Sex-specific aspects in Nephrology

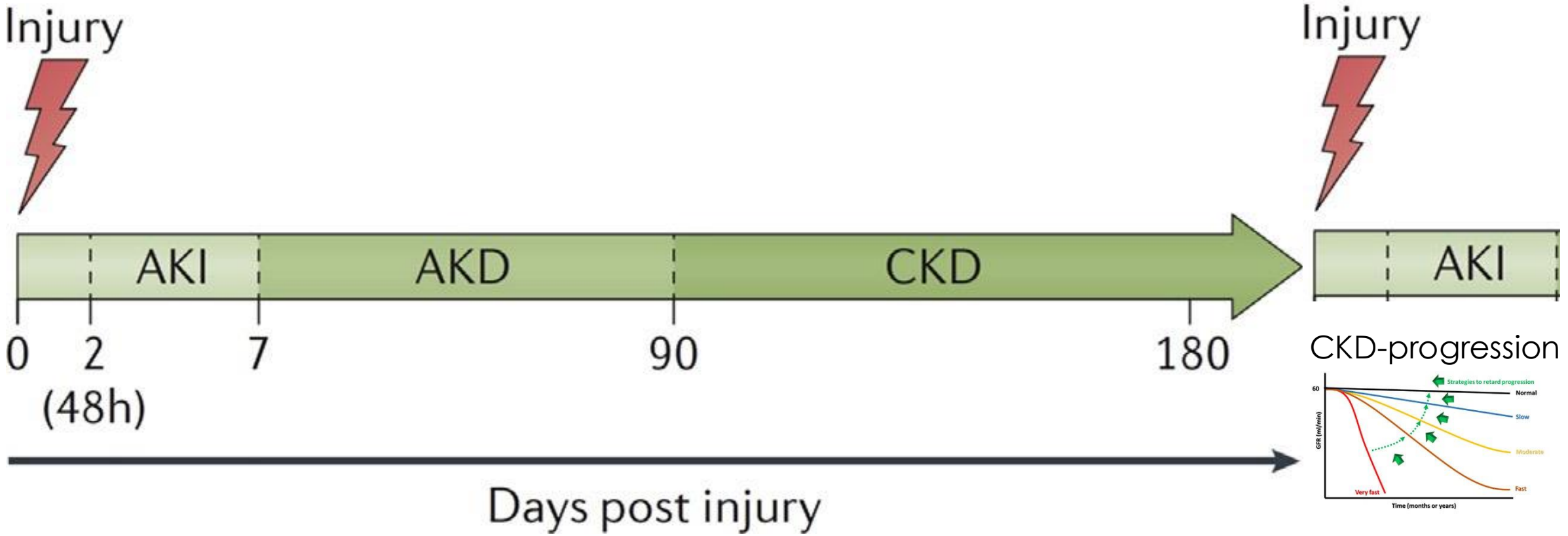
Jan Halbritter, MD

Department of Nephrology, University Medical Center Freiburg, Germany

International GeGe4Nephro Symposium – Gießen, 16.09.2026

Kidney disease – basic distinctions

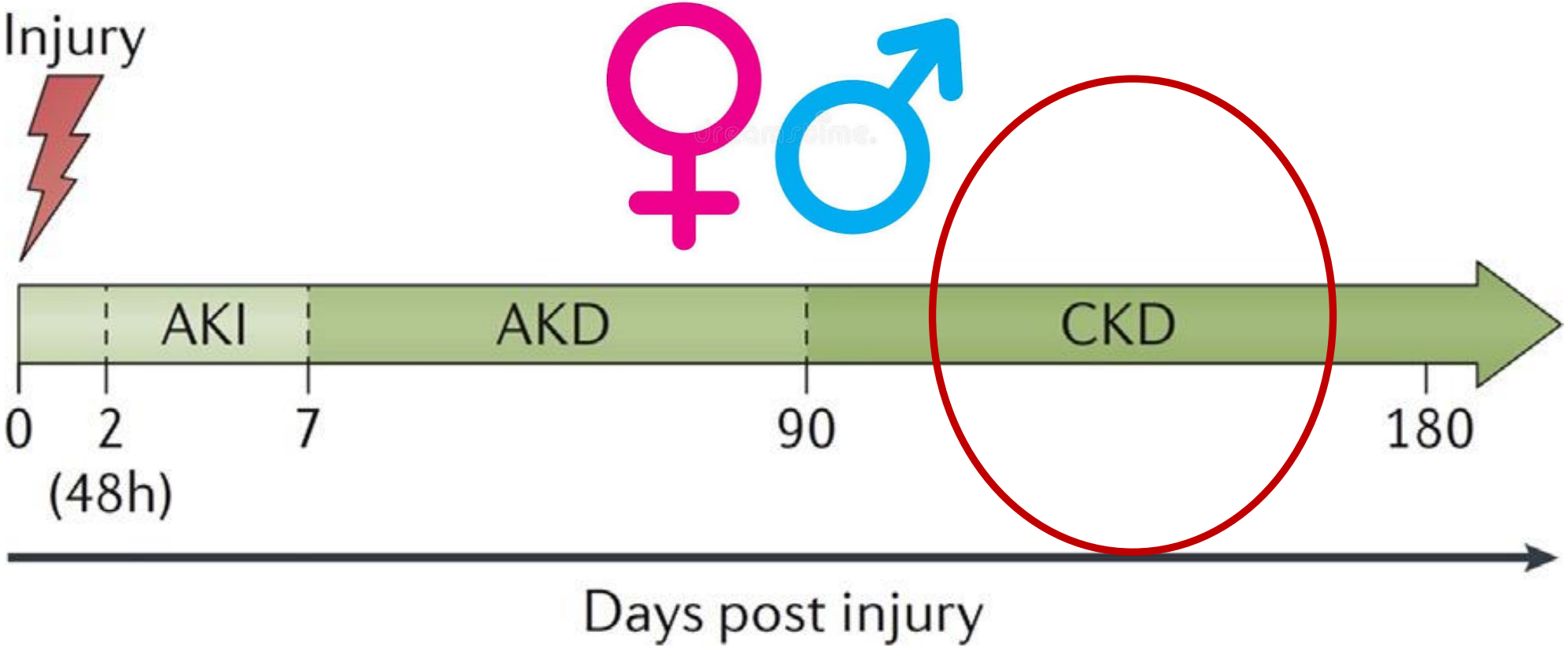
AKI (*acute kidney injury*) – AKD (*acute kidney disease*) – CKD (*chronic kidney disease*)



Liu KD et al, *KI Reports*, 2020

Is there any sex-related differences?

AKI (*acute kidney injury*) – AKD (*acute kidney disease*) – CKD (*chronic kidney disease*)



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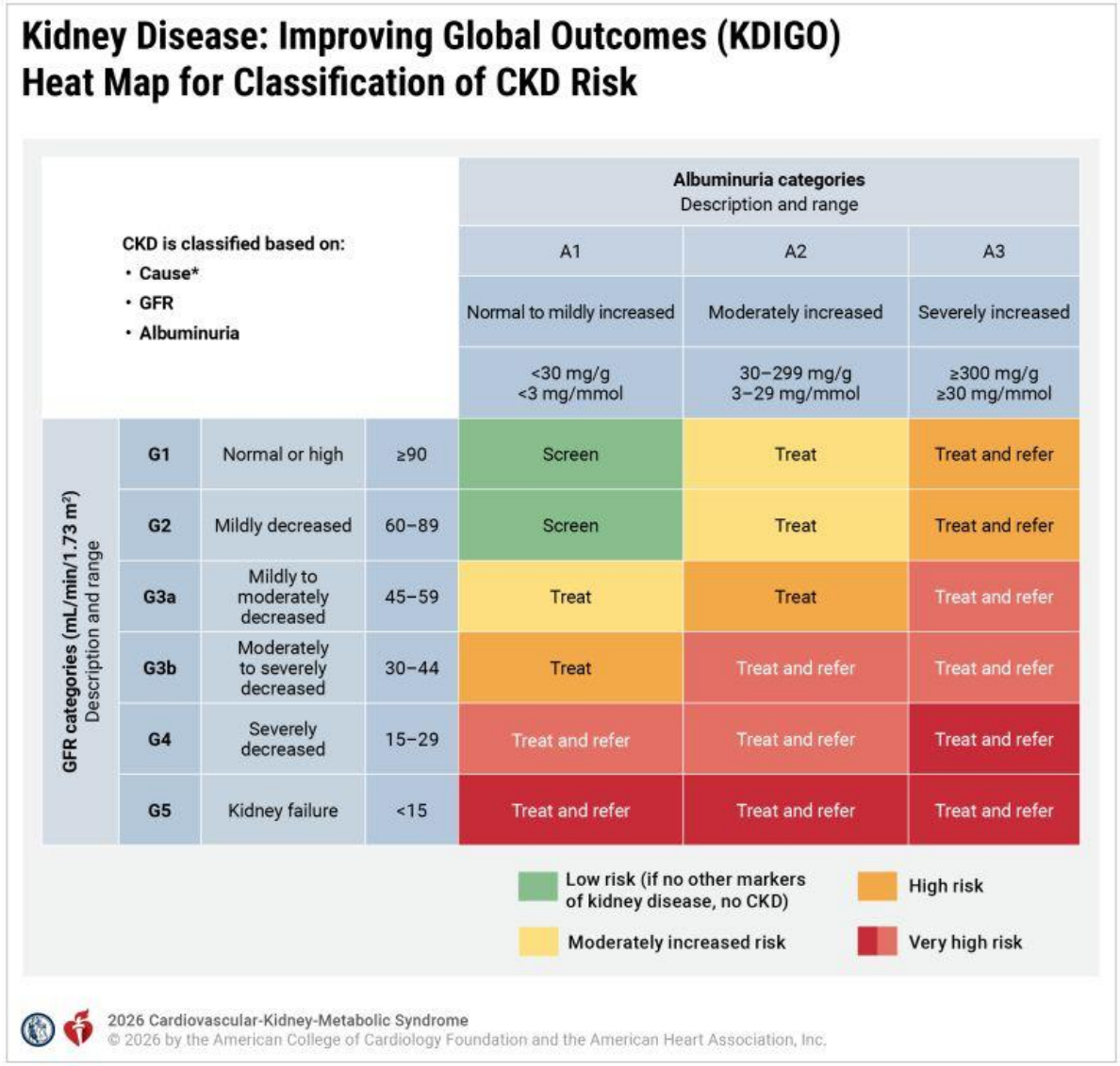
Chronic kidney disease – sex differences



Kidney Disease: Improving Global Outcomes (KDIGO)
Heat Map for Classification of CKD Risk

CKD is classified based on: • Cause* • GFR • Albuminuria				Albuminuria categories Description and range		
				A1	A2	A3
				Normal to mildly increased	Moderately increased	Severely increased
				<30 mg/g <3 mg/mmol	30–299 mg/g 3–29 mg/mmol	≥300 mg/g ≥30 mg/mmol
GFR categories (mL/min/1.73 m²) Description and range	G1	Normal or high	≥90	Screen	Treat	Treat and refer
	G2	Mildly decreased	60–89	Screen	Treat	Treat and refer
	G3a	Mildly to moderately decreased	45–59	Treat	Treat	Treat and refer
	G3b	Moderately to severely decreased	30–44	Treat	Treat and refer	Treat and refer
	G4	Severely decreased	15–29	Treat and refer	Treat and refer	Treat and refer
	G5	Kidney failure	<15	Treat and refer	Treat and refer	Treat and refer

Low risk (if no other markers of kidney disease, no CKD)
High risk
Moderately increased risk
Very high risk

2026 Cardiovascular-Kidney-Metabolic Syndrome
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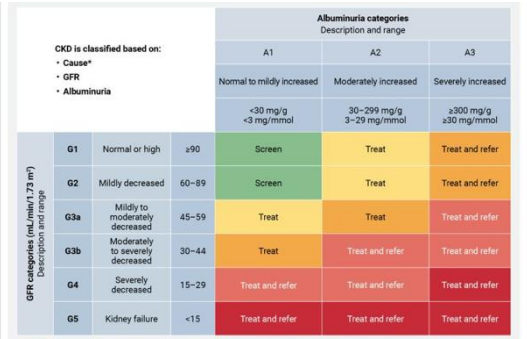
CKD prevalence is higher in women

HOWEVER

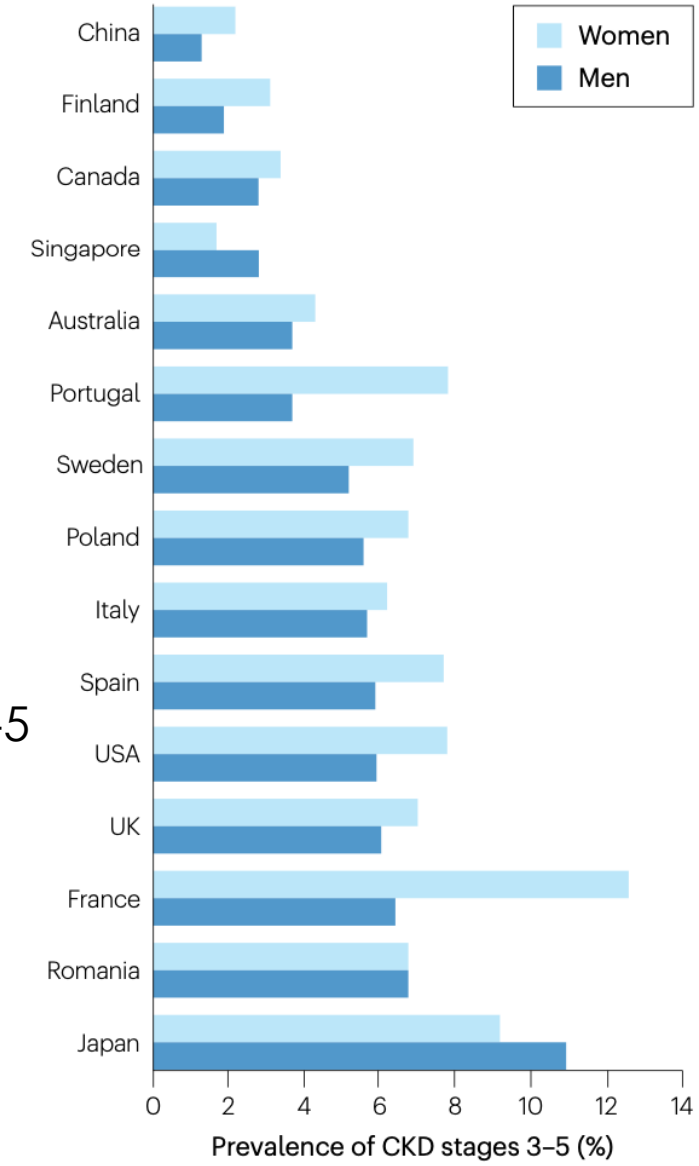
not for all stages and possibly biased by longer life expectancy in women

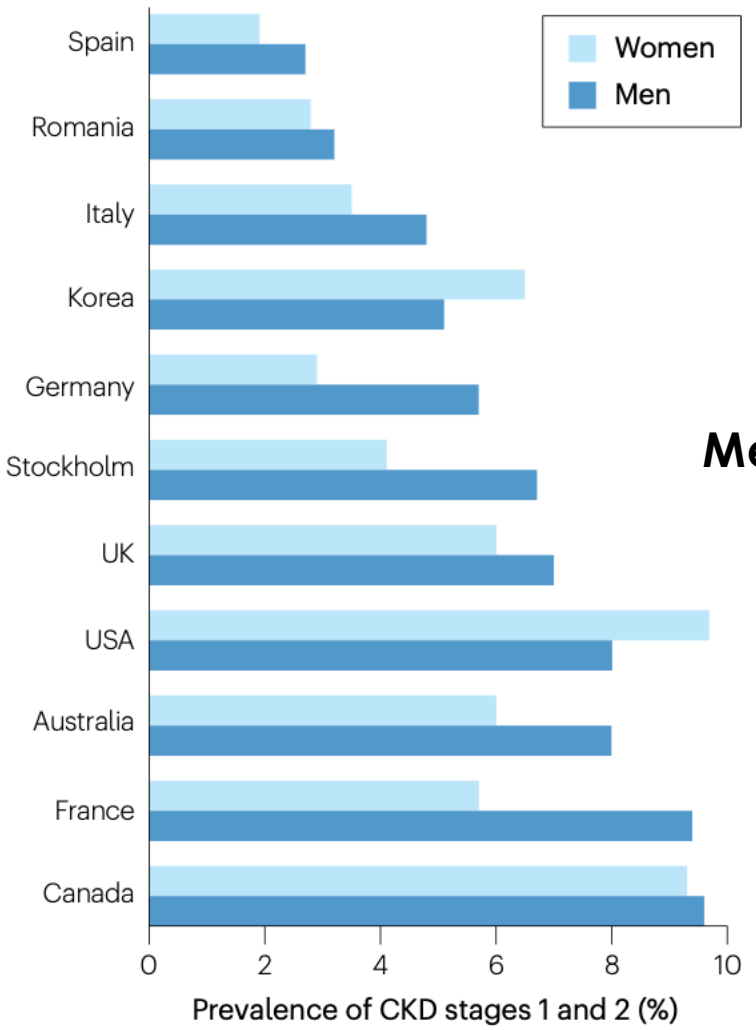
CKD prevalence – sex differences



Women > Men

CKD stages 3-5





Men > Women

CKD stages 1-2 driven by albuminuria

Chesnaye NC et al, *Nat Rev Nephrol*, 2024

KRT incidence – sex differences

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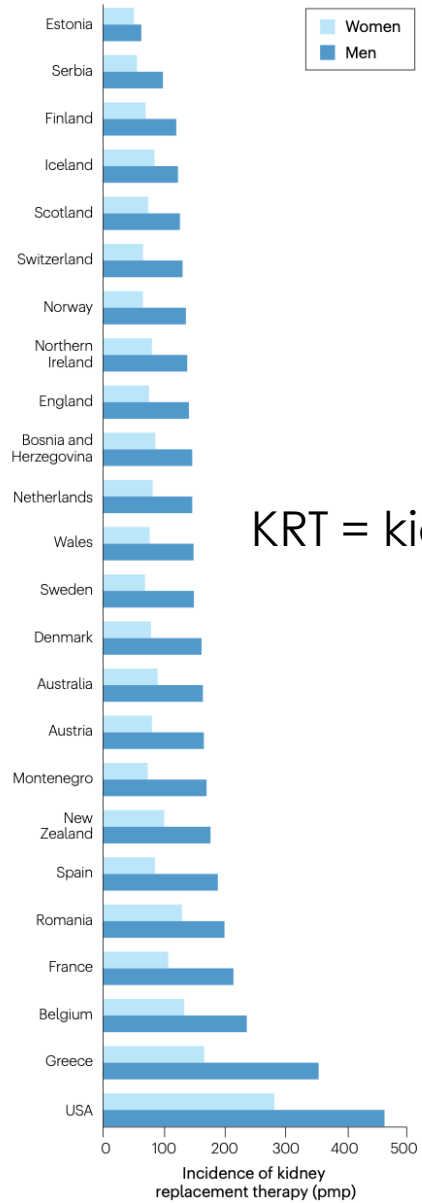
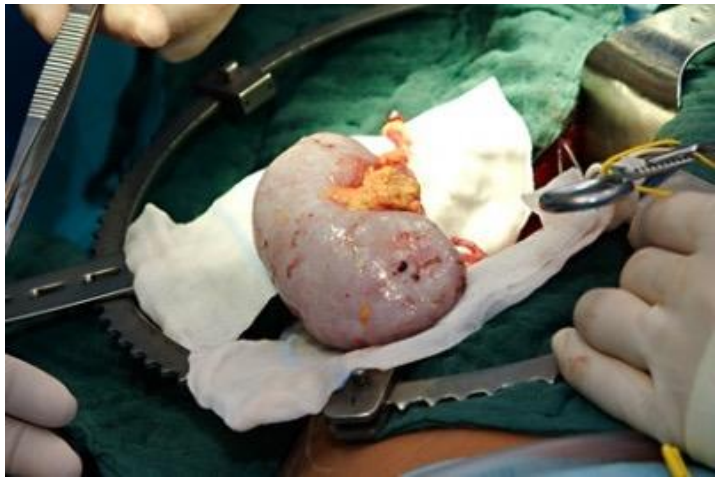


Men > Women

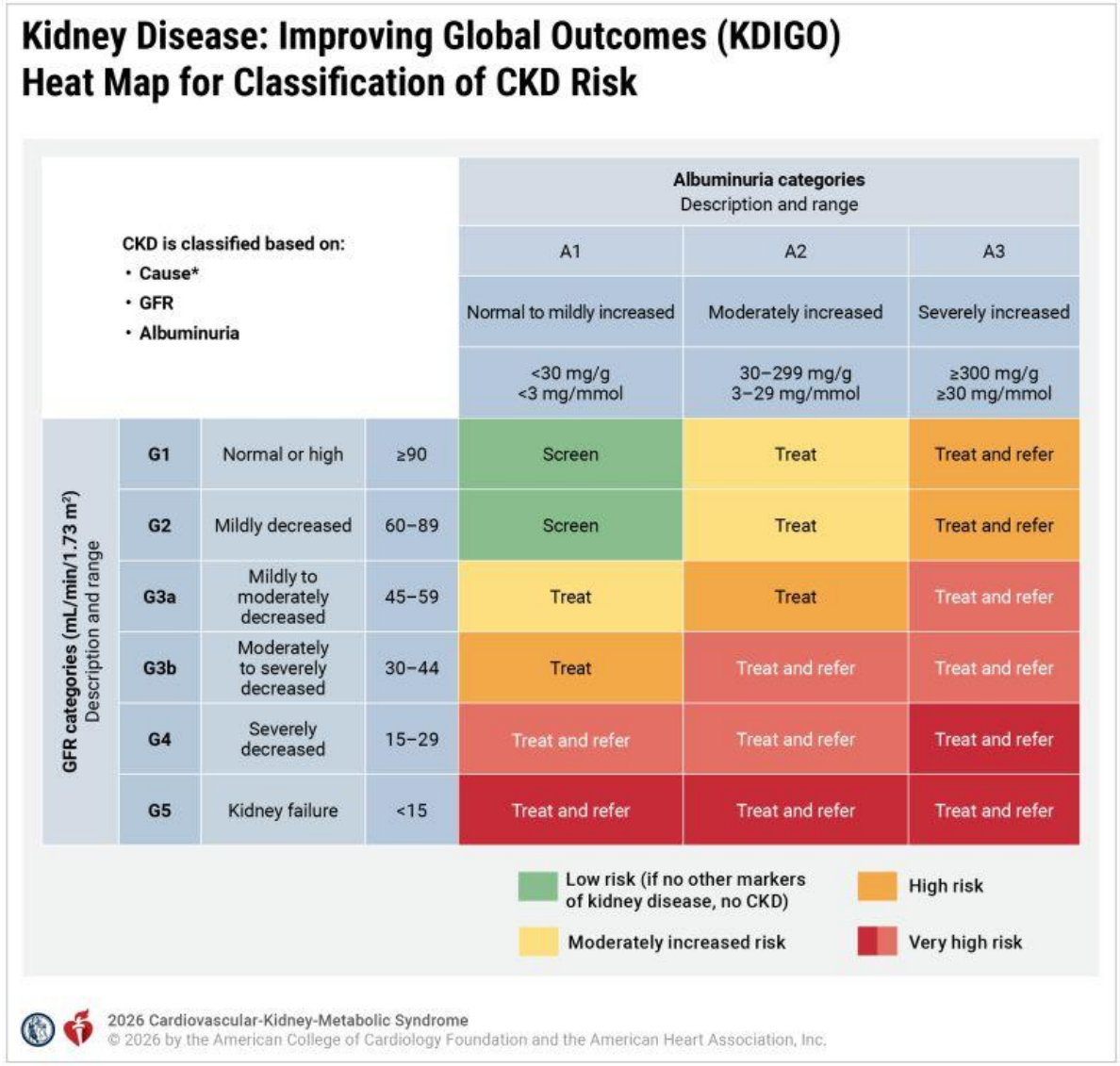
KRT = kidney replacement therapy (dialysis/ transplantation), CKD stage





Chesnaye NC et al, *Nat Rev Nephrol*, 2024

Chronic kidney disease – sex differences



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CKD prevalence is higher in women

HOWEVER

not for all stages and possibly biased by longer life expectancy in women

AND

CKD progression is more pronounced in men

CKD progression – sex differences

CKD Progression and Mortality Among Men and Women

Population	Analysis	Results
Swedish Renal Registry – Chronic Kidney Disease (SRR-CKD) 2008-2018 Incident patients • **G3b** = 7,388 • **G4** = 18,282 • **G5** = 9,410	Nephrology outpatient follow-up - Patient characteristics - Time to progression - Mortality before KRT - eGFR slope analysis	Women had lower risk of CKD progression [SHR 0.88 (95% CI, 0.85-0.92)] Women had lower risk of mortality before KRT [SHR 0.90 (95% CI, 0.85-0.94)] Women had lower cardiovascular mortality risk [SHR 0.83 (95% CI, 0.76-0.90)] Risk factors related to steeper eGFR slope • Age • Sex • Albuminuria

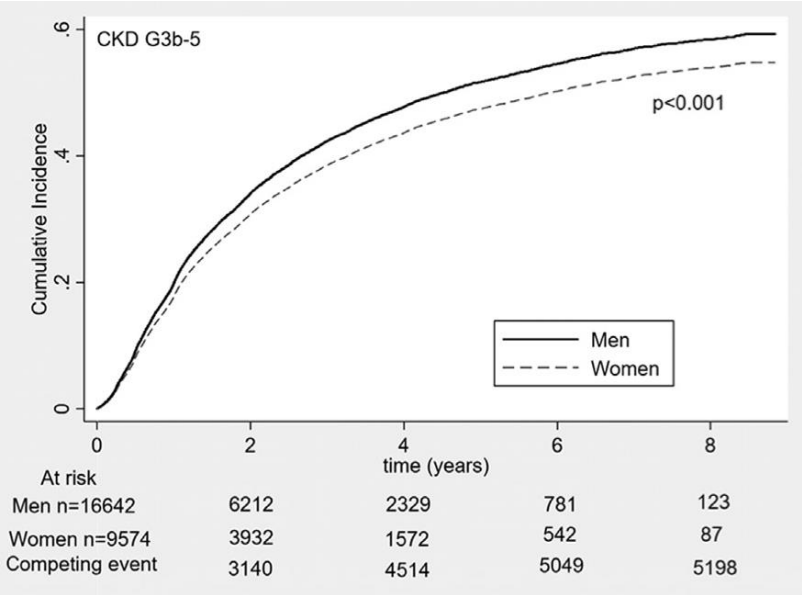
CONCLUSION: Compared to men, women had lower risk of CKD progression and all-cause mortality.

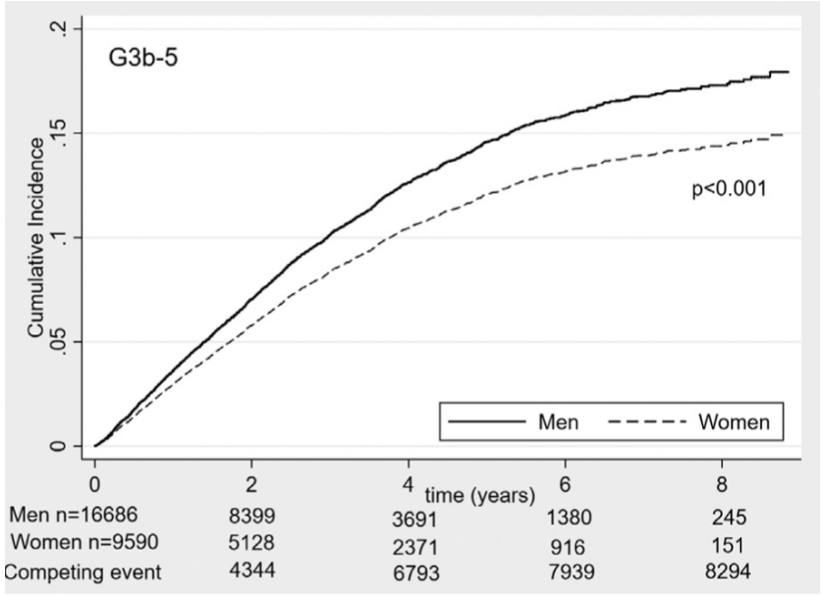
Oskar Swartling, Helena Rydell, Maria Stendahl, et al (2021)
@AJKDonline | DOI: 10.1053/j.ajkd.2020.11.026

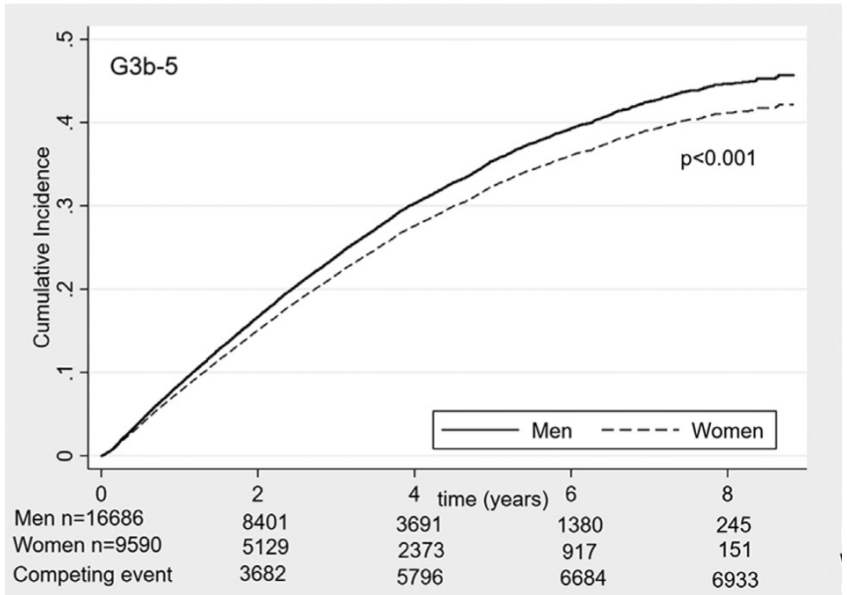
AJKD AMERICAN JOURNAL OF KIDNEY DISEASES

CKD progression – sex differences

Swedish Renal Registry – Chronic Kidney Disease (SRR-CKD) 2008-2018







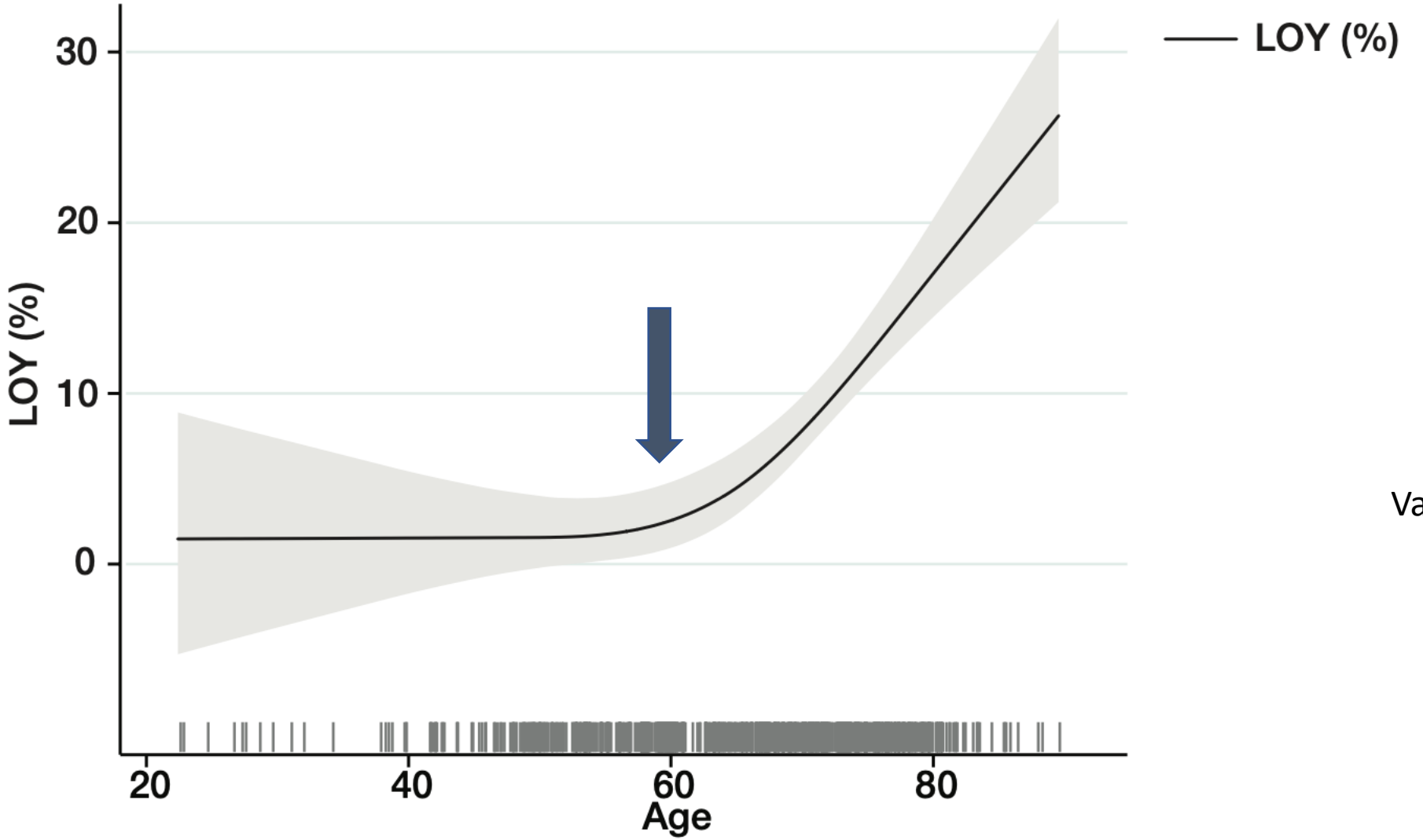
CKD-progression by 1 stage / KRT

CV-mortality

All-cause-mortality

Swartling O et al, *Am J Kid Dis*, 2021

Male CKD-progression – Loss-of-Y as a reason?

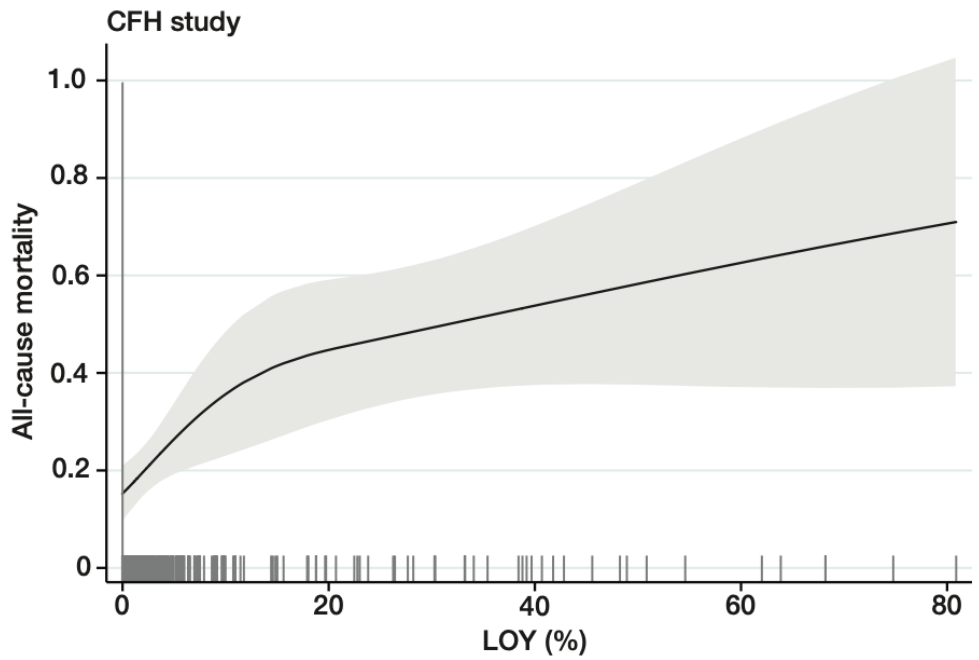


LOY was quantified in men with stable CKD (CARE for HOMe study, N=279)

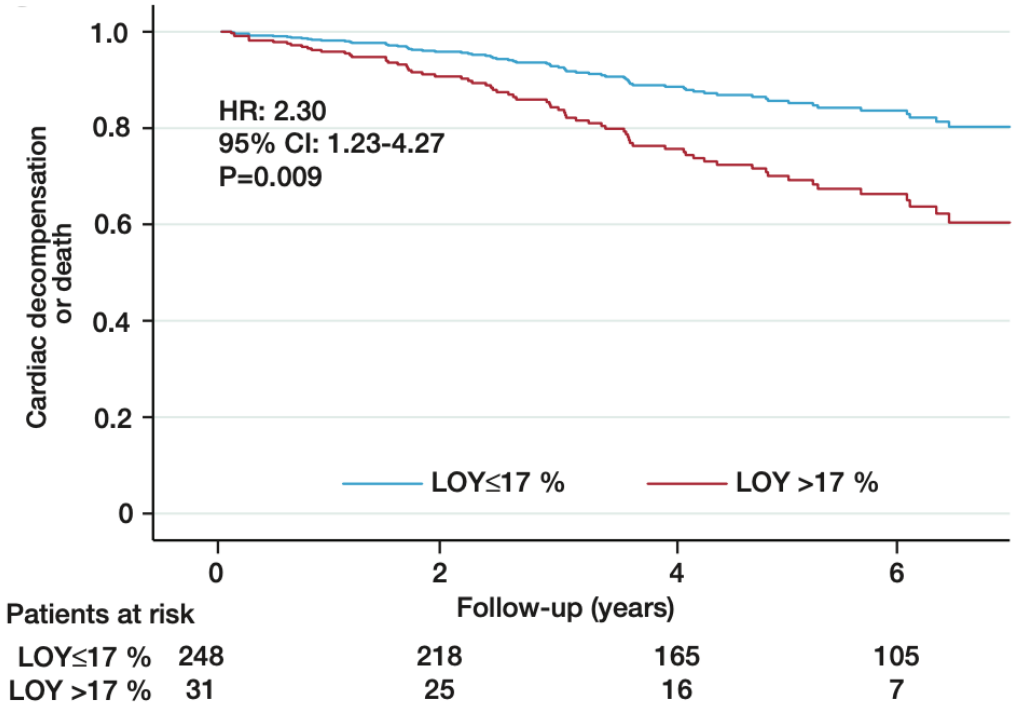
Validated in 4D study with CKD stage 5 patients on dialysis

Weyrich M et al, *Circulation*, 2024

Male CKD-progression – Loss-of-Y as a reason?



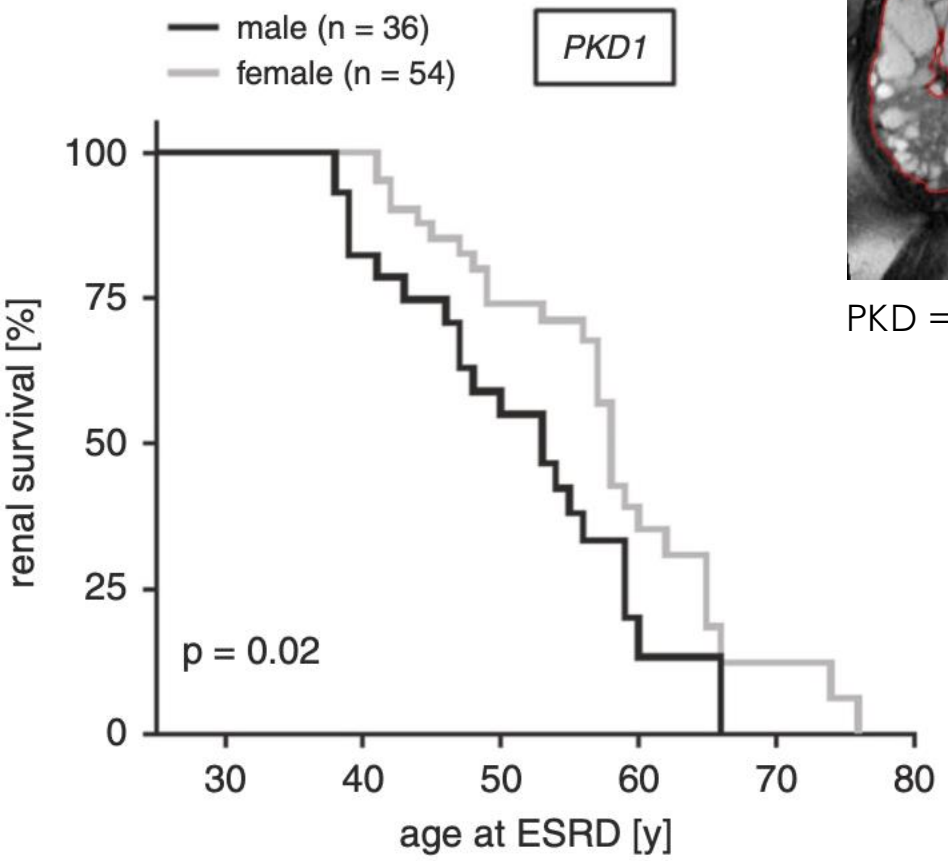
Cardiac decompensation or death

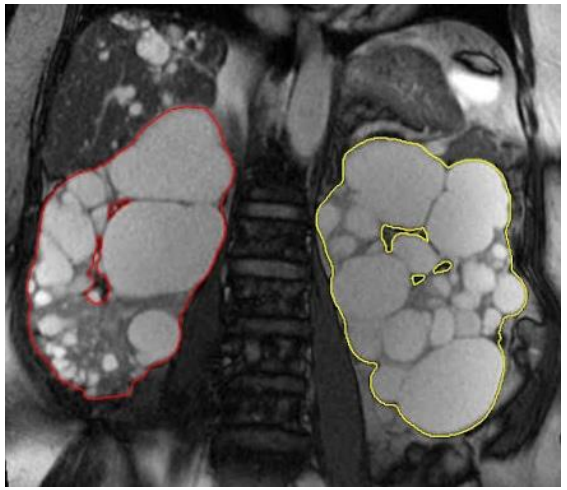


Weyrich M et al, *Circulation*, 2024

CKD-etiology is key: sex differences in PKD

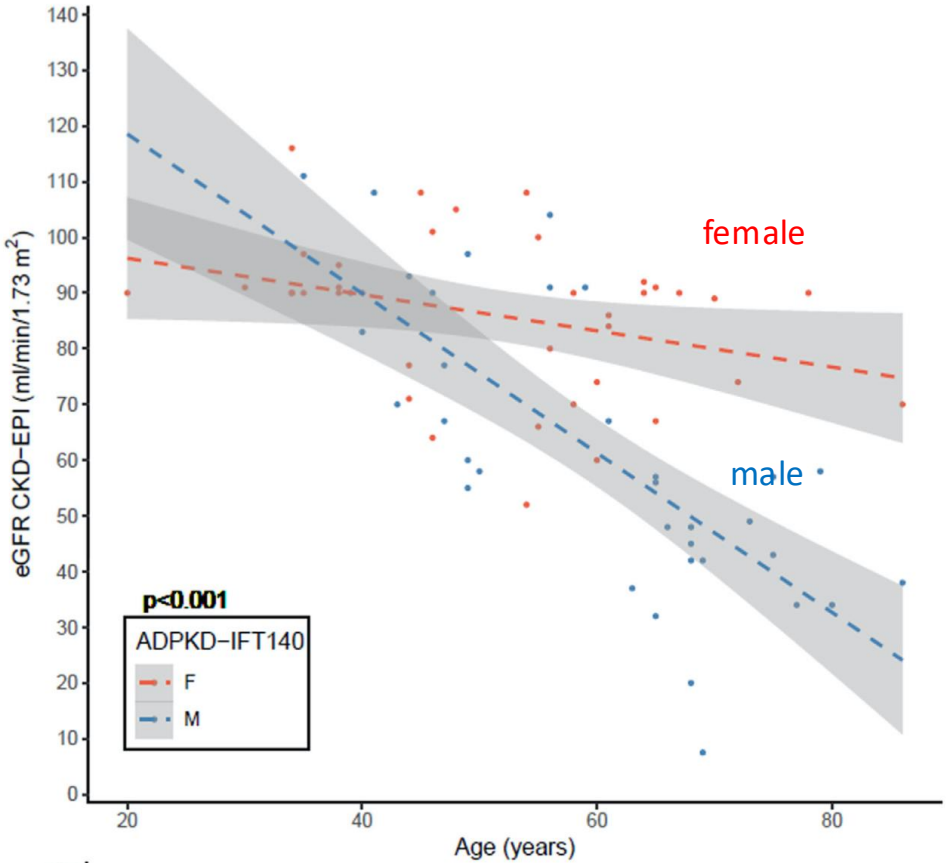
Sex differences in ADPKD-PKD1 renal survival





PKD = Polycystic kidney disease

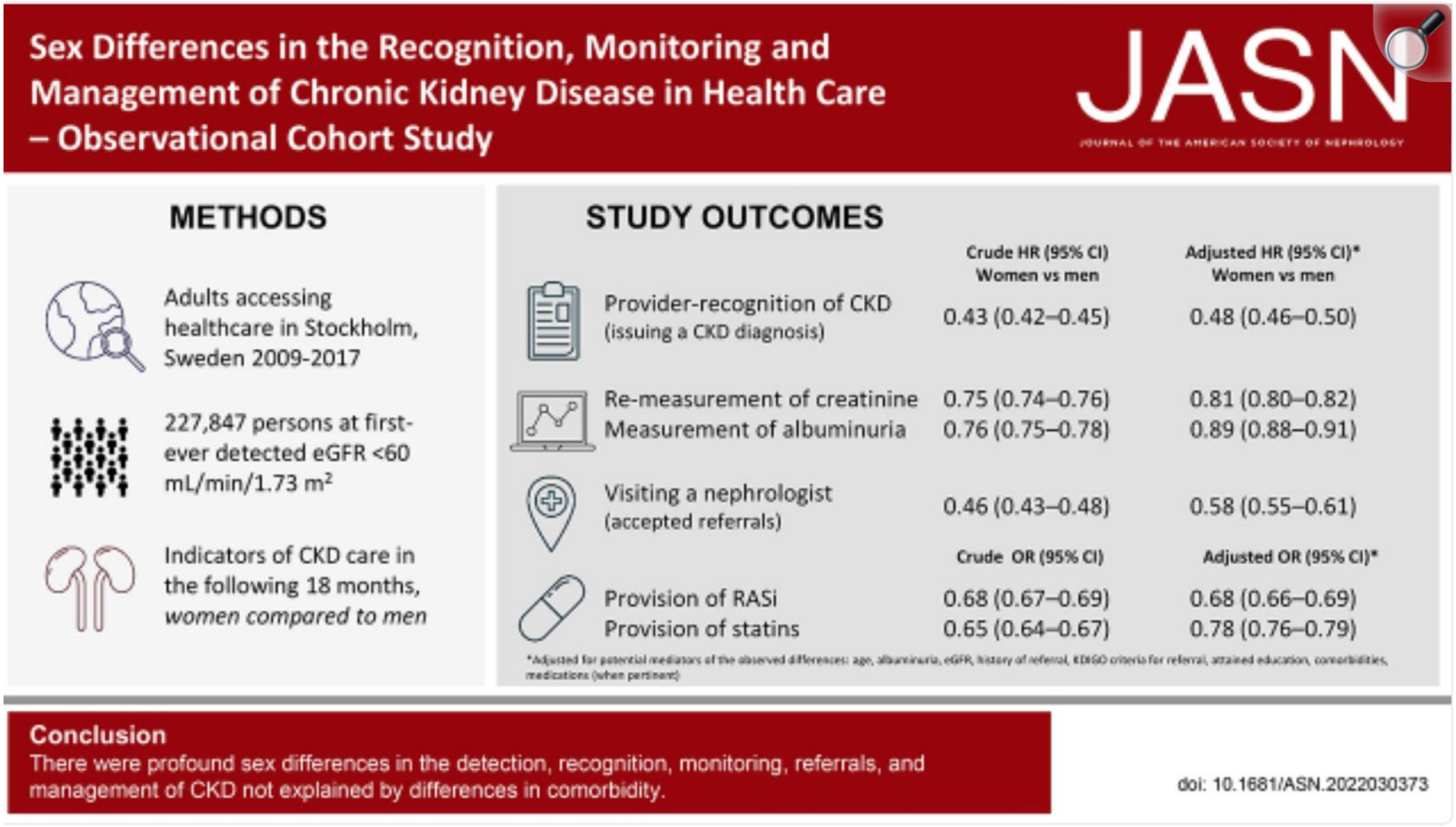
Sex differences in ADPKD-IFT140 kidney function



Schönauer… Halbritter, GIM, 2020

Zagorec et al, *Am J Kidney Dis*, 2025

CKD care and management – sex differences



Sex Differences in the Recognition, Monitoring and Management of Chronic Kidney Disease in Health Care – Observational Cohort Study

JASN
JOURNAL OF THE AMERICAN SOCIETY OF NEPHROLOGY

METHODS

Adults accessing healthcare in Stockholm, Sweden 2009-2017

227,847 persons at first-ever detected eGFR <60 mL/min/1.73 m²

Indicators of CKD care in the following 18 months, *women compared to men*

STUDY OUTCOMES

	Crude HR (95% CI) Women vs men	Adjusted HR (95% CI)* Women vs men
Provider-recognition of CKD (issuing a CKD diagnosis)	0.43 (0.42–0.45)	0.48 (0.46–0.50)
Re-measurement of creatinine	0.75 (0.74–0.76)	0.81 (0.80–0.82)
Measurement of albuminuria	0.76 (0.75–0.78)	0.89 (0.88–0.91)
Visiting a nephrologist (accepted referrals)	0.46 (0.43–0.48)	0.58 (0.55–0.61)
	Crude OR (95% CI)	**Adjusted OR (95% CI)***
Provision of RASi	0.68 (0.67–0.69)	0.68 (0.66–0.69)
Provision of statins	0.65 (0.64–0.67)	0.78 (0.76–0.79)

*Adjusted for potential mediators of the observed differences: age, albuminuria, eGFR, history of referral, KDIGO criteria for referral, attained education, comorbidities, medications (when pertinent)

Conclusion
There were profound sex differences in the detection, recognition, monitoring, referrals, and management of CKD not explained by differences in comorbidity.

doi: 10.1681/ASN.2022030373

KRT management – sex differences

Trends in Sex Disparities in Access to Kidney Transplantation

Setting & Participants

Retrospective cohort study

N = 2.3 million in USRDS

- Aged 18-79 years
- Initiated kidney replacement therapy between 1997-2020

Follow-up: 4 years

Findings

Era	Waitlisting	Living Donor Kidney Transplant (LDKT)	Deceased Donor Kidney Transplant (DDKT)
TOTAL	*Adjusted Hazard Ratio Comparing Men to Women*		
1997-2000	**0.81** (0.79-0.83)	**0.89** (0.85-0.93)	**0.92** (0.89-0.95)
2017-2020	↓ **0.86** (0.85-0.87)	↑ **0.79** (0.76-0.82)	↔ **1.16** (1.14-1.19)
DIABETES			
1997-2000	**0.75** (0.73-0.78)	**0.93** (0.86-1.00)	**0.93** (0.87-0.98)
2017-2020	↓ **0.78** (0.77-0.80)	↑ **0.75** (0.70-0.81)	↔ **1.15** (1.11-1.20)
OLDER AGE	*(60-79 years)*		
1997-2000	**0.65** (0.62-0.69)	**0.75** (0.66-0.84)	**0.92** (0.84-1.01)
2017-2020	↓ **0.82** (0.80-0.84)	↓ **0.77** (0.71-0.82)	↔ **1.15** (1.10-1.20)

↓ Disparity improved
↑ Disparity worsened
↔ Disparity flipped from favoring men to favoring women

CONCLUSION: Since 1997, sex inequities in waitlisting have improved but remain significant, especially for women who are older, and with diabetes-attributed kidney failure. Worsening sex inequities in LDKT among women and DDKT among waitlisted men, warrant further study.

Jessica L. Harding, Chengcheng Hu, Stephen O. Pastan, Ana Rossi, and Rachel E. Patzer

DOI: 10.1053/j.ajkd.2024.12.008

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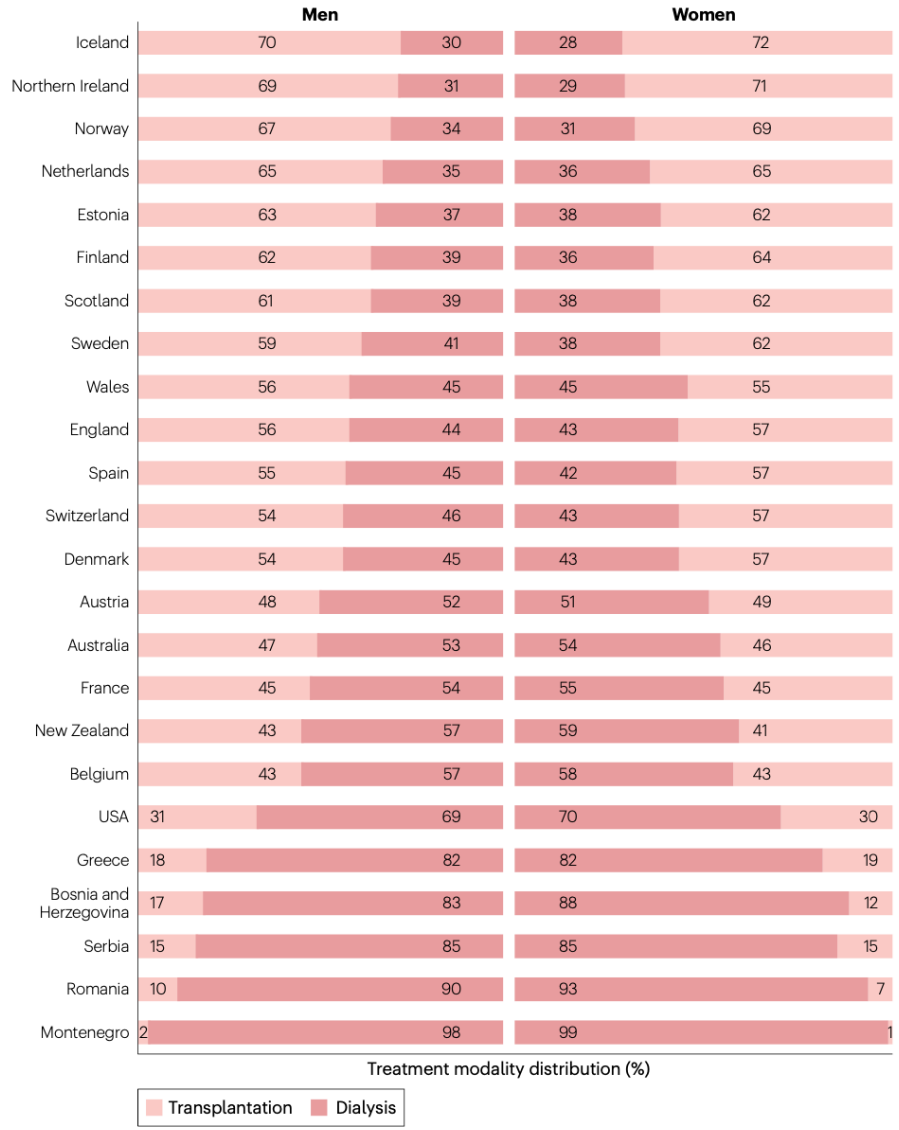
KRT modalities – no sex differences



Chesnaye NC et al, *Nat Rev Nephrol*, 2024

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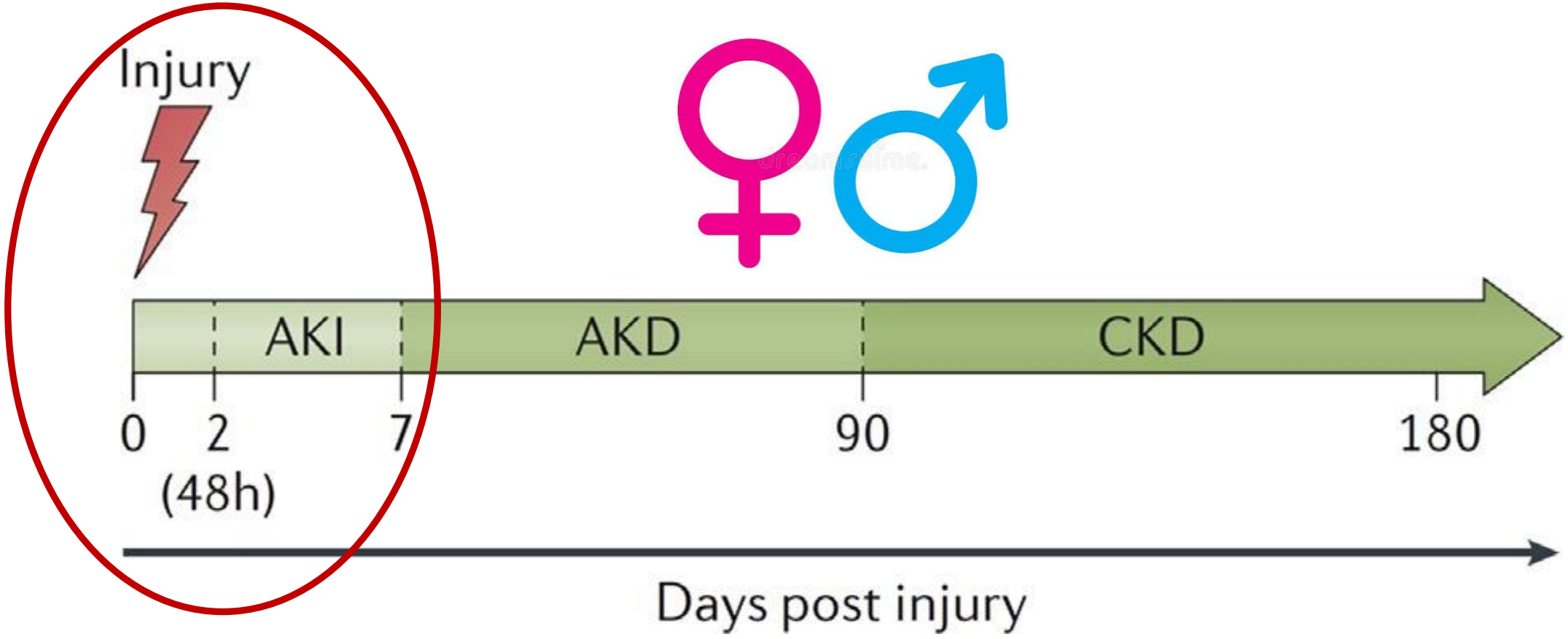

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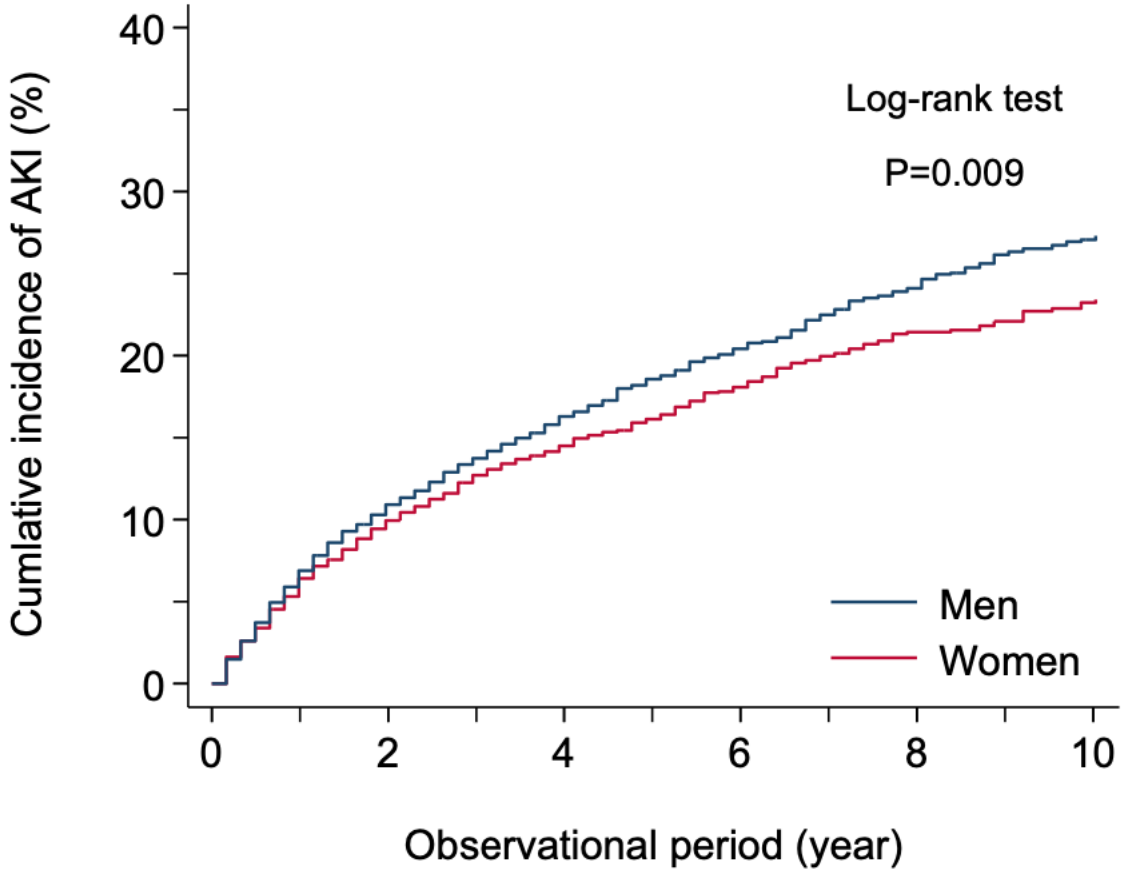
Acute kidney injury (AKI) – sex differences



Number at risk

Men	8947	4882	2947	1791	1081	603
Women	5605	3118	1887	1176	688	412

CKD prevalence is higher in women

HOWEVER

AKI incidence is more pronounced in men

Kawano Y et al, *Scientific Reports*, 2026

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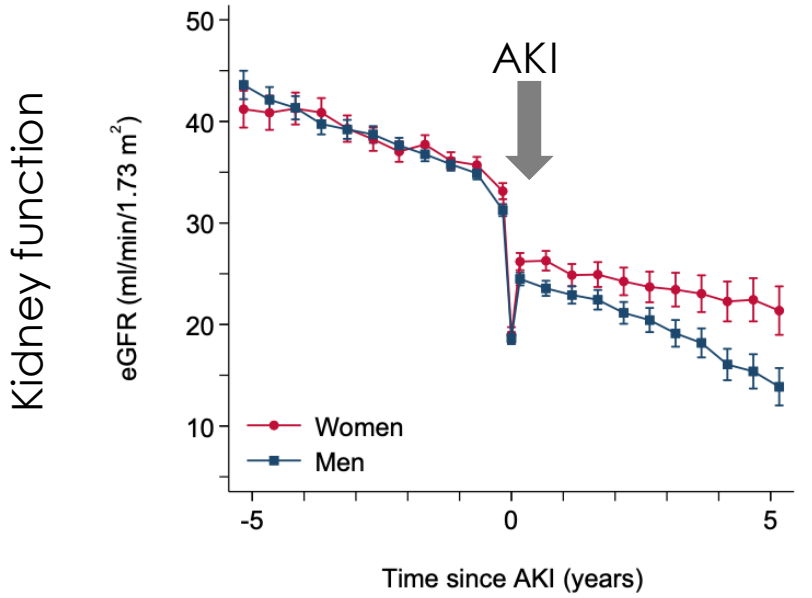

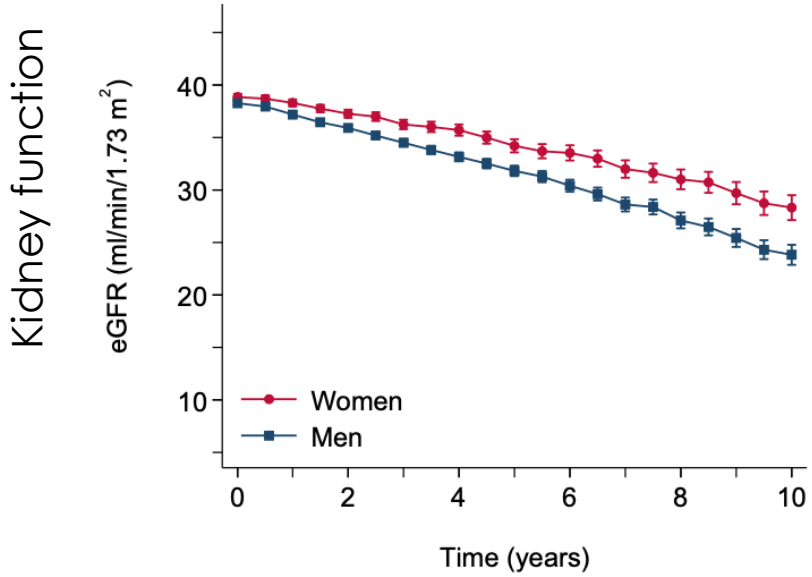

CKD prevalence is higher in women

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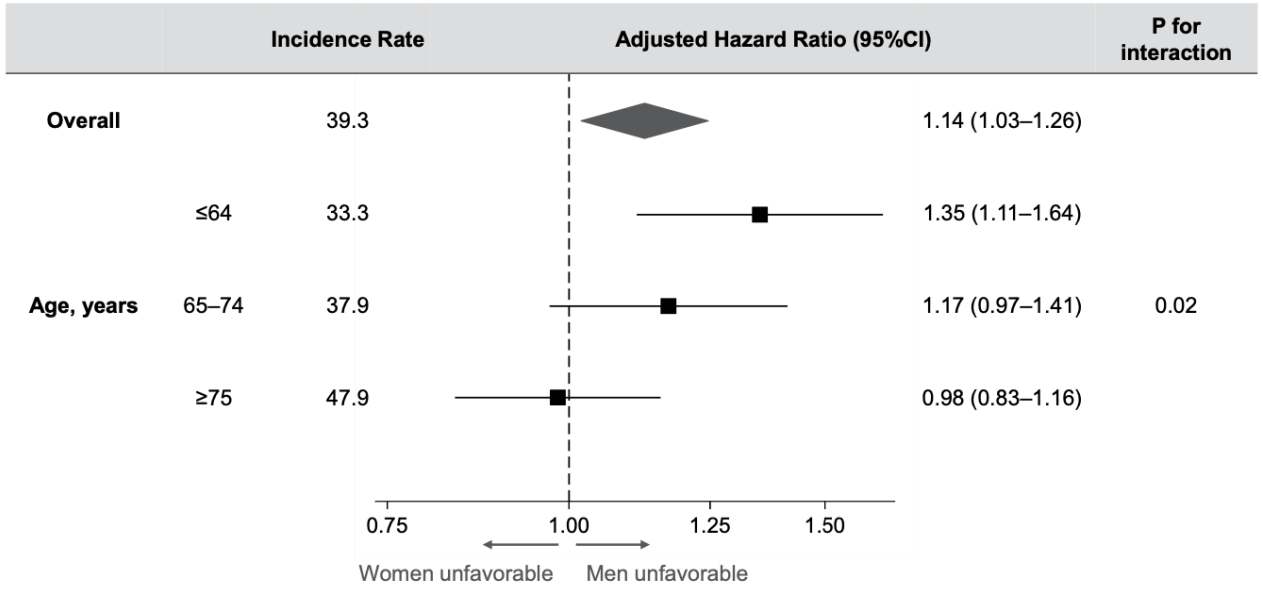
Loss-of-kidney function is more pronounced in men

Kawano Y et al, *Scientific Reports*, 2026

AKI – sex differences are age-dependent



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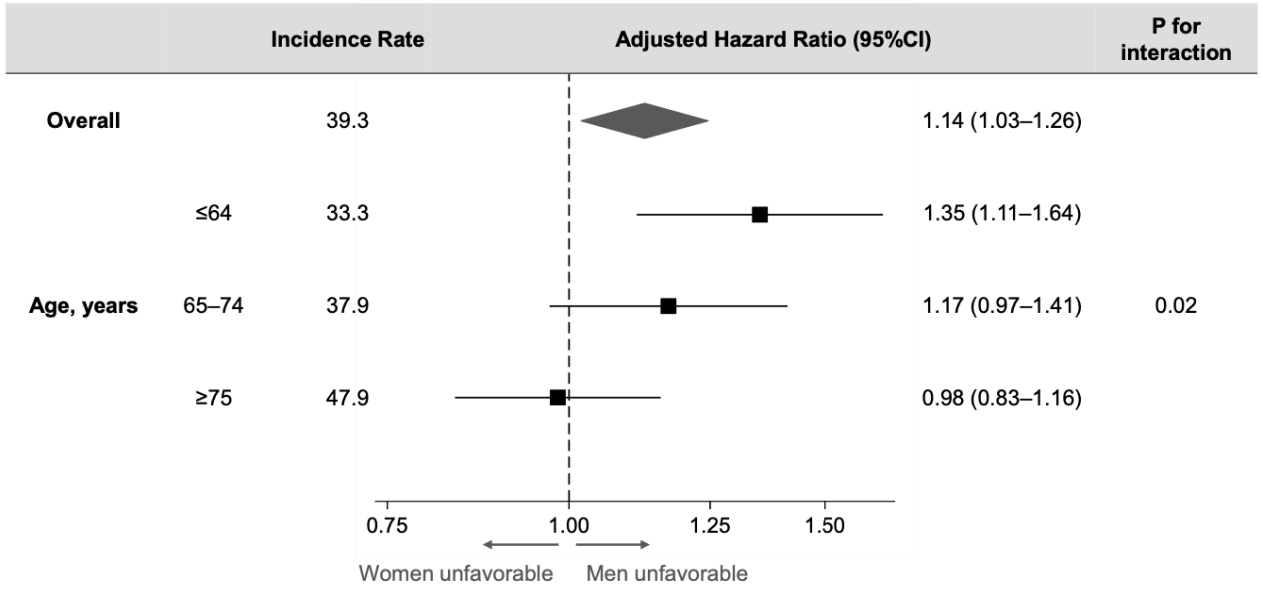
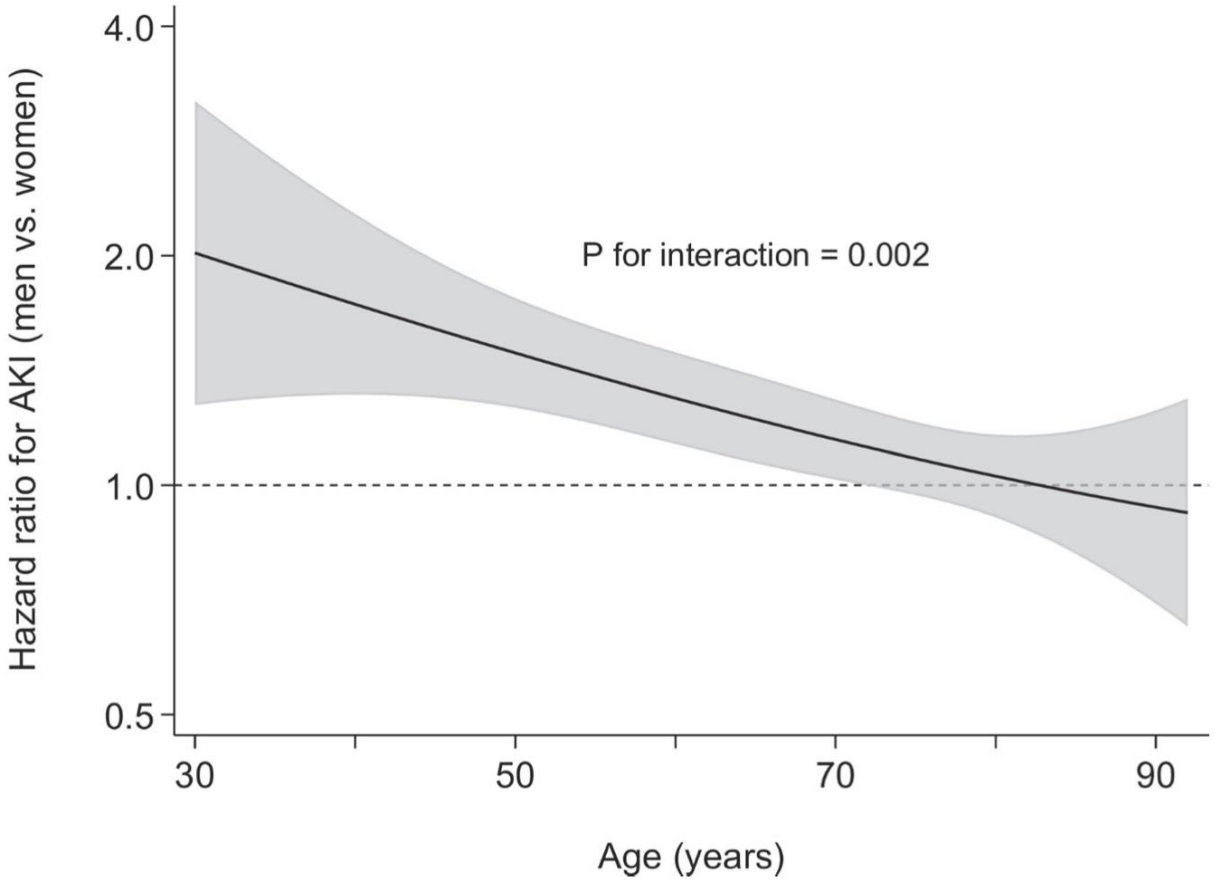
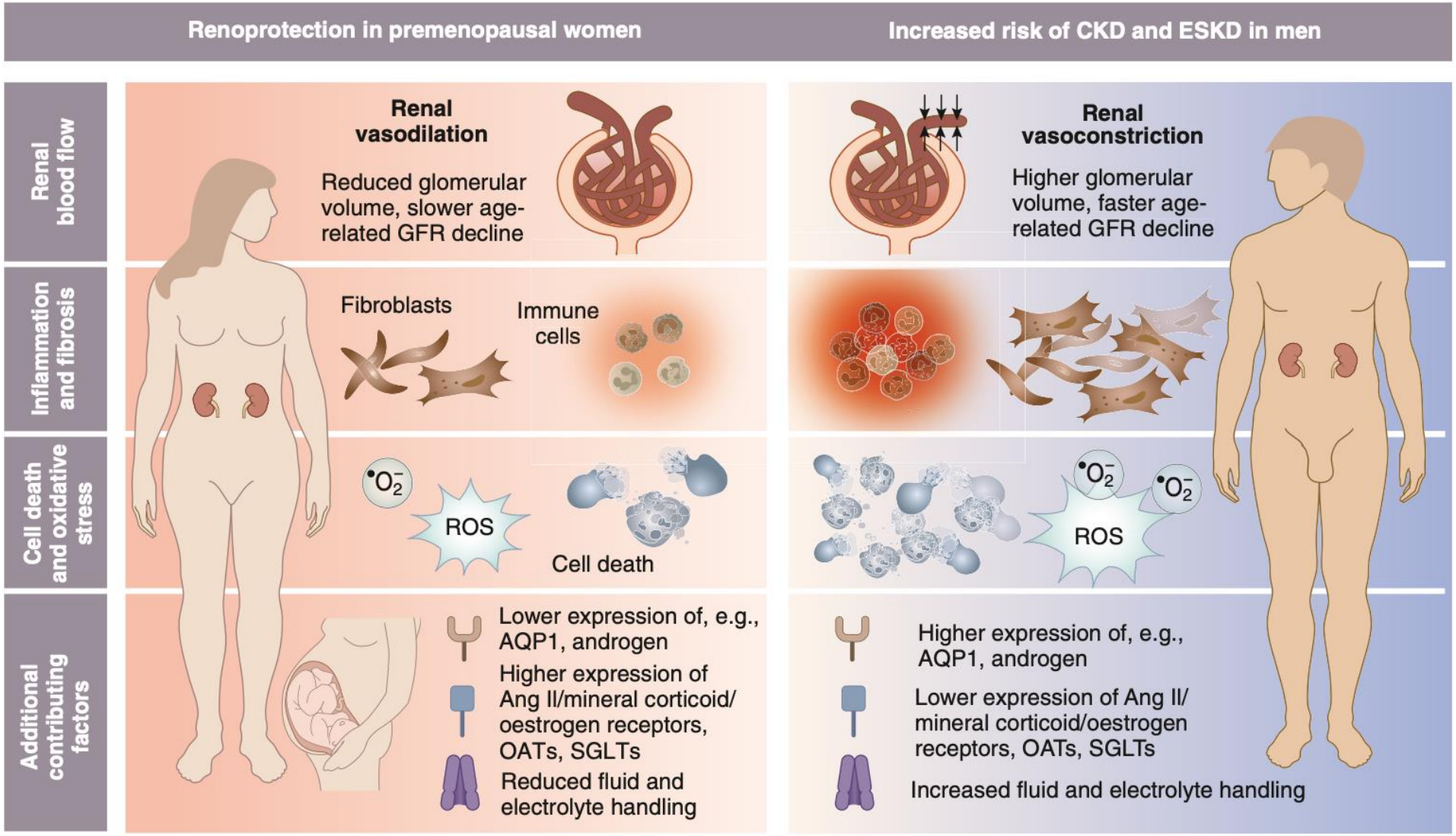




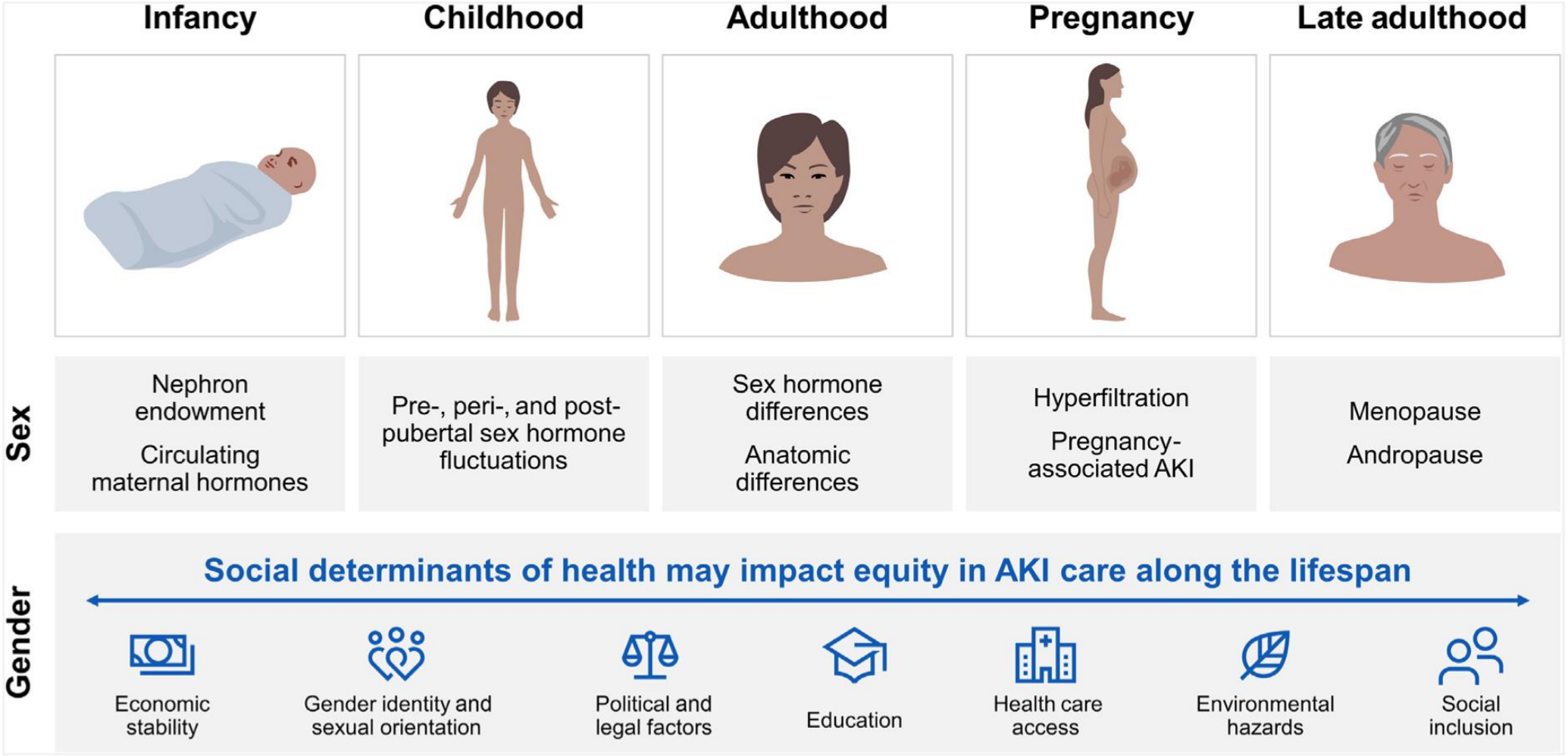
Kawano Y et al, *Scientific Reports*, 2026

SEX DIMORPHISM in kidney physiology



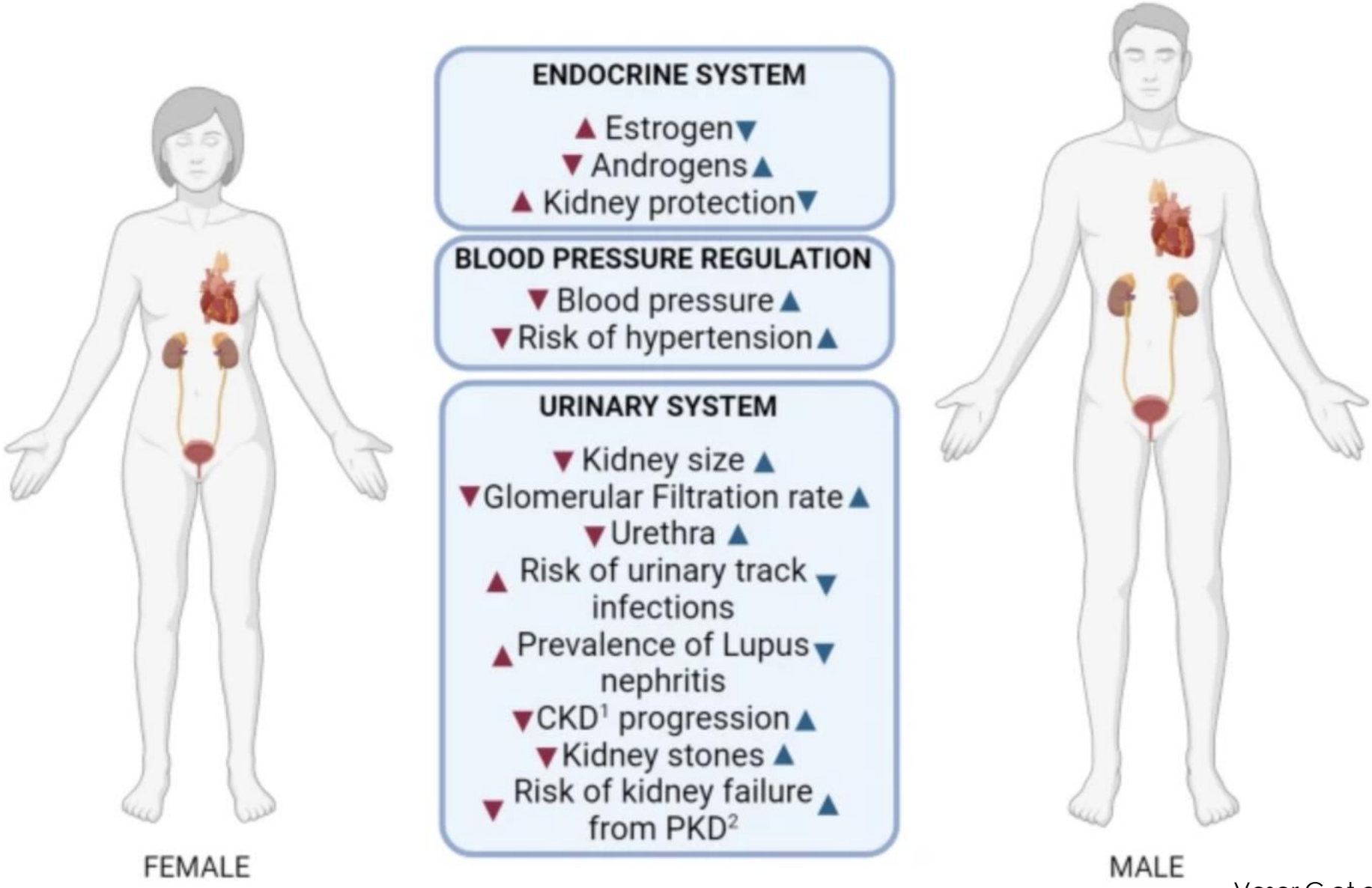
Steiger S et al, *Kidney Int*, 2025

Sex-related AKI risk is changing over lifetime



Soranno DE et al, *Kidney Int*, 2025

SEX DIMORPHISM in NEPHROLOGY



Veser C et al, *Biol Sex Differ*, 2024

SUMMARY

Kidney disease is a continuum from acute kidney injury (AKI) to chronic kidney disease (CKD)

Sex dimorphism is to be determined separately for AKI and CKD

Although CKD-prevalence is higher in women, overall CKD burden is higher in men

- more pronounced CKD-progression in males due to
  - higher rates of albuminuria
  - higher rates of hypertension
  - higher rates of diabetes
  - higher rates of smoking
  - higher CV-event-rate
  - loss-of-Y as an additional explanatory factor
- Premenopausal women seem to be better protected from AKI – protection is lost over lifetime

Sex-/Gender-related disparities in terms of CKD care, management, and access to kidney transplantation

THANK YOU

Berlin





Freiburg



DFG
Heisenberg-Programm
DFG Deutsche Forschungsgemeinschaft
CeRKiD Center for Rare Kidney Diseases Zentrum für seltene Nierenerkrankungen
ERKNet The European Rare Kidney Disease Reference Network
Else Kröner Fresenius Stiftung
Bundesministerium für Forschung, Technologie und Raumfahrt