	No.	%	No.	%
Hypodysplasia				
With identified uropathy	522	43.6	71	27.1
Without urinary tract malformations	167	13.9	33	12.5
Neurogenic bladder	44	3.7	8	3.0
Chronic glomerulonephritis†	31	2.6	16	6.1
Focal glomerulosclerosis	21	1.8	12	4.6
Congenital nephrotic syndrome	13	1.1	5	1.9
Membranous nephropathy	3	0.3	2	0.8
Systemic lupus erythematosus	13	1.1	5	1.9
Hemolytic uremic syndrome	43	3.6	9	3.4
Polycystic kidney disease	60	5.0	9	3.4
Nephronophthysis	41	3.4	21	8.0
Alport's syndrome	18	1.5	9	3.4
Cystinosis	22	1.8	9	3.4
Hereditary nephropathies‡	45	3.8	13	4.9
Cortical necrosis (perinatal)	49	4.1	8	3.0
Medications	14	1.2	2	0.8
Idiopathic interstitial nephritis	24	2.0	9	3.4
Wilms' tumour	4	0.3	3	1.1
Miscellaneous non-hereditary diseases	23	1.9	8	3.0
Unknown	40	3.3	11	4.3

* Including monolateral renal agenesis (65), nephrectomy (30), and multicystic kidney (25).
† Including unlisted systemic immunological diseases.
‡ Other than those individually listed.

Fig 2. Estimated kidney survival in children with CRF by age. Overall population (n = 1197; —■—); patients with baseline creatinine clearance <25 mL/min (n = 315; —▲—); 25–50 mL/min (n = 419; —●—); 51–75 mL/min (n = 463; —▼—).



- The incidence of RRT was 7.3/year/100 patients
- The risk of developing ESRD by the age of 20 years was 68%

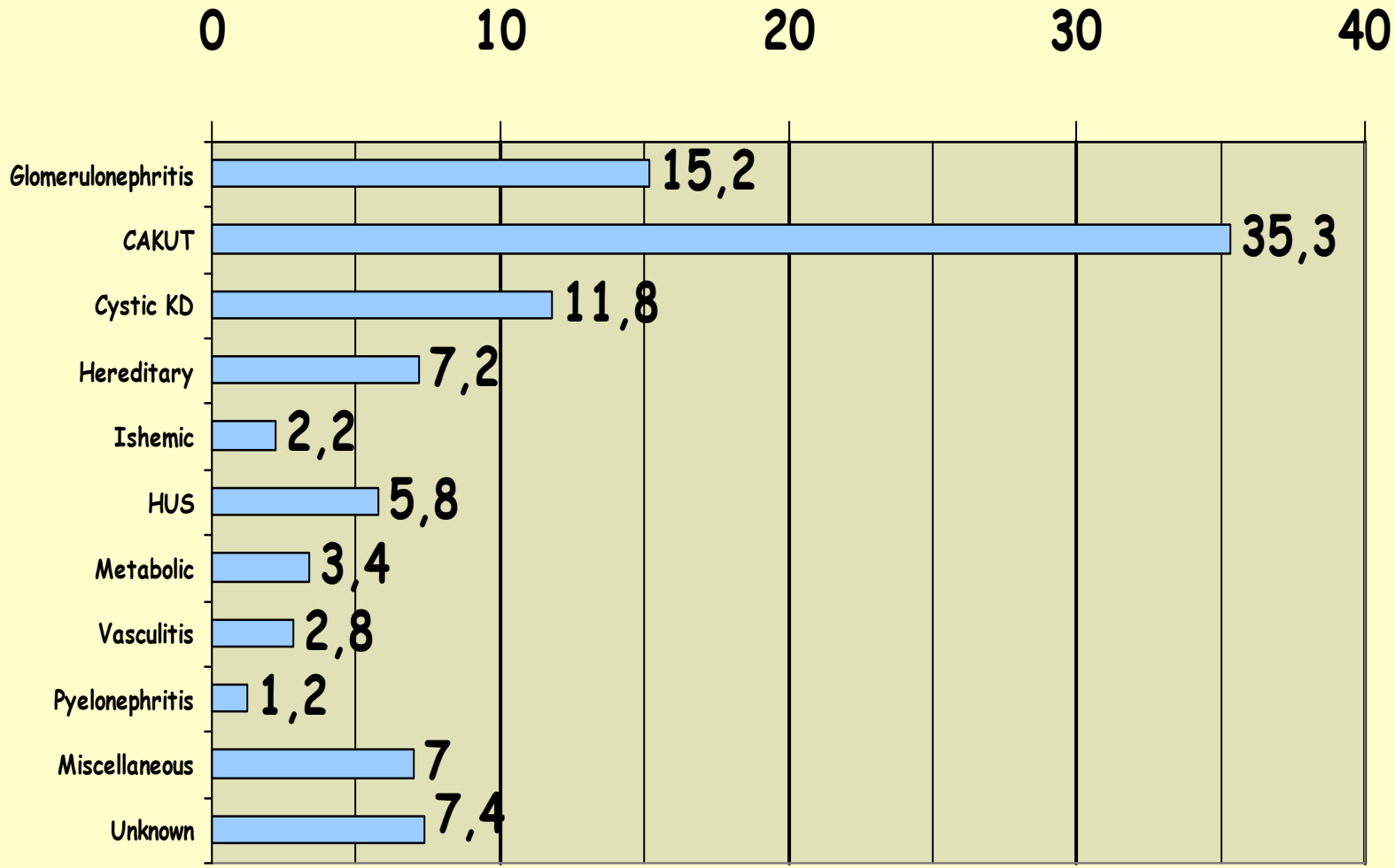
ESPN 2008 Report

- Total population: 628 million
- Children (0-14 years): 98 million (15.6%)

Patients accepted for RRT

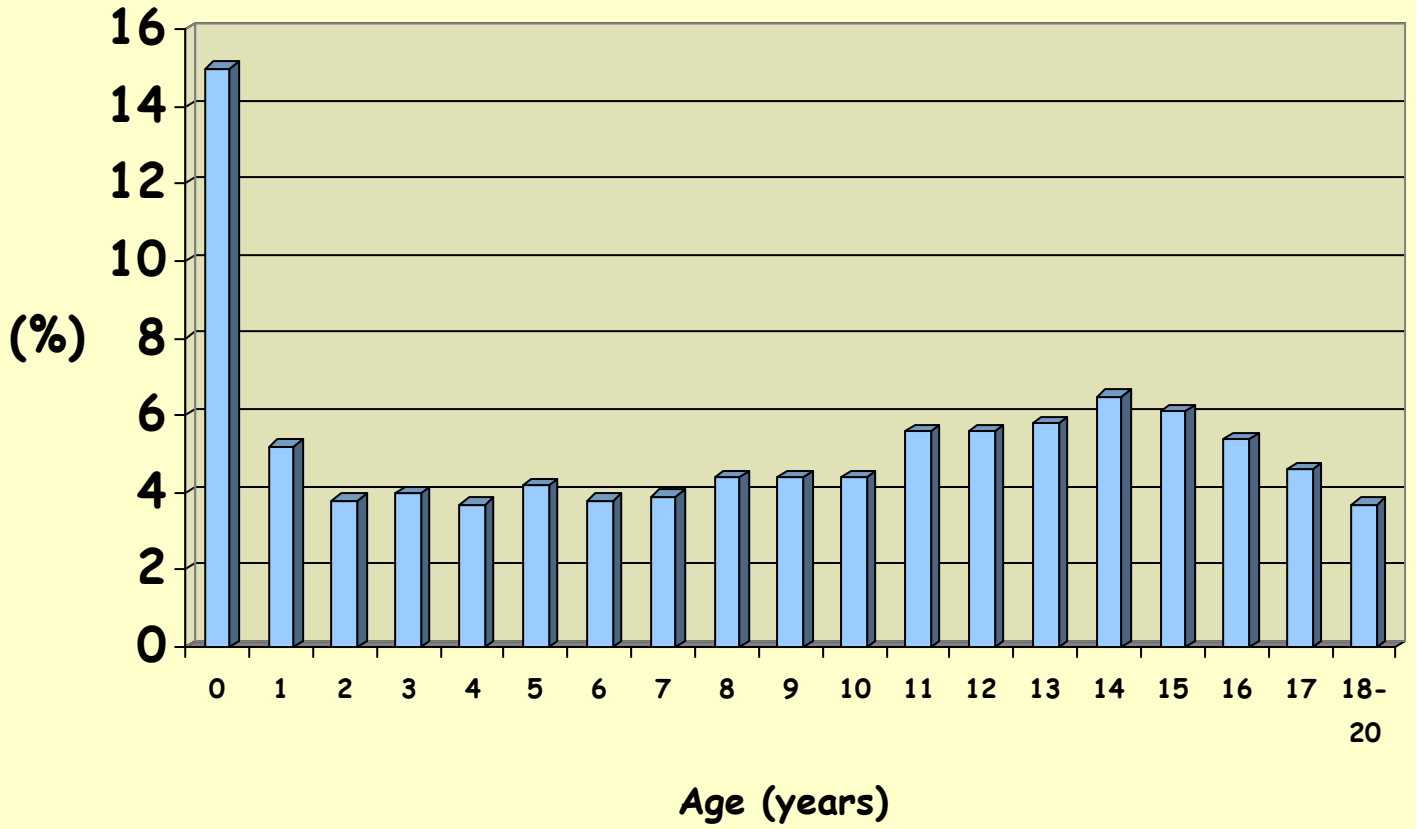
- Incidence 5.2 pmarp (0-24.5)
- Prevalence 28.6 pmarp (3.2-72.6)

ESPN 2008 Report



NAPRTCS 2008 (n: 7036)

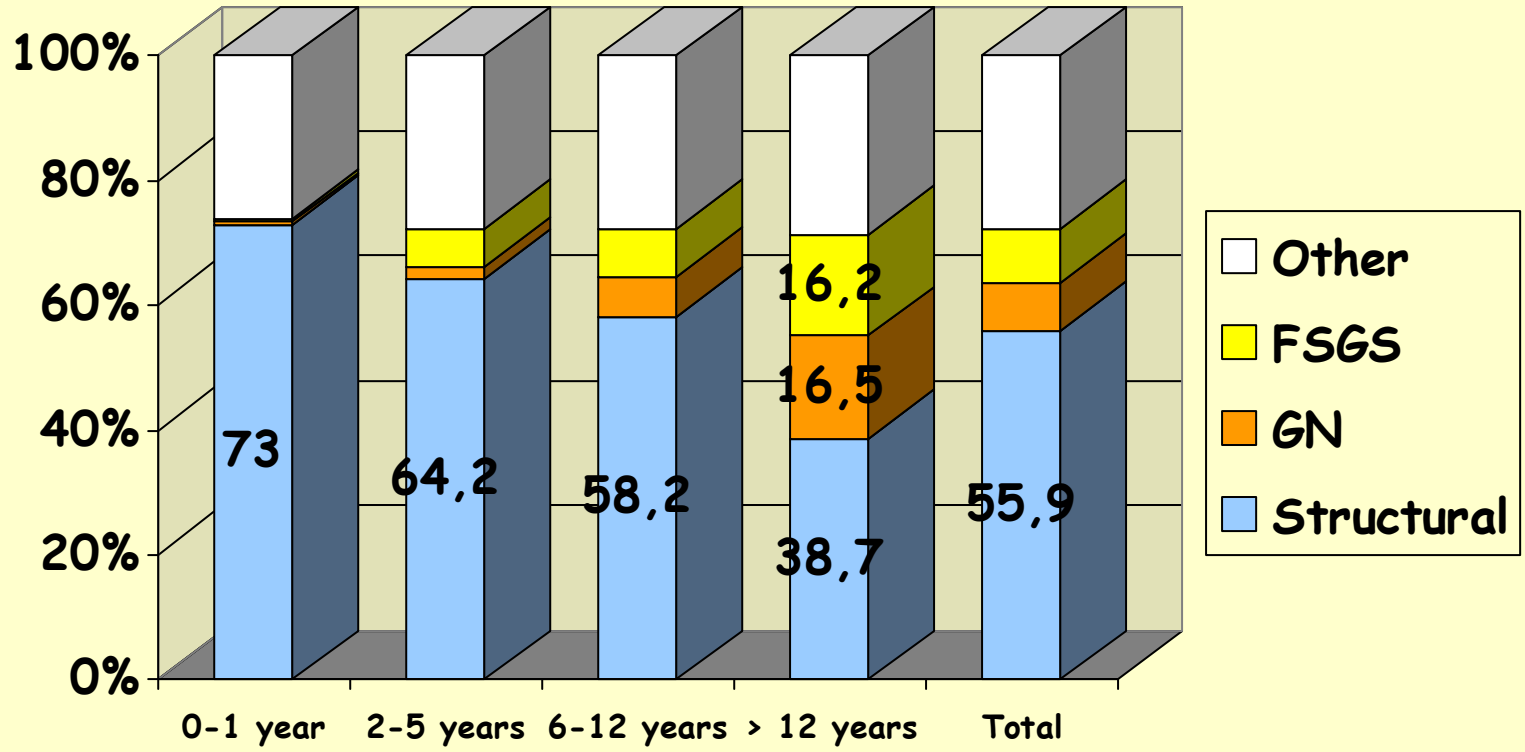
(1994; GFR < 75; Canada, Mexico, Costa Rica, USA)



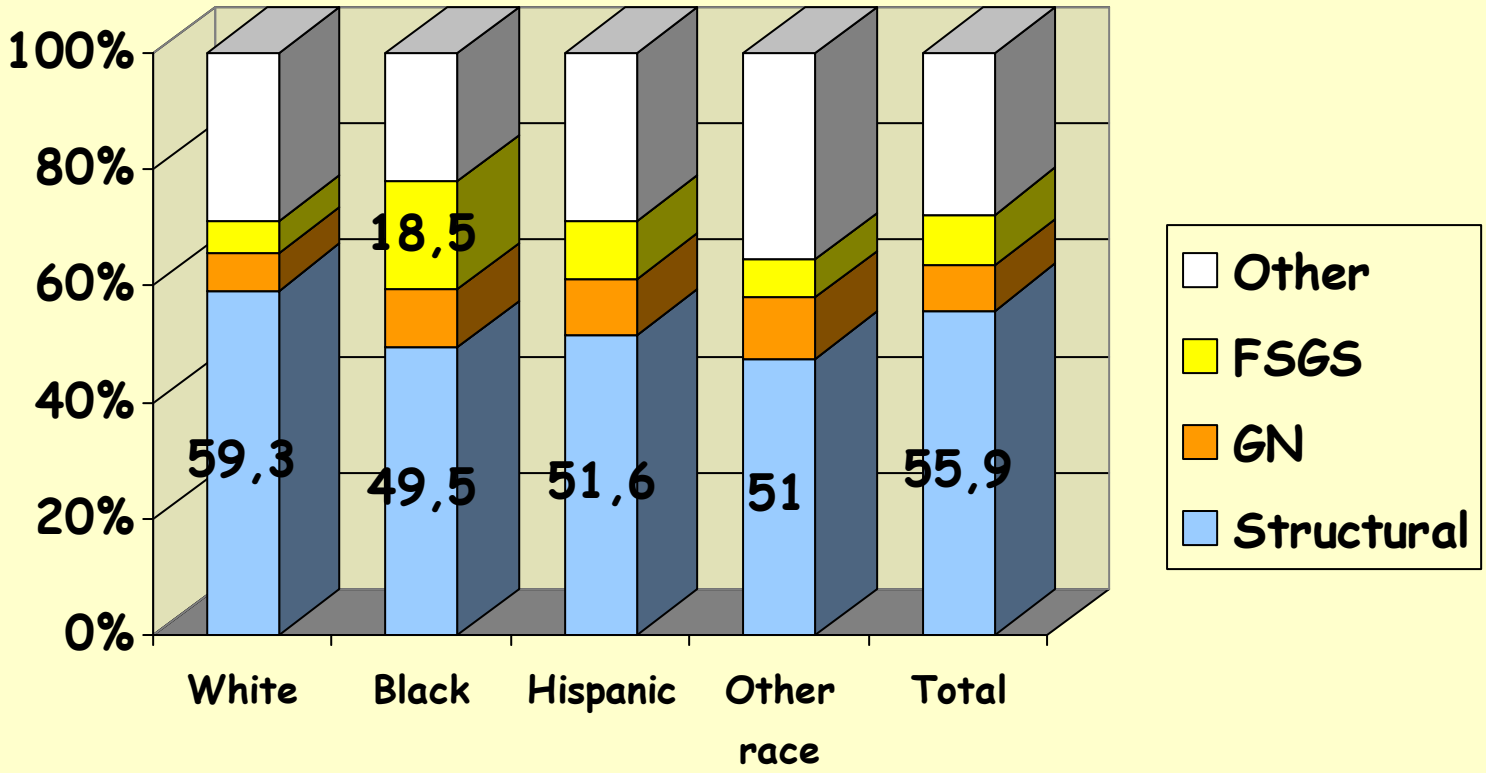
NAPRTCS 2008

- Structural
  - Prune belly, reflux nephropathy and aplasia/hypoplasia/displasias
- Glomerulonephritis
  - Chronic GN, idiopathic crescentic GN
  - MPGN, MGN, SLE, HSP, IgAN
  - Wegener's granulomatosis
- FSGS
- Other

NAPRTCS 2008 (n: 7026)



NAPRTCS 2008



NAPRTCS 2008
Chronic Kidney Disease

EXHIBIT 14.4
PROGRESSION TO ESRD

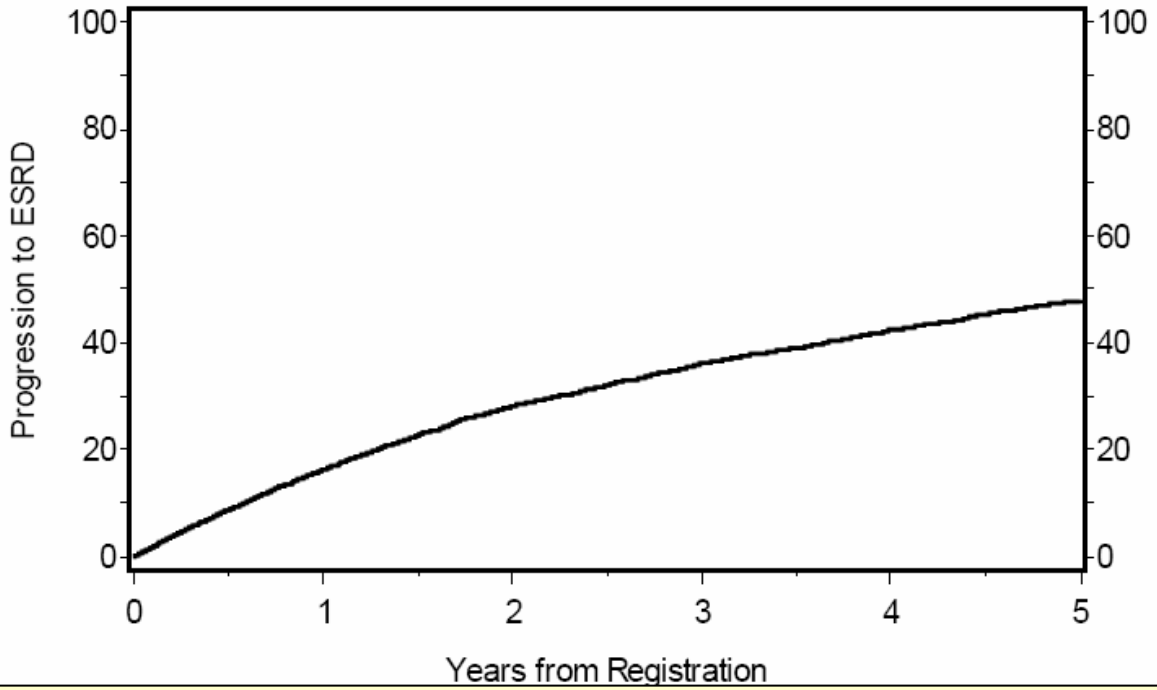


EXHIBIT 14.5
PROGRESSION TO ESRD
BY BASELINE CALCULATED CREATININE CLEARANCE (mL/min/1.73 m^2)

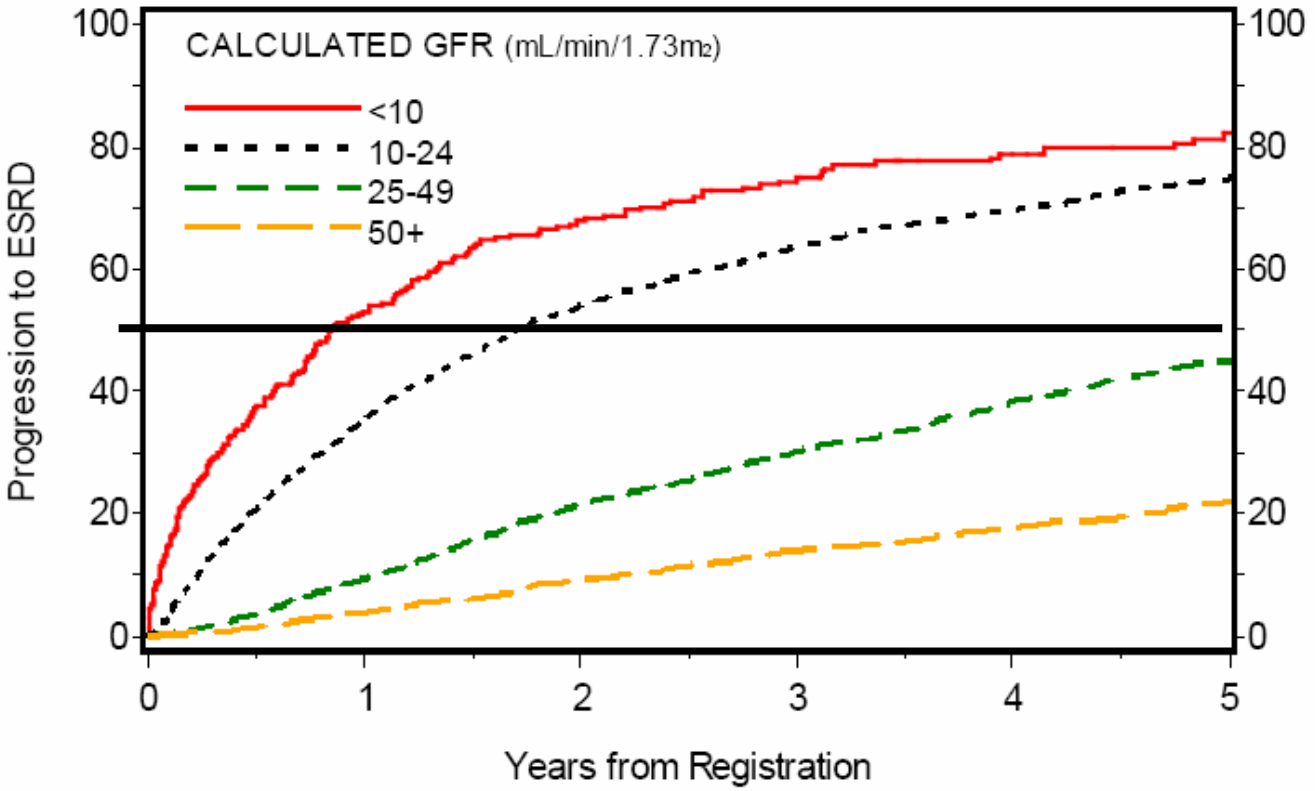
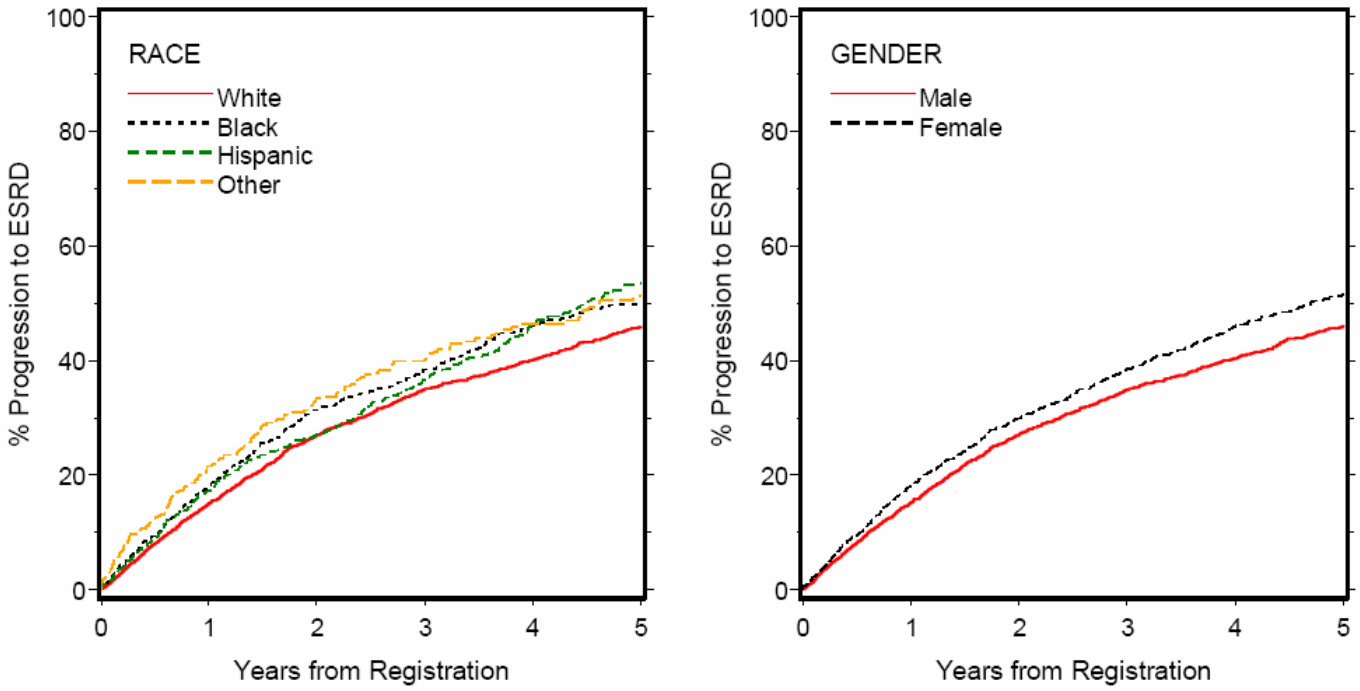
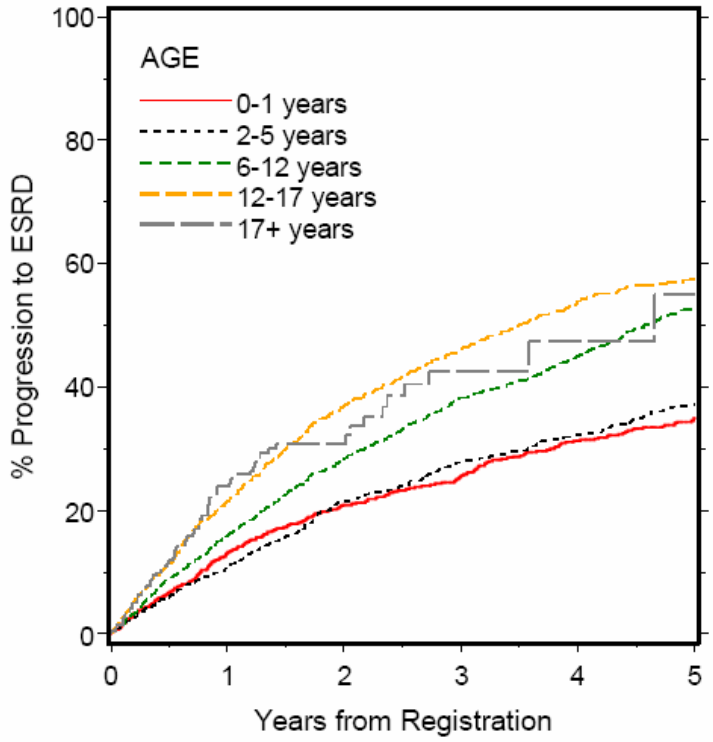
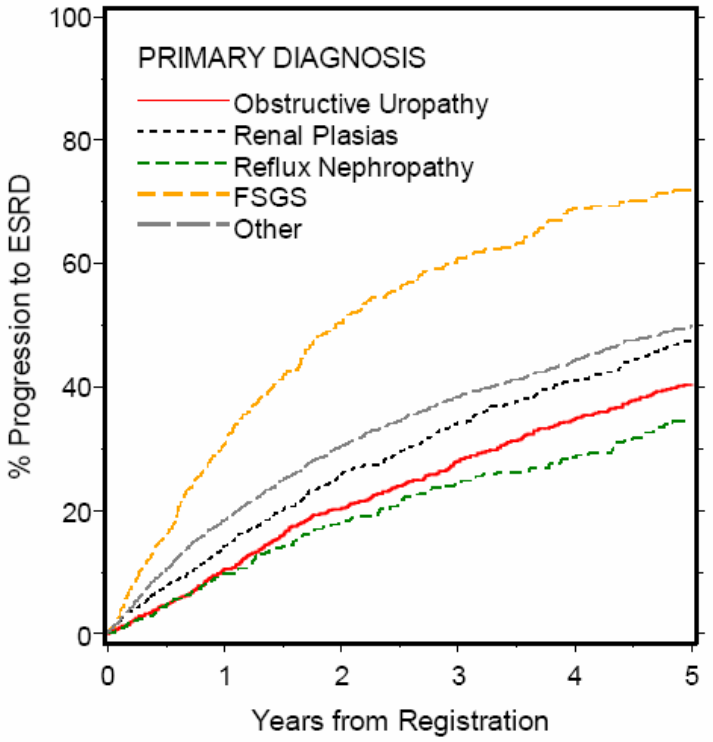
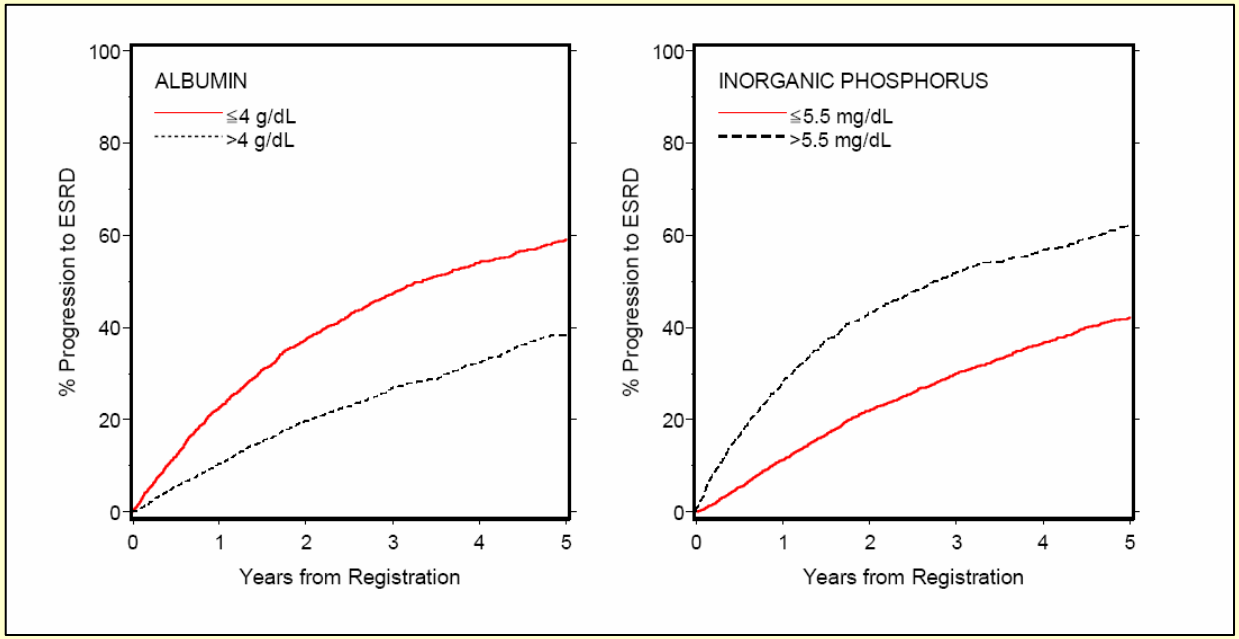


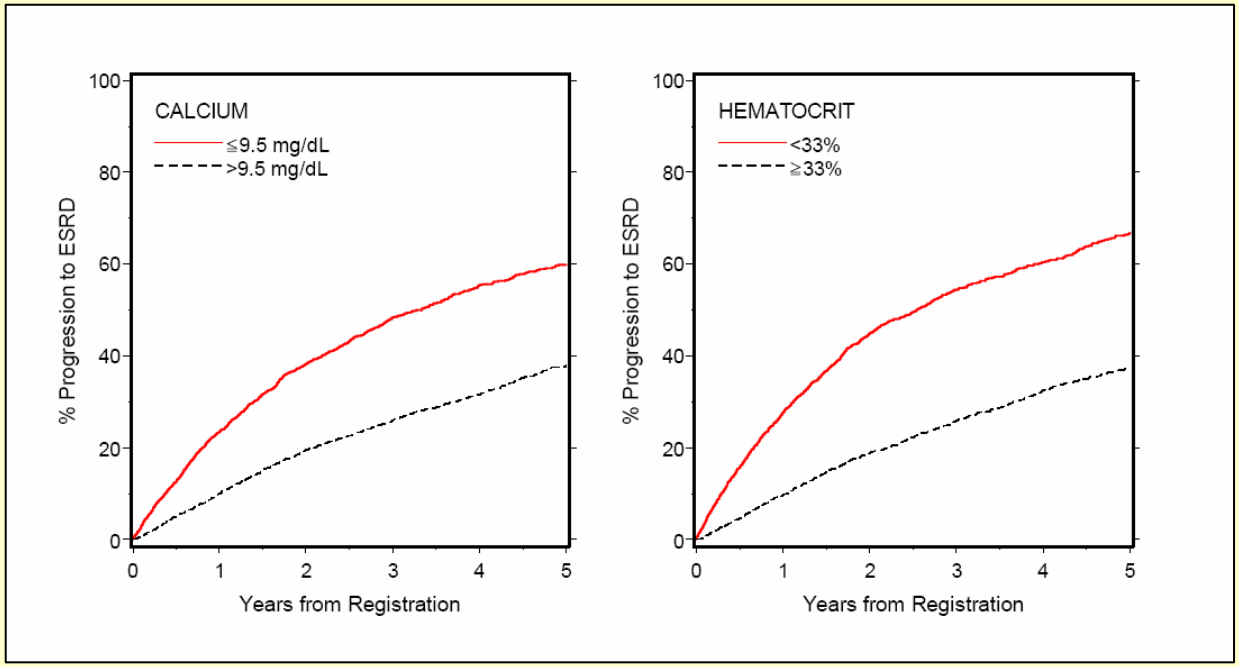
EXHIBIT 14.6
PROGRESSION TO ESRD BY SELECTED PATIENT CHARACTERISTICS



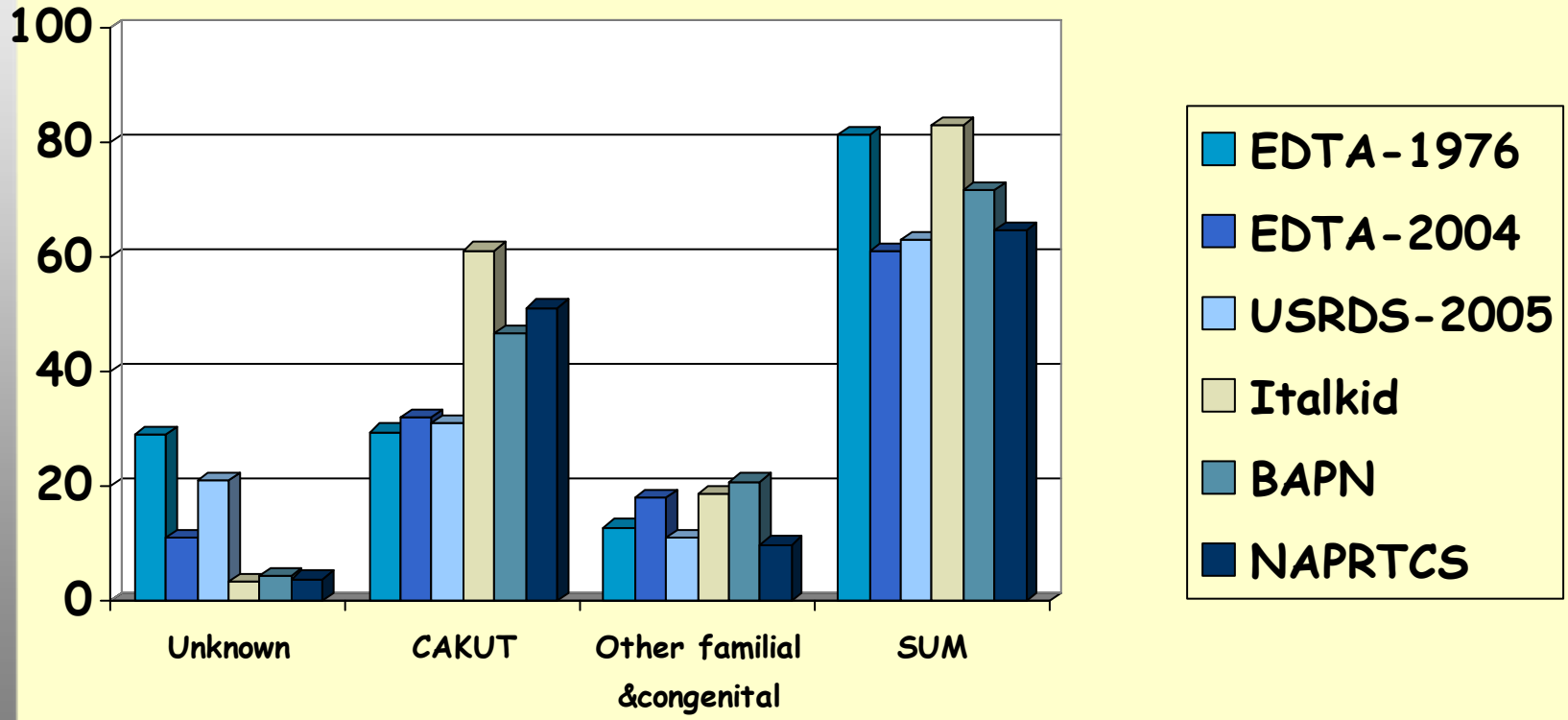

AGE
0-1 years
2-5 years
6-12 years
12-17 years
17+ years
% Progression to ESRD
Years from Registration
0
20
40
60
80
100
0
1
2
3
4
5


PRIMARY DIAGNOSIS
Obstructive Uropathy
Renal Plasias
Reflux Nephropathy
FSGS
Other
% Progression to ESRD
Years from Registration
0
20
40
60
80
100
0
1
2
3
4
5


ALBUMIN
≤4 g/dL
>4 g/dL
% Progression to ESRD
Years from Registration
INORGANIC PHOSPHORUS
≤5.5 mg/dL
>5.5 mg/dL
% Progression to ESRD
Years from Registration


CALCIUM
≤9.5 mg/dL
>9.5 mg/dL
% Progression to ESRD
Years from Registration
HEMATOCRIT
<33%
≥33%
% Progression to ESRD
Years from Registration

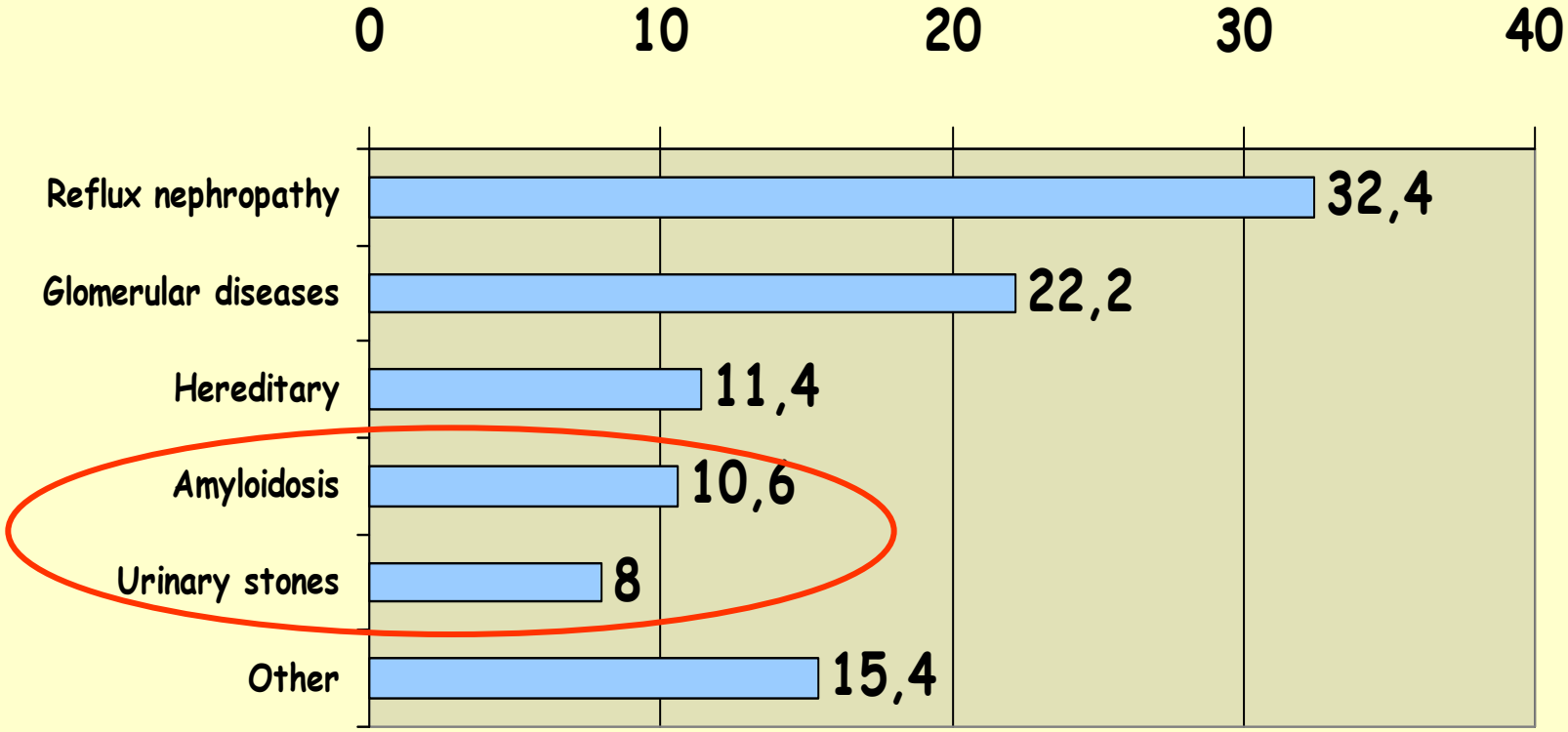
Causes of CKD



Adapted from: Neild GH. Pediatr Nephrol 2009; 24: 1913-1919.

Etiology of chronic renal failure in Turkey

- Study period: 1979-1993
- GFR < 50
- 459 children
- M/F: 1.23 (254/205)



- Sirin A et al. Pediatr Nephrol 1995; 9: 549-552.

Pediatr Nephrol (2009) 24:797–806
DOI 10.1007/s00467-008-0998-4

ORIGINAL ARTICLE

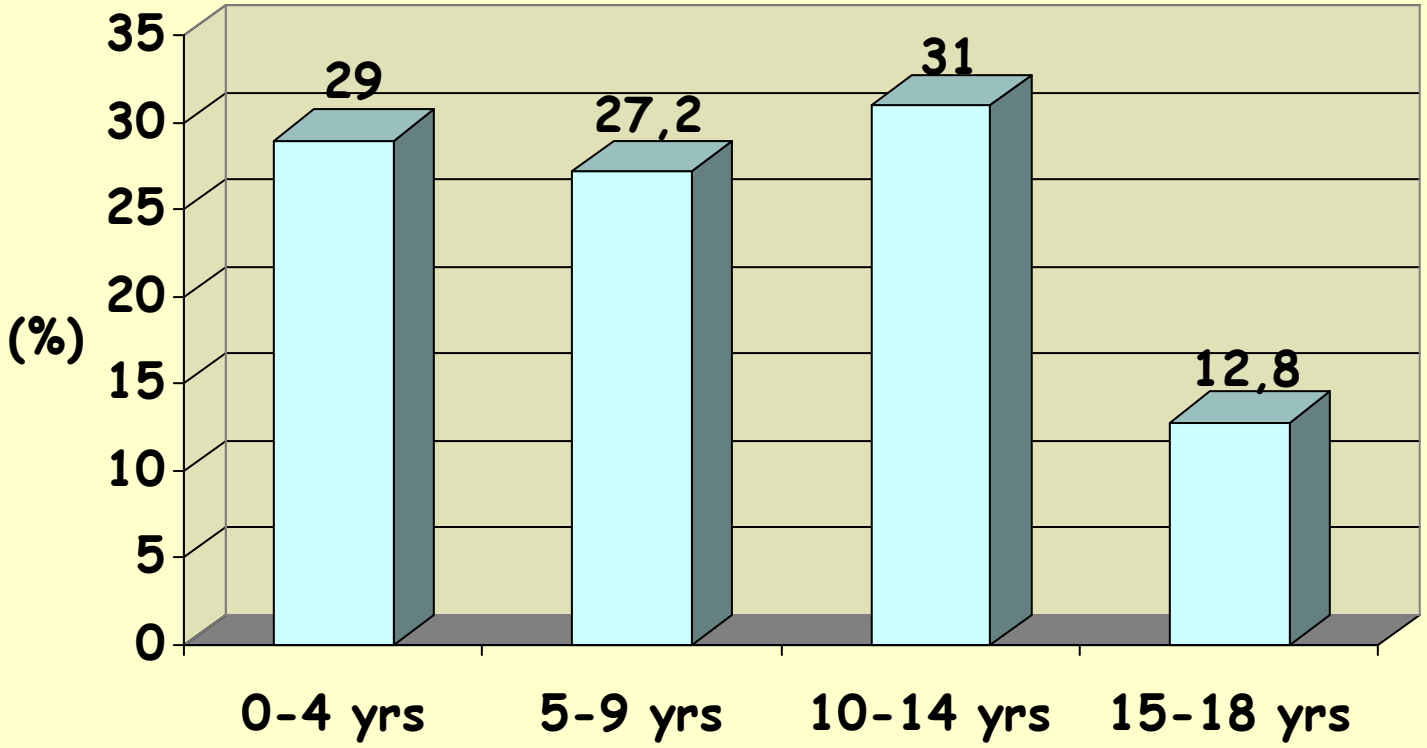
Chronic kidney disease in children in Turkey

Kenan Bek · Sema Akman · Ilmay Bilge ·
Rezan Topaloğlu · Salim Çalışkan · Harun Peru ·
Nurcan Cengiz · Oğuz Söylemezoğlu

- Turkish Society for Pediatric Nephrology-CKD Working Group
- 29 pediatric nephrology centers in Turkey
- eGFR ≤ 75 ml/min per 1.73 m^2
- < 19 years, diagnosed in 2005

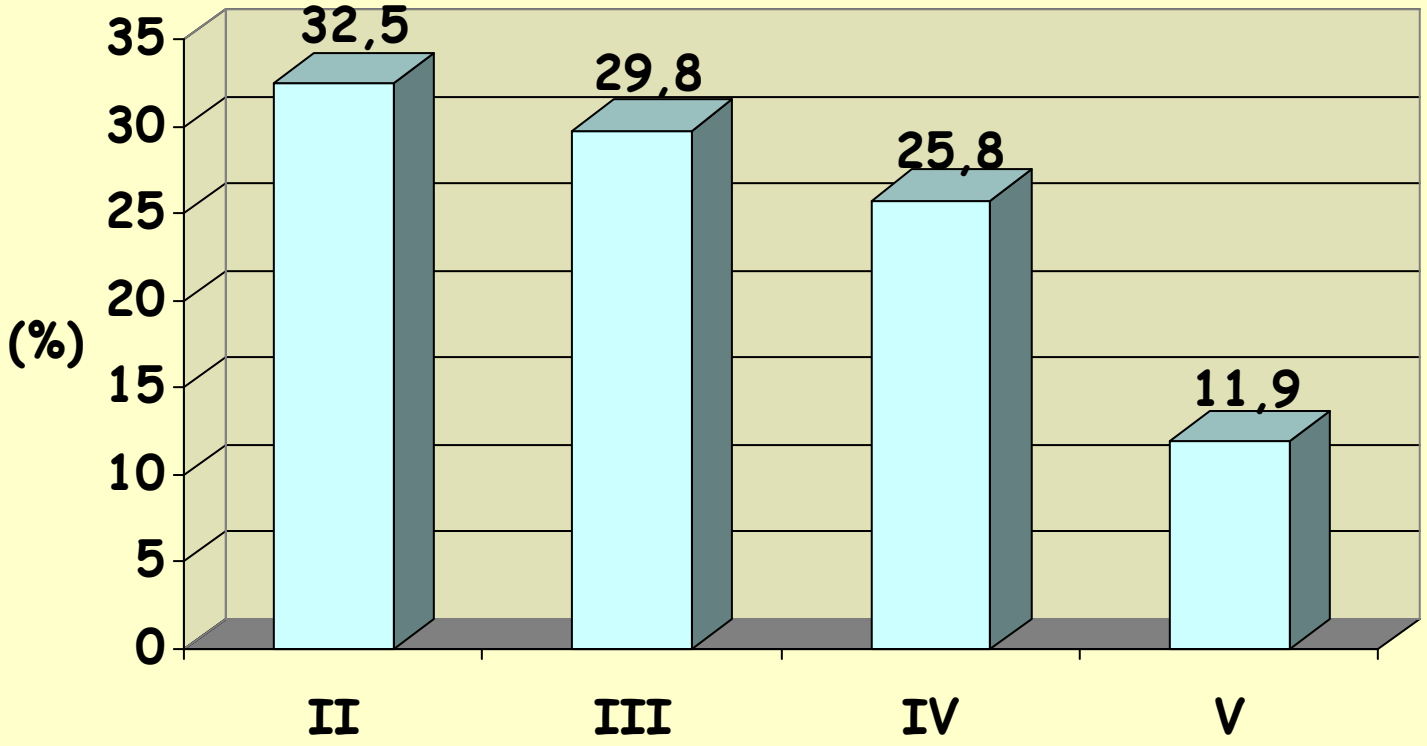
- 282 patients
  - M/F 1.29 (159/123)
  - mean age 8.05 ± 5.25 years

Age distribution of patients at diagnosis



- Bek et al. Turkish SPN CKDWG. Pediatr Nephrol 2009; 24:797-806.

CKD stages of the patients at diagnosis



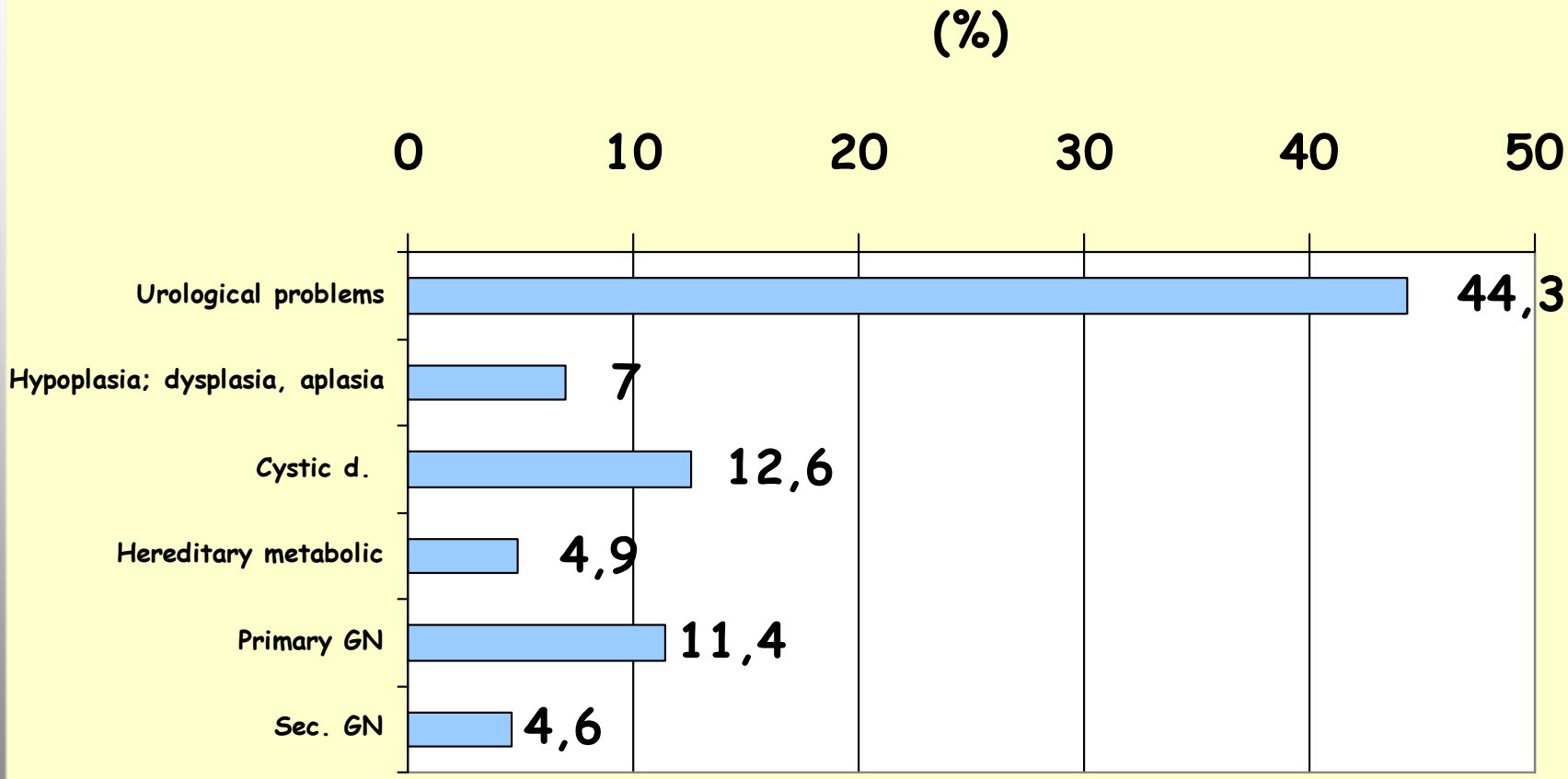
- Bek et al. Turkish SPN CKDWG. Pediatr Nephrol 2009; 24:797-806.

Table 3 Etiologic classification of the patients (*FSGS* focal segmental glomerulosclerosis, *PKD* polycystic kidney disease, *SLE* systemic lupus erythematosus, *HUS* hemolytic uremic syndrome, *HSP* Henoch–Schönlein purpura)

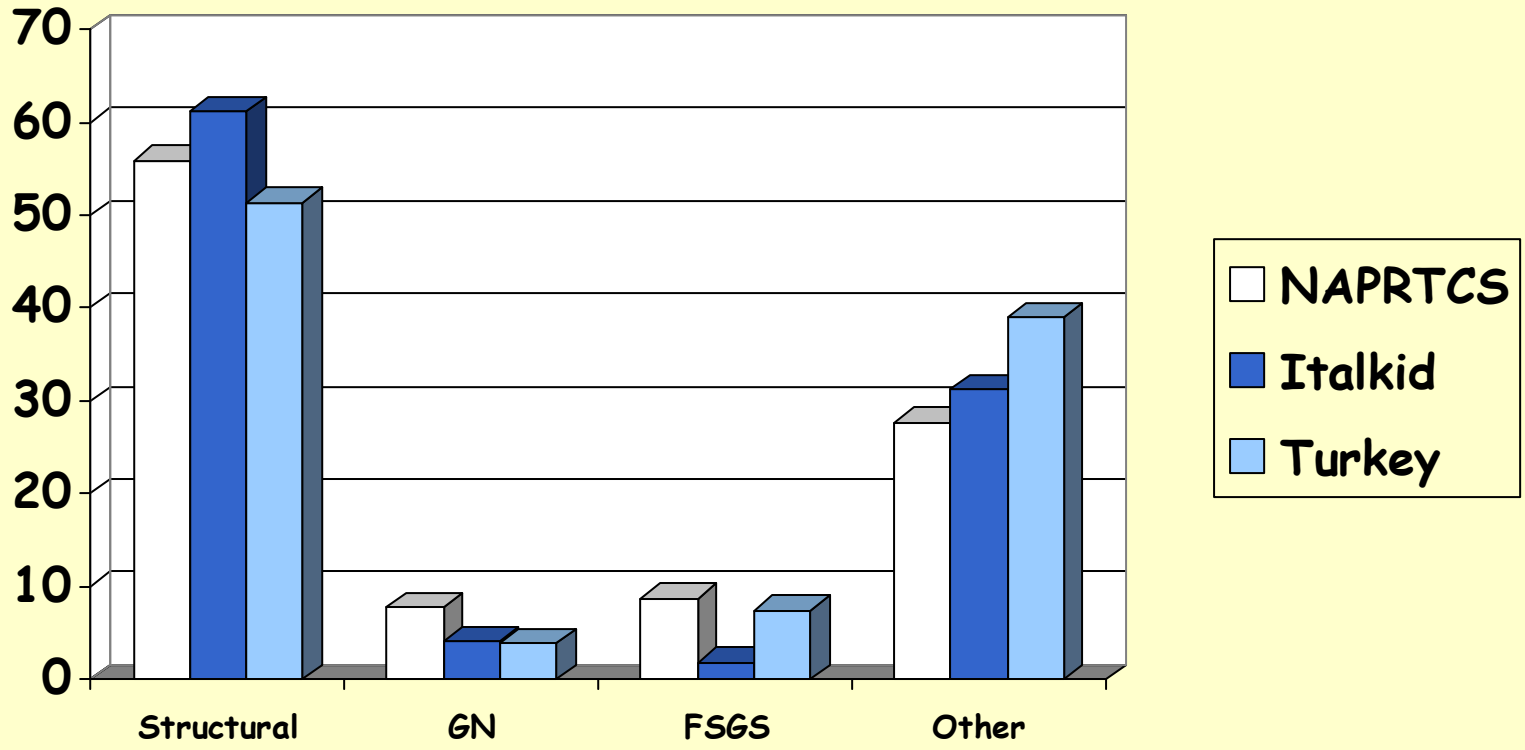
Etiology	Number	Percent	Male/female
Urological problems/tubulointerstitial diseases	143	50.7	85/58
Vesicoureteral reflux	52	18.5	26/26
Obstructive uropathy	30	10.7	26/4[a]
Neurogenic bladder	43	15.2	22/21
Chronic pyelonephritis	7	2.2	4/3
Nephrolithiasis + chronic pyelonephritis	8	2.6	6/2
Tubulo-interstitial nephritis	3	1.0	1/2
Primary glomerulonephritis	32	11.4	19/13
FSGS	21	7.4	11/10
Others	11	4.0	8/3
Cystic renal diseases	35	12.6	18/17
Autosomal recessive PKD	8	3.0	6/2
Juvenile nephronophthisis	20	7.0	10/10
Multicystic-dysplastic kidney	5	1.9	2/3
Other	2	0.7	0/2
Secondary glomerulopathies	13	4.6	4/9
Amyloidosis	6	2.1	1/5
SLE	1	0.4	0/1
HUS	5	1.7	3/2
Other	1	0.4	0/1
Hereditary/metabolic diseases	14	4.9	10/4
Alport disease	6	2.1	4/2
Cystinosis	4	1.4	4/0
Primary hyperoxaluria type 1	1	0.4	0/1
Other	3	1.0	2/1
Hypoplasia/dysplasia/Aplasia	20	7.0	9/10
Vasculitis (HSP)	1	0.4	1/0
Renal neoplasms	1	0.4	1/0
Various syndromic cases	9	3.3	5/4
Unknown	22	7.8	11/11

[a] The only significant difference for gender was detected for obstructive uropathy ($P<0.05$)

Causes of CKD



- Bek et al. Turkish SPN CKDWG. Pediatr Nephrol 2009; 24:797-806.


70
60
50
40
30
20
10
0
Structural
GN
FSGS
Other
NAPRTCS
Italkid
Turkey

Summary

- Leading causes:
  - CAKUT,
  - Other congenital and familial diseases.
- Factors affecting the pattern
  - Race, ethnicity, environment, wealth, age, time
- Preventable, curable in certain cases
- Measures to slow down progression