Fysisk träning och kronisk njursjukdom – State of the Art

Vårmötet i Uppsala 250520

NAOMI CLYNE, DOCENT, ÖVERLÄKARE. NJURMEDICIN, SKÅNES UNIVERSITETS SJUKHUS I LUND, LUNDS UNIVERSITET

Trött

Nedsatt koncentrations-förmåga

Orkeslös

Hur känns det att vara njursjuk?

Ökad stress-känslighet

Vila hjälper inte

Nedsatt muskel-uthållighet

Nedsatt muskelstyrka

Nedsatt kondition

Klåda

Benkramper

Torr hud

Nedsatt aptit

Vilka symtom har man som njursjuk?

Sämre sömn

Matleda

Andfådd

Lös avföring

Ändrad smakupp-levelse

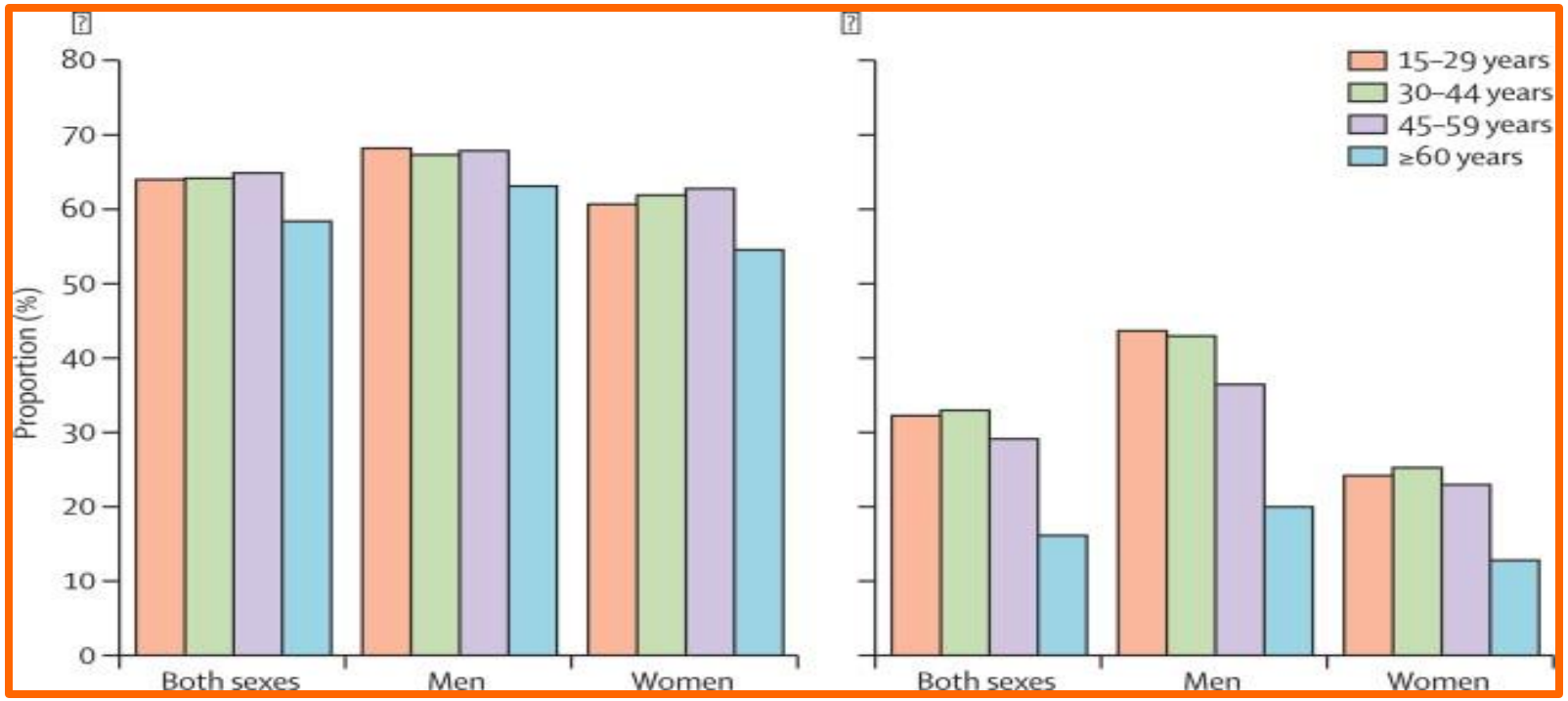

Ökad infektions-känslighet
Diskreta symtom vid infektion
Blodbrist
Vilka är riskerna när man är njursjuk?
Ökad hjärtkärl-sjuklighet
Hjärtsvikt
Hjärtinfarkt
Ökad risk för benskörhet
Klaffvitier
Arrytmier
Ökad dödlighet
Per obstr kärlsjd

CKD är vanlig

	Global prevalens
CKD stadier 1-5	844 miljoner
NEB	4 miljoner

Jager, K et al, NDT 2019

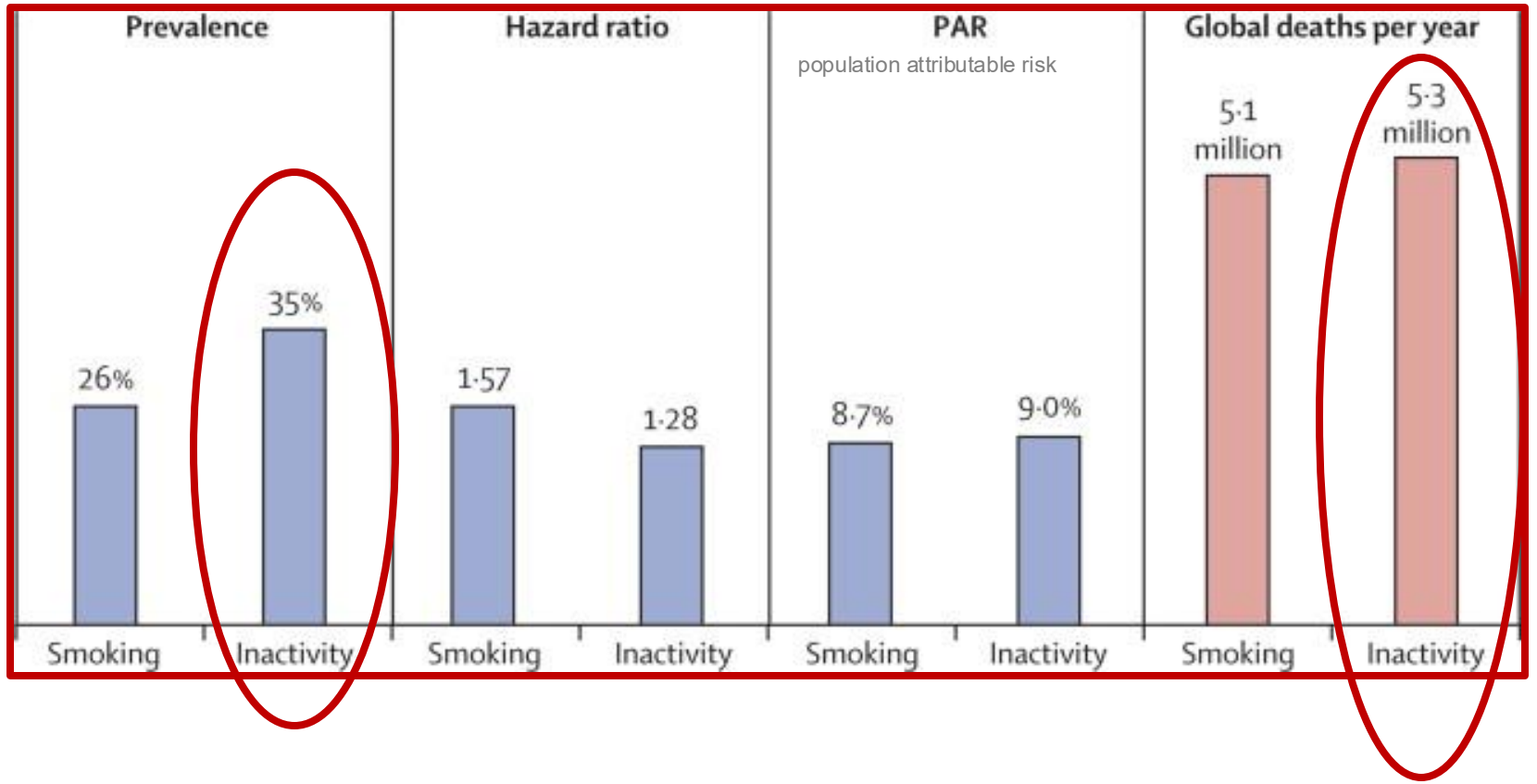
Fysisk aktivitet är ovanlig



Walking for 10 min/day > 5 days/week + Physically strenuous activity > 3 times/ week

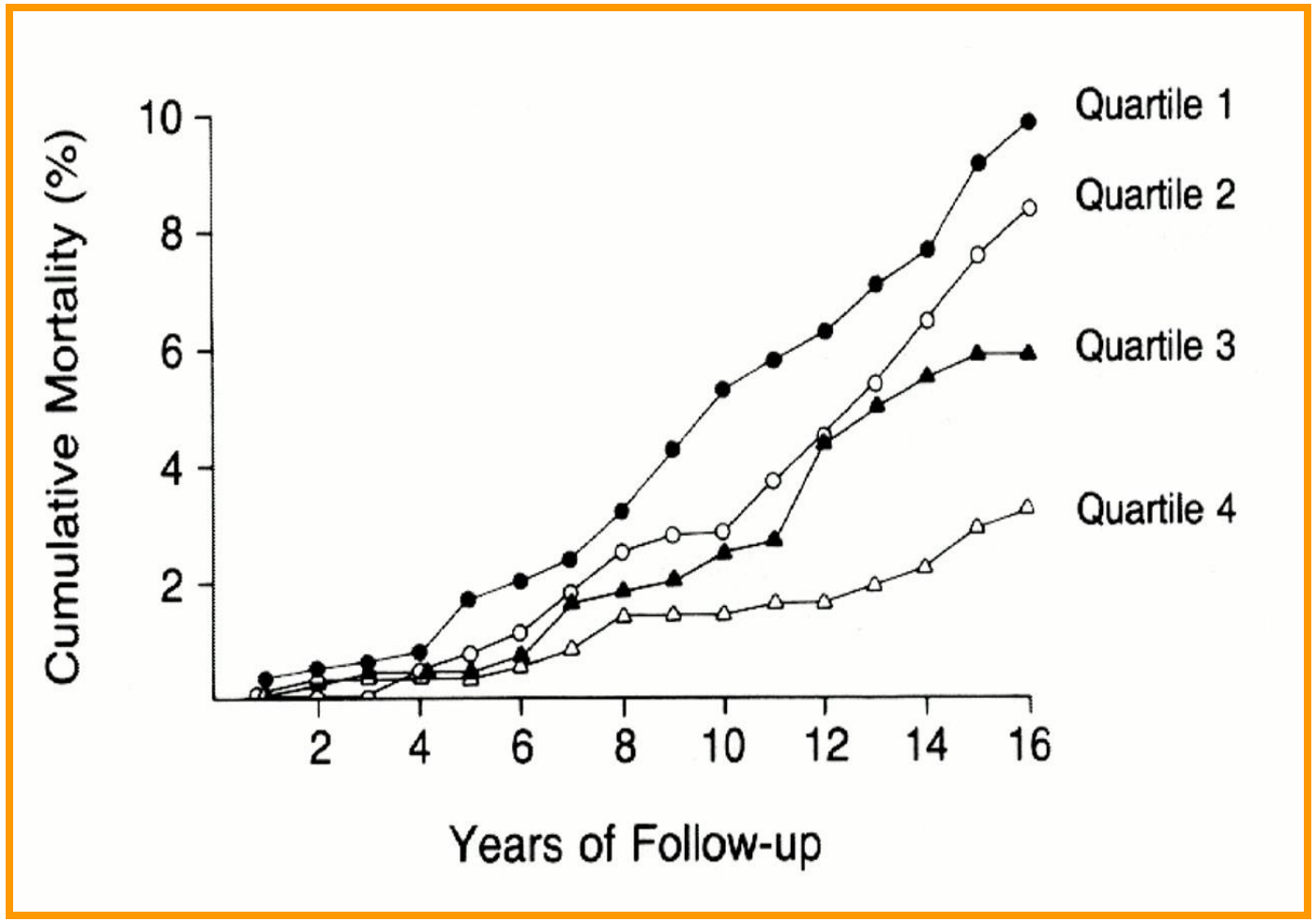
Hallal et al, The Lancet Volume 380, Issue 9838 2012 247 - 257

Fysisk inaktivitet är lika farlig som rökning



Chi Pang Wen , Xifeng Wu, The Lancet Volume 380, Issue 9838 2012 192 - 193

Kumulativ åldersjusterad kardiovaskulär dödlighet i relation till fysisk aktivitet hos friska individer



Sandvik et al, NEJM 328:8, 1993

EXERCISE TRAINING IMPROVES ABNORMAL LIPID AND CARBOHYDRATE METABOLISM IN HEMODIALYSIS PATIENTS

A. P. Goldberg, J. M. Hagberg, J. A. Delmez,
G. W. Heath, and H. R. Harter

Although chronic maintenance hemodialysis will palliate many of the manifestations of the uremic syndrome and prolong survival in patients with end-stage renal failure, it will not retard the accelerated rate at which atherosclerosis and cardiovascular complications develop in these patients[1,2]. Abnormalities in lipid and carbohydrate metabolism have been recognized for many years in patients with chronic renal failure[3-6], and probably contribute to their high cardiovascular mortality rate[1,7,8]. A strikingly low plasma high density lipoprotein (HDL) cholesterol concentration also has been reported in hemodialysis patients[6,9]; this level is even lower than would be expected for their degree of hypertriglyceridemia[6]. Although a relationship between HDL cholesterol and cardiovascular morbidity and mortality has not yet been ascertained in the dialysis population, in nonuremic man the plasma level of HDL cholesterol seems to be an important predictor of cardiovascular risk[10-12].

Physical exercise training appears to have a beneficial effect on hypertriglyceridemia[13,14], low HDL cholesterol levels[15,16], glucose intolerance[17,18], and hyperinsulinism[19-21] in nonuremic man. Therefore, this study was designed to ascertain whether exercise training would improve these metabolic abnormalities in patients with end-stage renal disease receiving hemodialysis, and to determine whether these patients could safely participate in an exercise training program.

MATERIALS AND METHODS

Patient Selection. Seven uremic patients (5 males, 2 females) requiring hemodialysis for 4 to 6 hrs 3 times weekly were selected for study (Table I). Their age was 37.0 ± 8.7 yrs (mean ± SD) and their duration on dialysis at the start of exercise was 46 ± 33 mos. All received iron for anemia (males also received Decadurabolin), multivitamins, aluminum hydroxide for hyperphosphatemia, and calcium carbonate. Three of the men also received antihypertensive medication (Table I). Patients were selected to participate if they: a) had hypertriglyceridemia and/or low plasma levels of HDL cholesterol on at least 2 fasting blood sample analyses (Table II); b) had no medical problems which would contraindicate participation in an exercise training program, such as severe ventricular dysrhythmias, poorly controlled hypertension, unstable angina pectoris, a prior myocardial infarction or hyperkalemia[22]; c) were on a stable medication regimen, diet and dialysis schedule; and d) were motivated to participate. Diabetes mellitus, hypothyroidism, alcoholism and liver disease were excluded by history and appropriate clinical tests.

TABLE I

STUDY PATIENTS

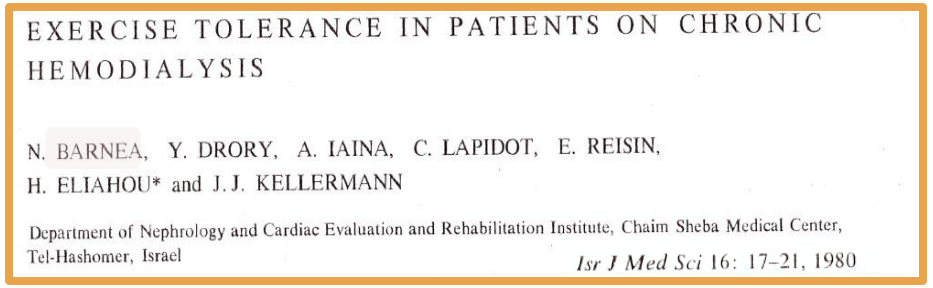
Patients	Age/Sex	DX*	Weight/Height (kg/cm)	Duration HD+ (mos)	Complications#
1	31/M	GN	68.3/183	11	HT, Cardiomegaly, Angina
2	32/M	GN	139.6/209	39	HT, Cardiomegaly, CHF, TX (2)
3	26/F	GN	53.2/155	42	Anemia, PTX, TX (2)
4	45/M	GN	77.5/180	55	TX (2)
5	42/M	HT	95.7/183	23	HT, Cardiomegaly
6	33/F	GN	57.4/170	42	Anemia
7	50/M	GN	76.8/182	113	CHF, Cardiomegaly
Mean	37.0			46.4	
SD	8.7			32.7	

*DX: GN = Chronic Glomerulonephritis, HT = Hypertension (Nephrosclerosis)
+Months on hemodialysis prior to onset of exercise training
#HT = Hypertension, CHF = Congestive Heart Failure, TX = Transplant, PTX = Parathyroidectomy

From the Washington University School of Medicine, Departments of Preventive Medicine and Medicine, Lipid Research Center, Chromalloy American Kidney Center, Division of Applied Physiology, and the I.W. Johnson Rehabilitation Institute, St. Louis, Missouri.
Supported by Contracts NO1-AM-82208 (Artificial Kidney Chronic Uremia Program, NIAMDD), and NO1-HV-2-2916-L (Lipid Research Clinics Project), NIH Grants AM09976 and AM07126, Fellowship Training Grants NIH 1F32HL05689-01 (J. Hagberg) and NHLBI HL07081 (G. Heath), and NIH Grant RR-0036 (Clinical Research Center, Washington University).

1979, in USA, 7 HD patients,
26 – 50 years
Bicycle ergometer cycling,
then walking,
then walking/jogging
for 32 weeks.

LUND UNIVERSITY



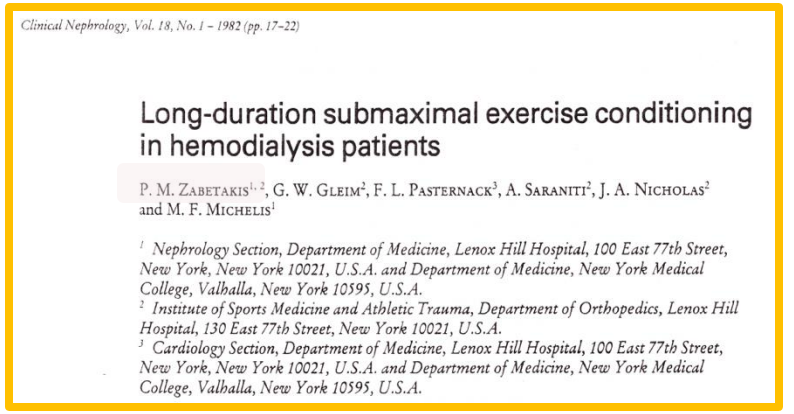
EXERCISE TOLERANCE IN PATIENTS ON CHRONIC HEMODIALYSIS

N. BARNEA, Y. DRORY, A. IAINA, C. LAPIDOT, E. REISIN, H. ELIAHOU* and J. J. KELLERMANN

Department of Nephrology and Cardiac Evaluation and Rehabilitation Institute, Chaim Sheba Medical Center, Tel-Hashomer, Israel

Isr J Med Sci 16: 17–21, 1980

HD patients -1980 - Israel



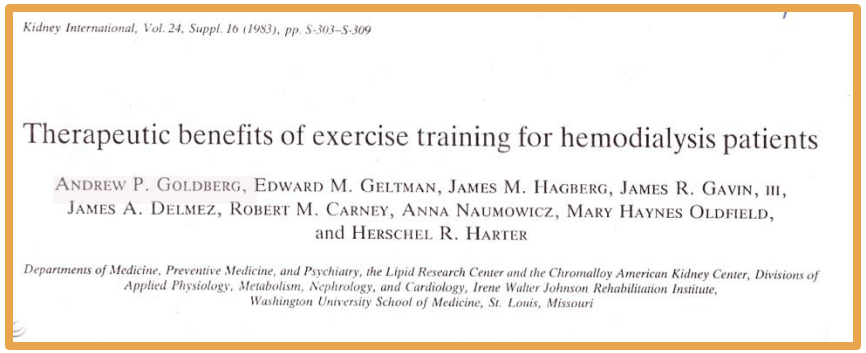
Clinical Nephrology, Vol. 18, No. 1 – 1982 (pp. 17–22)

Long-duration submaximal exercise conditioning in hemodialysis patients

P. M. ZABETAKIS[1, 2], G. W. GLEIM[2], F. L. PASTERNACK[3], A. SARANITI[2], J. A. NICHOLAS[2] and M. F. MICHELIS[1]

[1] *Nephrology Section, Department of Medicine, Lenox Hill Hospital, 100 East 77th Street, New York, New York 10021, U.S.A. and Department of Medicine, New York Medical College, Valhalla, New York 10595, U.S.A.*
[2] *Institute of Sports Medicine and Athletic Trauma, Department of Orthopedics, Lenox Hill Hospital, 130 East 77th Street, New York 10021, U.S.A.*
[3] *Cardiology Section, Department of Medicine, Lenox Hill Hospital, 100 East 77th Street, New York, New York 10021, U.S.A. and Department of Medicine, New York Medical College, Valhalla, New York 10595, U.S.A.*

HD patients -1982 - USA



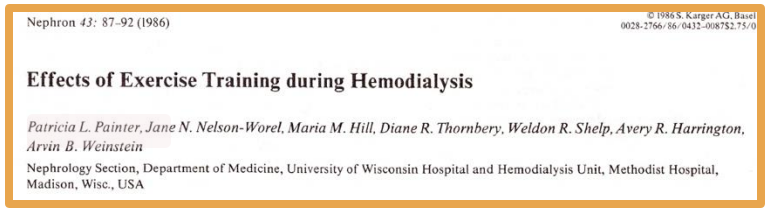
Kidney International, Vol. 24, Suppl. 16 (1983), pp. S-303–S-309

Therapeutic benefits of exercise training for hemodialysis patients

ANDREW P. GOLDBERG, EDWARD M. GELTMAN, JAMES M. HAGBERG, JAMES R. GAVIN, III, JAMES A. DELMEZ, ROBERT M. CARNEY, ANNA NAUMOWICZ, MARY HAYNES OLDFIELD, and HERSCHEL R. HARTER

Departments of Medicine, Preventive Medicine, and Psychiatry, the Lipid Research Center and the Chromalloy American Kidney Center, Divisions of Applied Physiology, Metabolism, Nephrology, and Cardiology, Irene Walter Johnson Rehabilitation Institute, Washington University School of Medicine, St. Louis, Missouri

HD patients -1983 - USA



Nephron *43*: 87–92 (1986)

0028-2766/86/0432-0087$2.75/0

Effects of Exercise Training during Hemodialysis

Patricia L. Painter, Jane N. Nelson-Worel, Maria M. Hill, Diane R. Thornbery, Weldon R. Shelp, Avery R. Harrington, Arvin B. Weinstein

Nephrology Section, Department of Medicine, University of Wisconsin Hospital and Hemodialysis Unit, Methodist Hospital, Madison, Wisc., USA

HD patients -1986 - USA

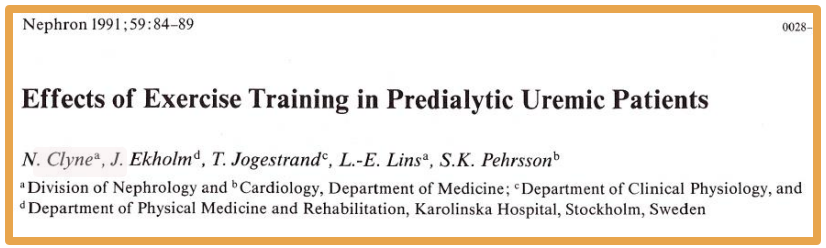
Nieren- und Hochdruckkrankheiten, Jahrgang 16, Nr. 1/1987, S. 25–32

Körperliches Training bei chronischer Niereninsuffizienz

E. RÖSELER, R. AURISCH, D. STRANGFELD, K. PRECHT und F. PRIEM

Nephrologische Abteilung der Universitätsklinik für Innere Medizin des Bereiches Medizin (Charité) der Humboldt-Universität Berlin

CKD 5 patients -1987 - Germany



Nephron 1991;59:84–89
0028-

Effects of Exercise Training in Predialytic Uremic Patients

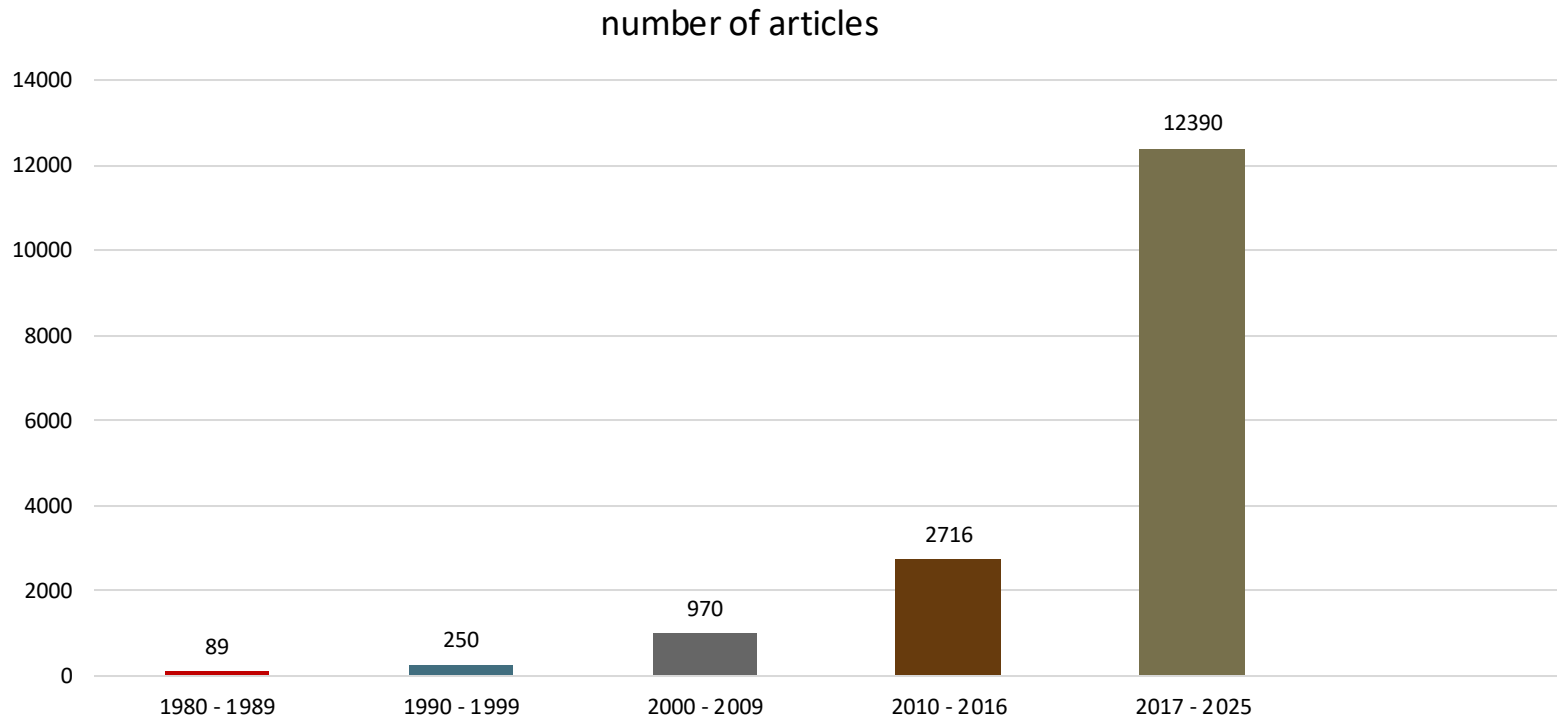
N. Clyne[a], *J. Ekholm*[d], *T. Jogestrand*[c], *L.-E. Lins*[a], *S.K. Pehrsson*[b]

[a] Division of Nephrology and [b] Cardiology, Department of Medicine; [c] Department of Clinical Physiology, and [d] Department of Physical Medicine and Rehabilitation, Karolinska Hospital, Stockholm, Sweden

CKD 5 patients -1991 - Sweden

LUND UNIVERSITY

Artiklar om träning och fysisk aktivitet vid CKD och NEB

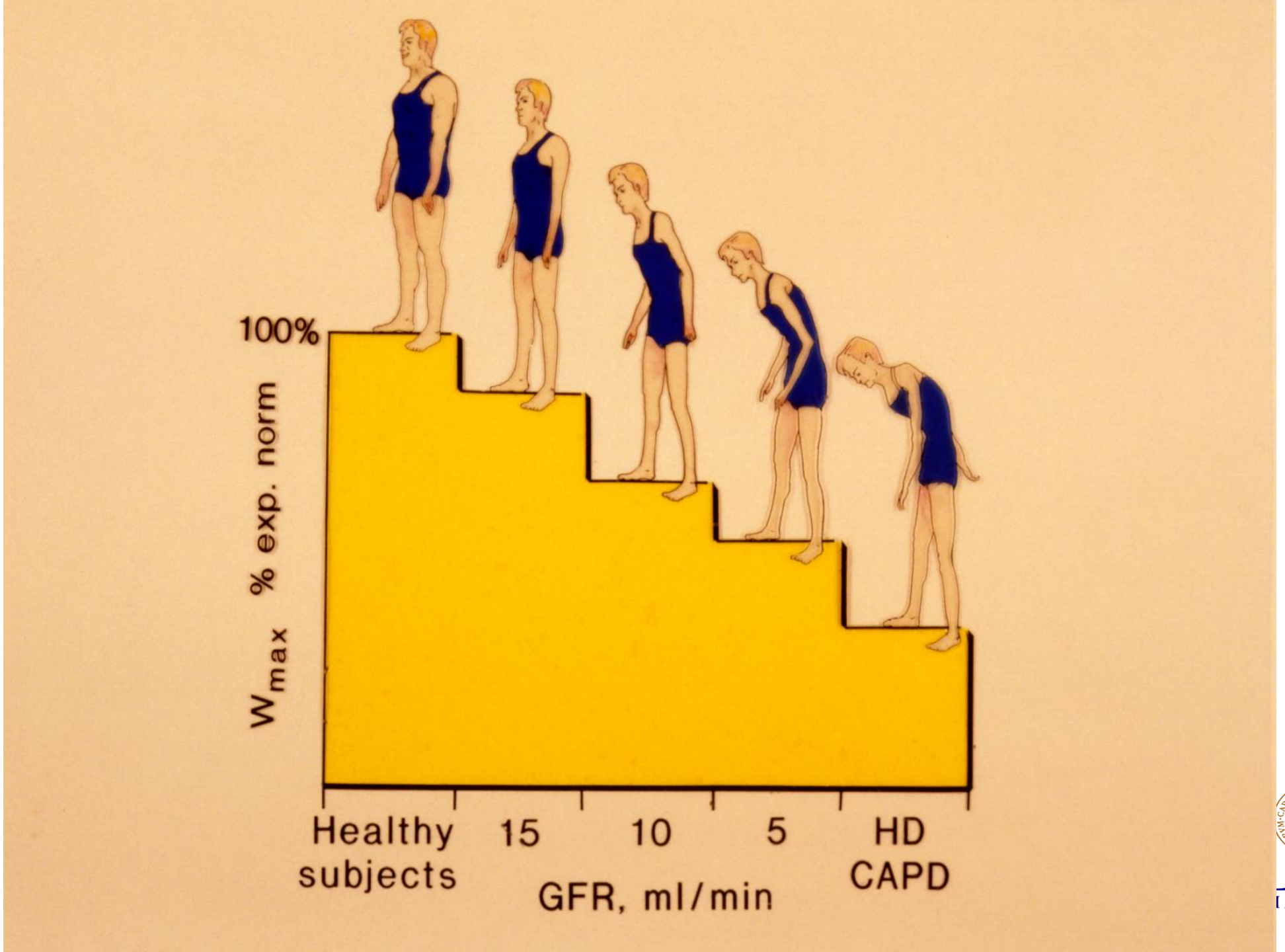


KDIGO 2024 Clinical practice Guideline for the Evaluation and Management of CKD

- We recommend that people with CKD be advised to undertake moderate-intensity physical activity for a cumulative duration of at least 150 minutes per week, or to a level compatible with their cardiovascular and physical tolerance (1D).

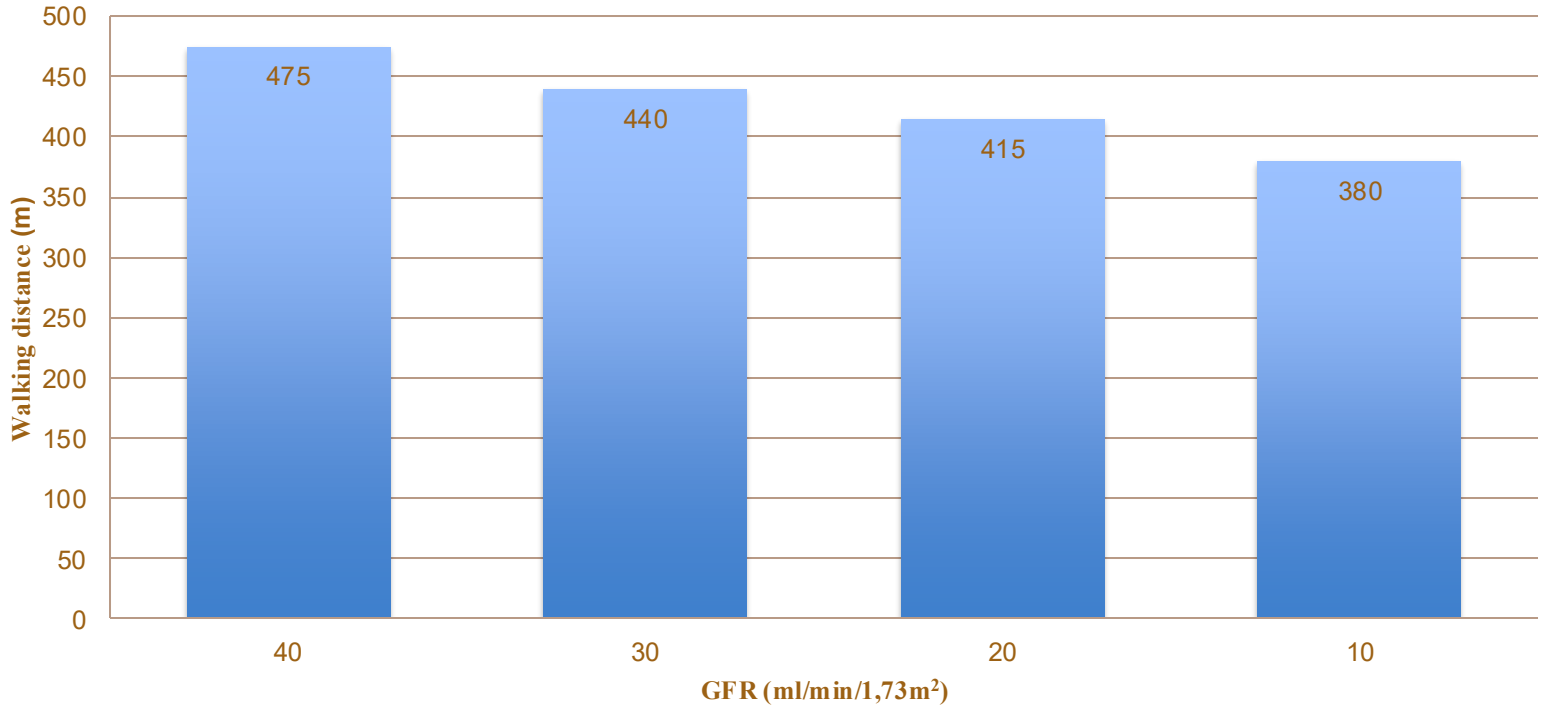
Kidney International, 2024, 105(Suppl 4S):S117-S314.

GFR och fysisk funktion


100%
W_{max} % exp. norm
Healthy subjects
15
10
5
HD CAPD
GFR, ml/min

GFR påverkar gångsträckan vid CKD 3b-5

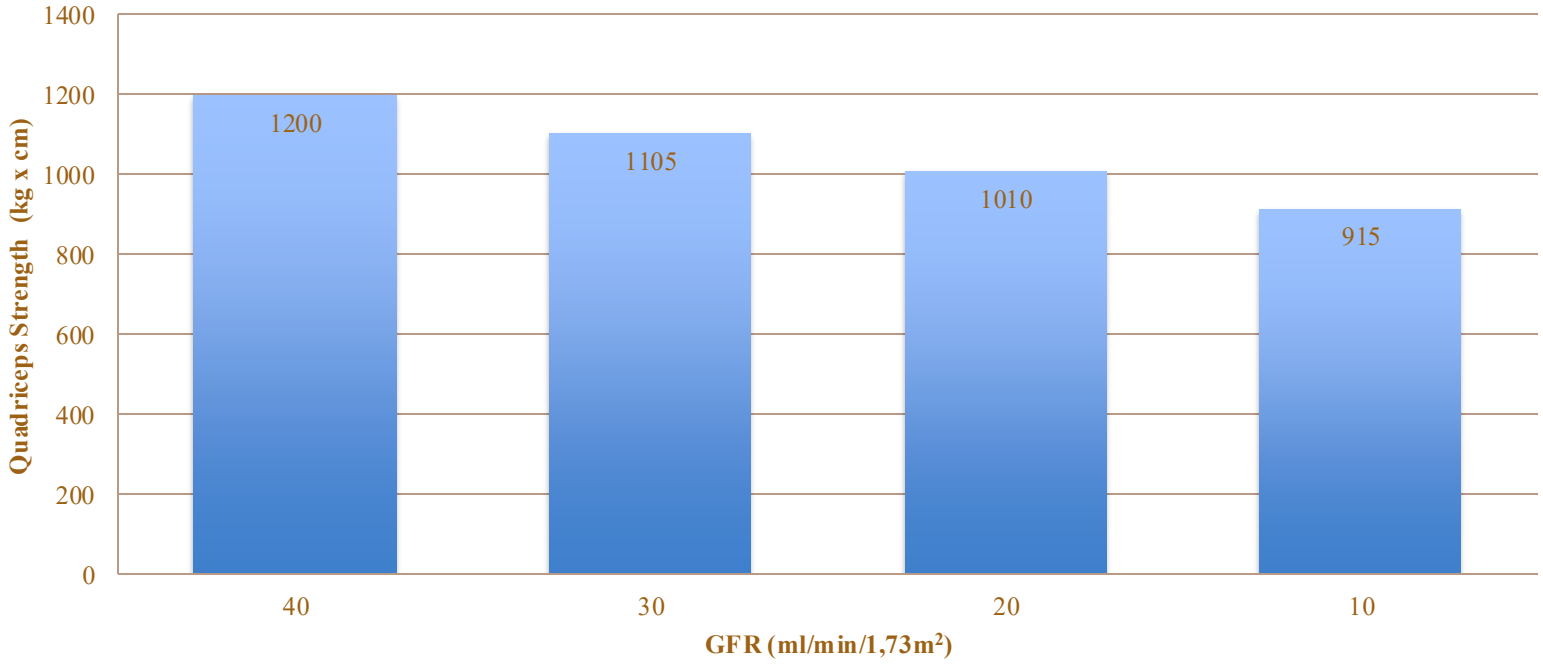
10ml/min/1.73 m^2 minskning av GFR motsvarar 35m kortare gångsträcka (6-Min Walk Test)



Hellberg et al, Nephrology 2017,22:513-519.

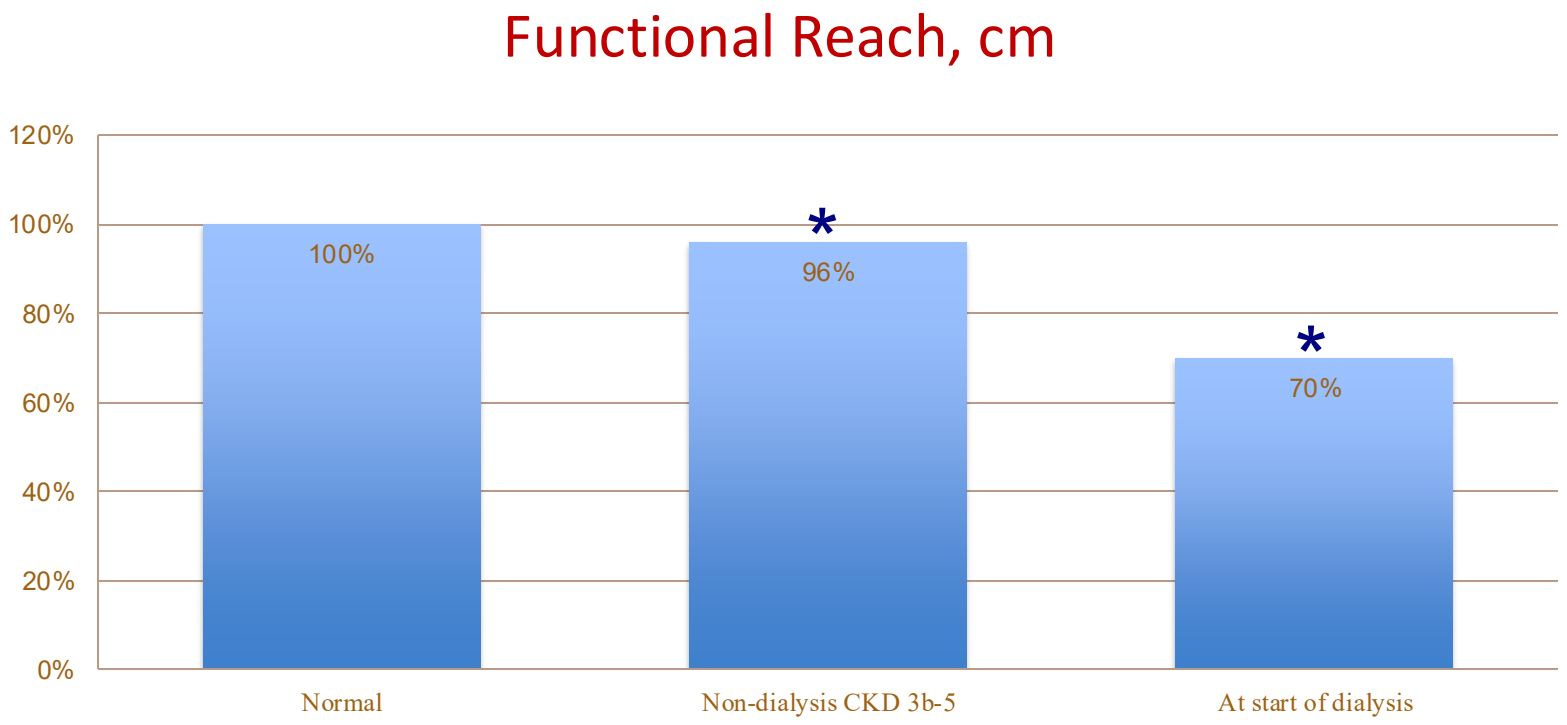
GFR påverkar muskelstyrkan vid CKD 3b-5

10ml/min/1.73m^2 minskning av GFR motsvarar
10% lägre quadriceps strength



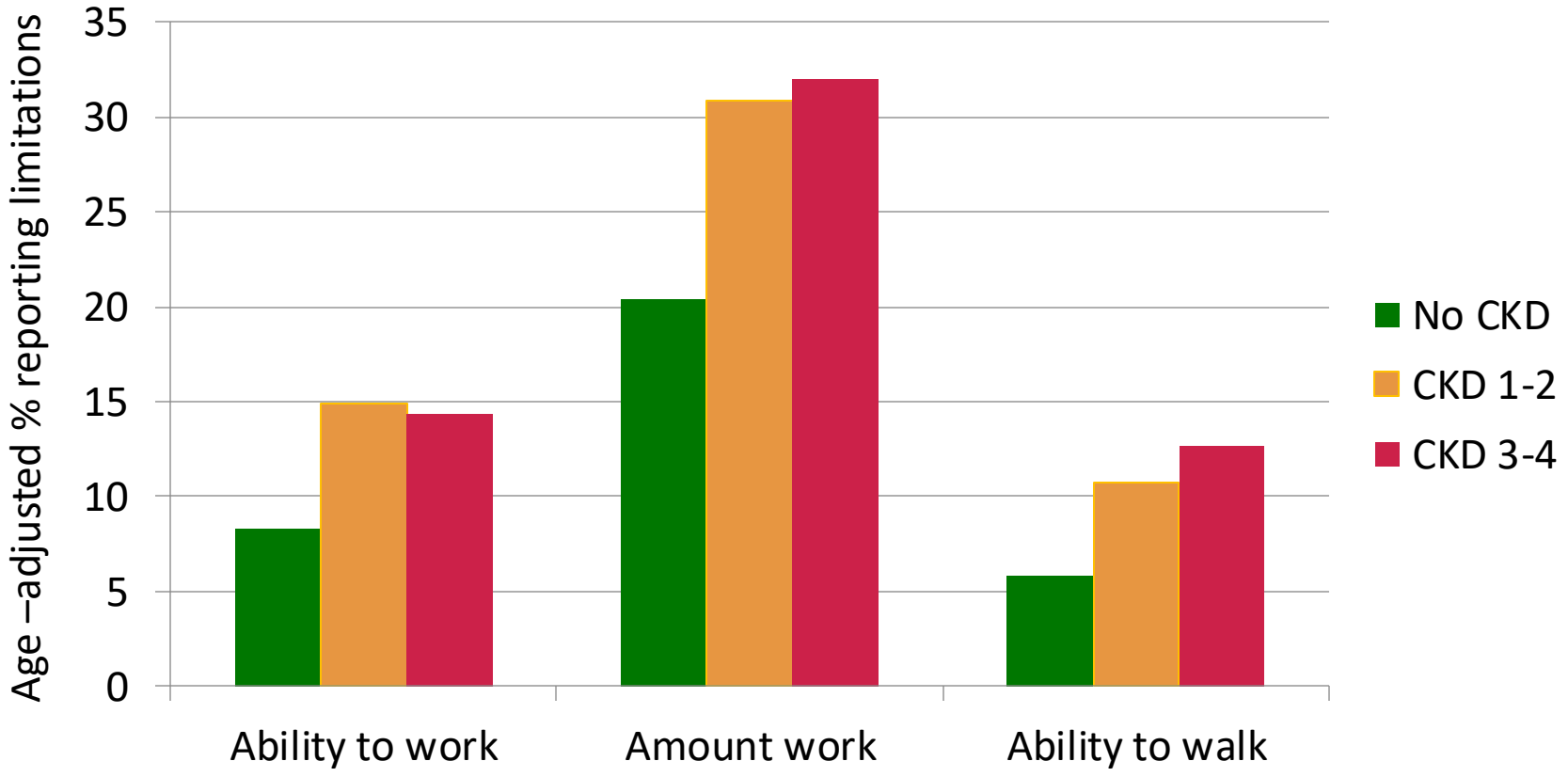
Hellberg et al, Nephrology 2017,22:513-519

GFR påverkar balansen vid CKD 3b-5



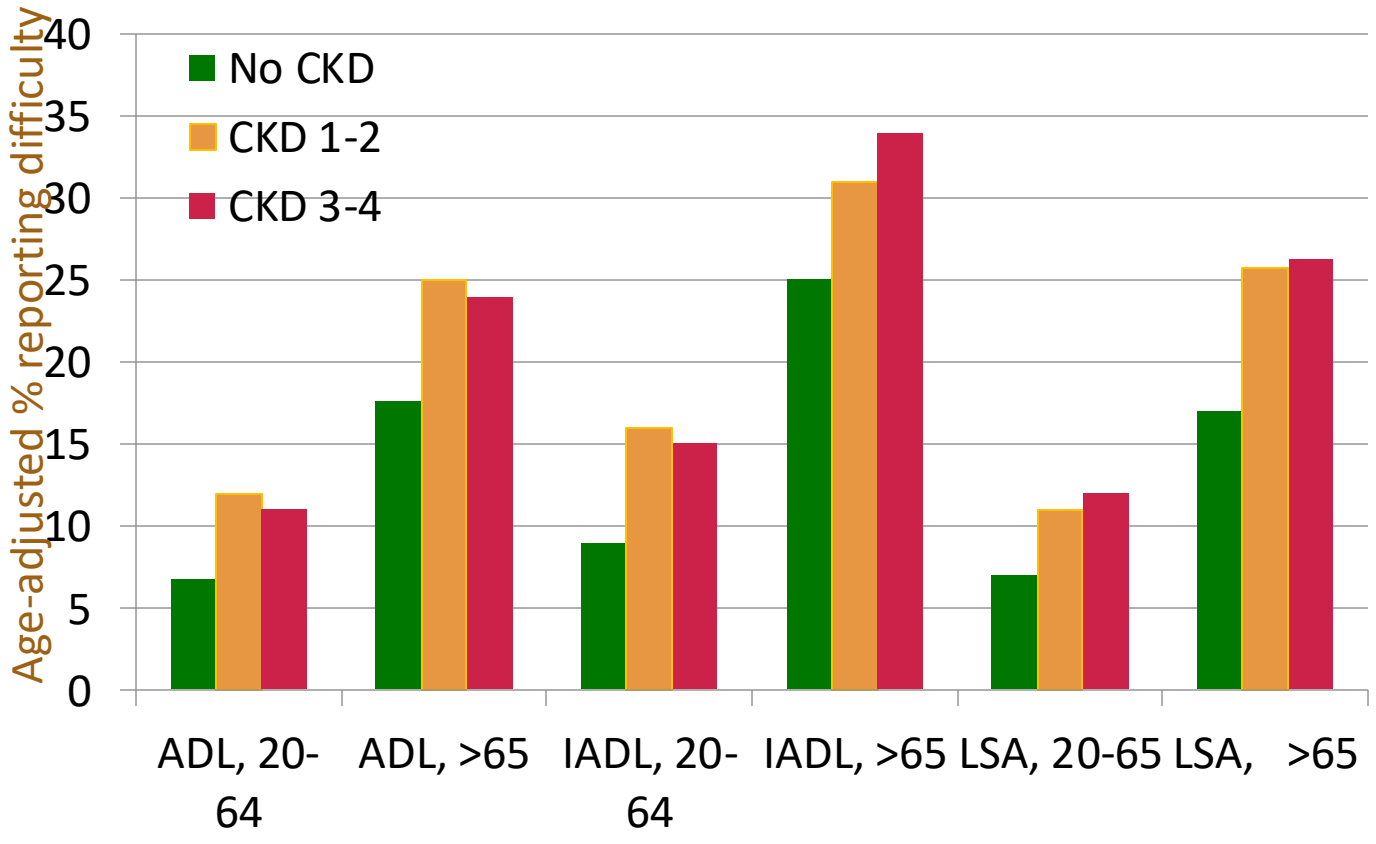
Adapted from: Hellberg, M et al Nephron Clin Pract 2014;126:116-123 and Hellberg et al, Nephrology 2017,22:513-519

Självrapporterad prevalens av funktionsinskränkning bland 20-64 åringar i USA



Adapted from Platinga et al, Am J Kidney Dis 57(2): 212-227, 2011

Självrapporterad prevalens av svårigheter med ADL bland 20-64 åringar i USA



ADL: Acitivities of daily living

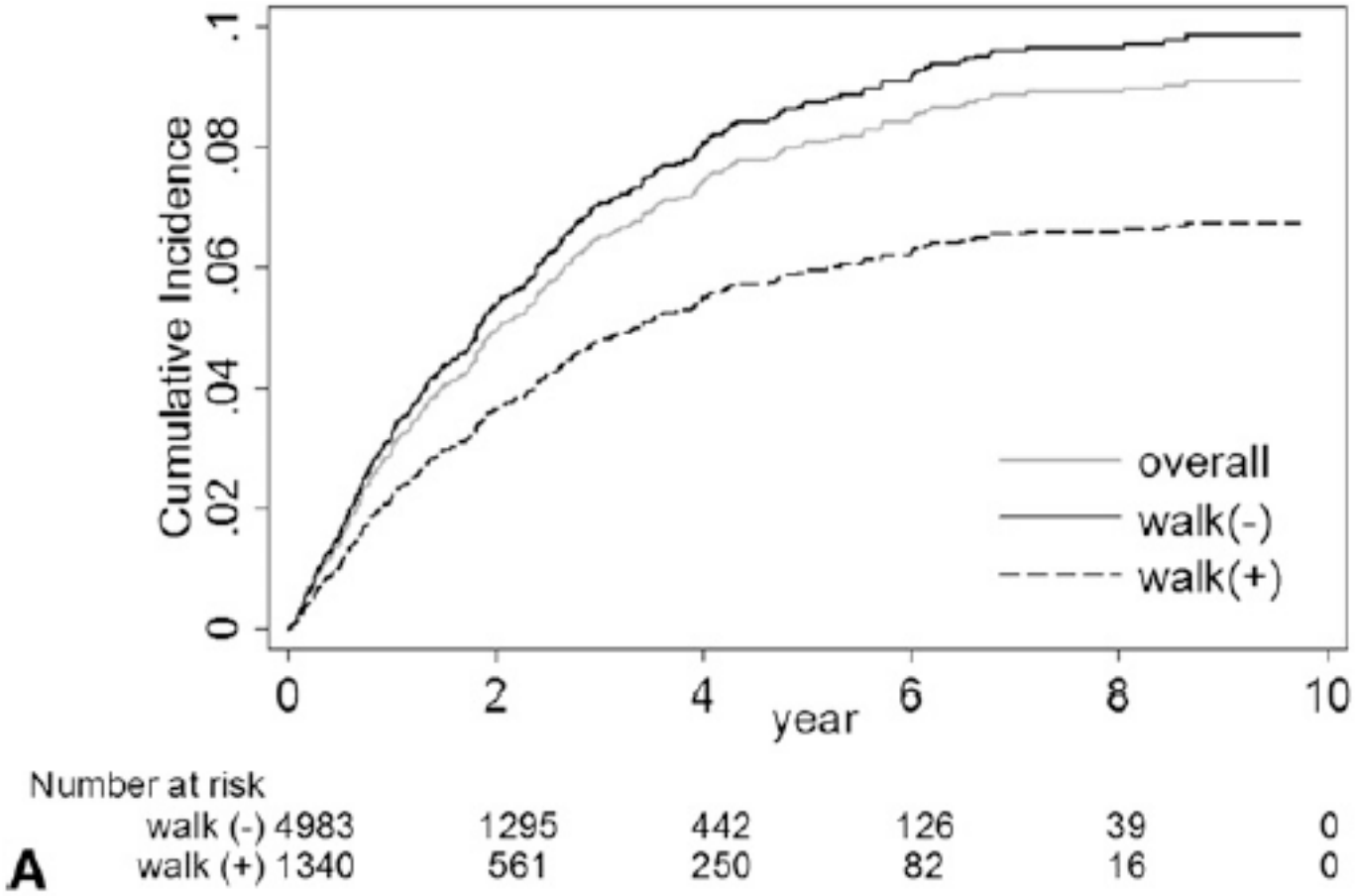
IADL: Instrumental ADL

LSA: Leisure and social activities

Adapted from Platinga et al, Am J Kidney Dis 57(2): 212-227, 2011

Fysisk funktion och dödlighet och sjuklighet

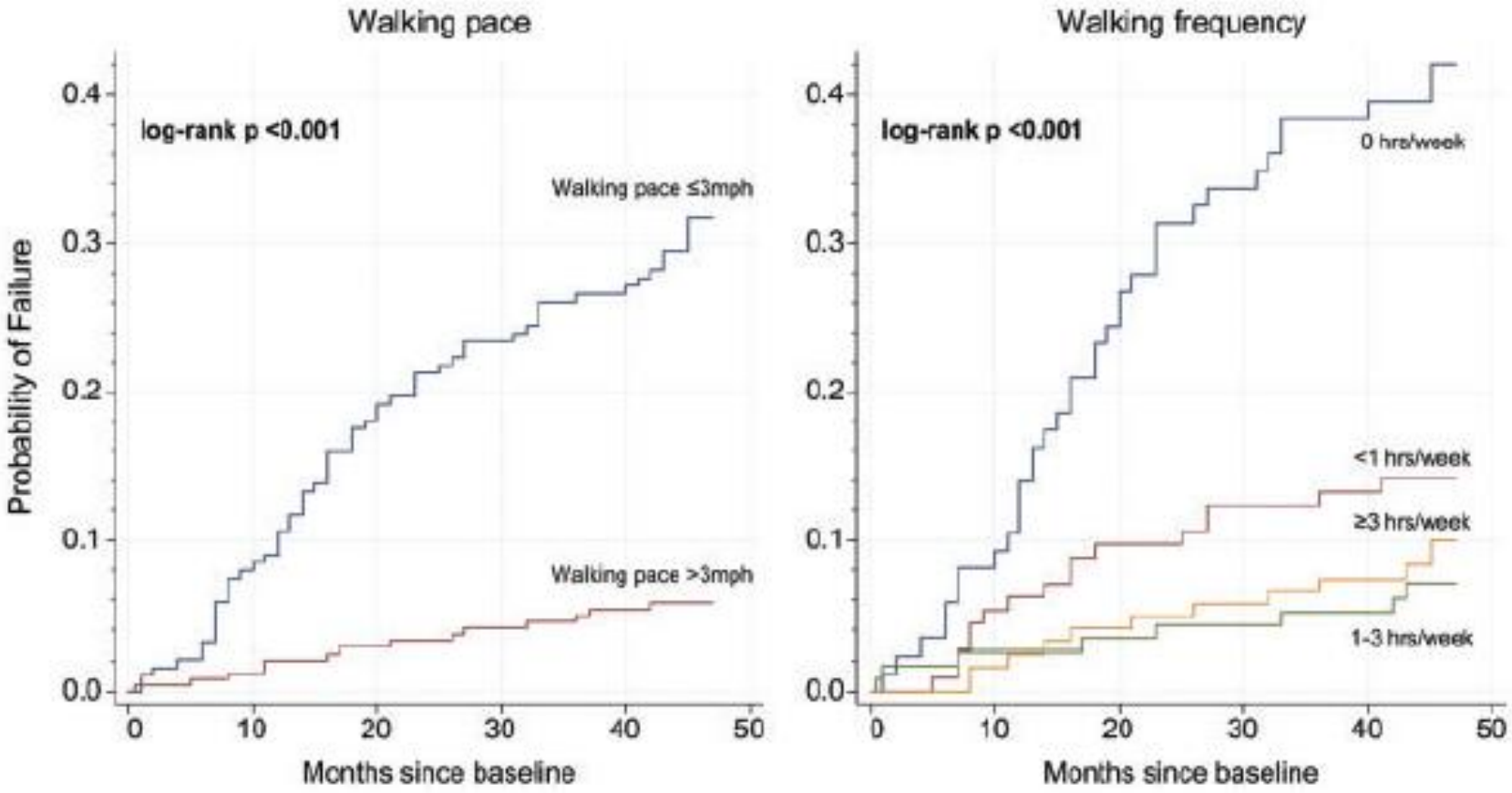
Förhållandet mellan dödlighet och gång vid CKD 3-5



Adjusted for age, eGFR, body mass index, coronary artery disease, diabetes mellitus, cerebrovascular accident, cancer

Chen et al, CJASN, May 15, 2014.

Överlevnad hos patienter med CKD 1-5 utan NEB, i relation till fysisk funktion, n=435



Clarke, AL et al, CKJ 2019,12(1):122-128.

Risk för den sammansatta endpointen: dödlighet och NEB samt MACE

Activity volume= intensity (MET), frequency and duration(h) per week

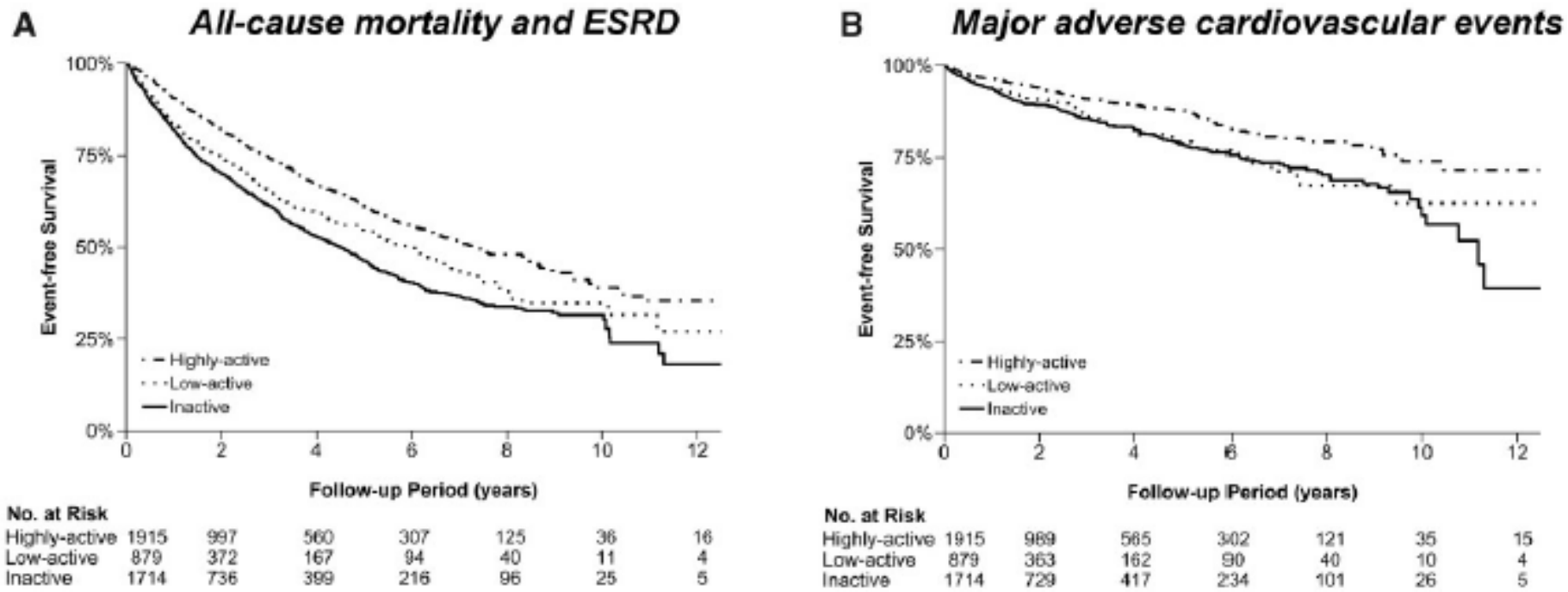
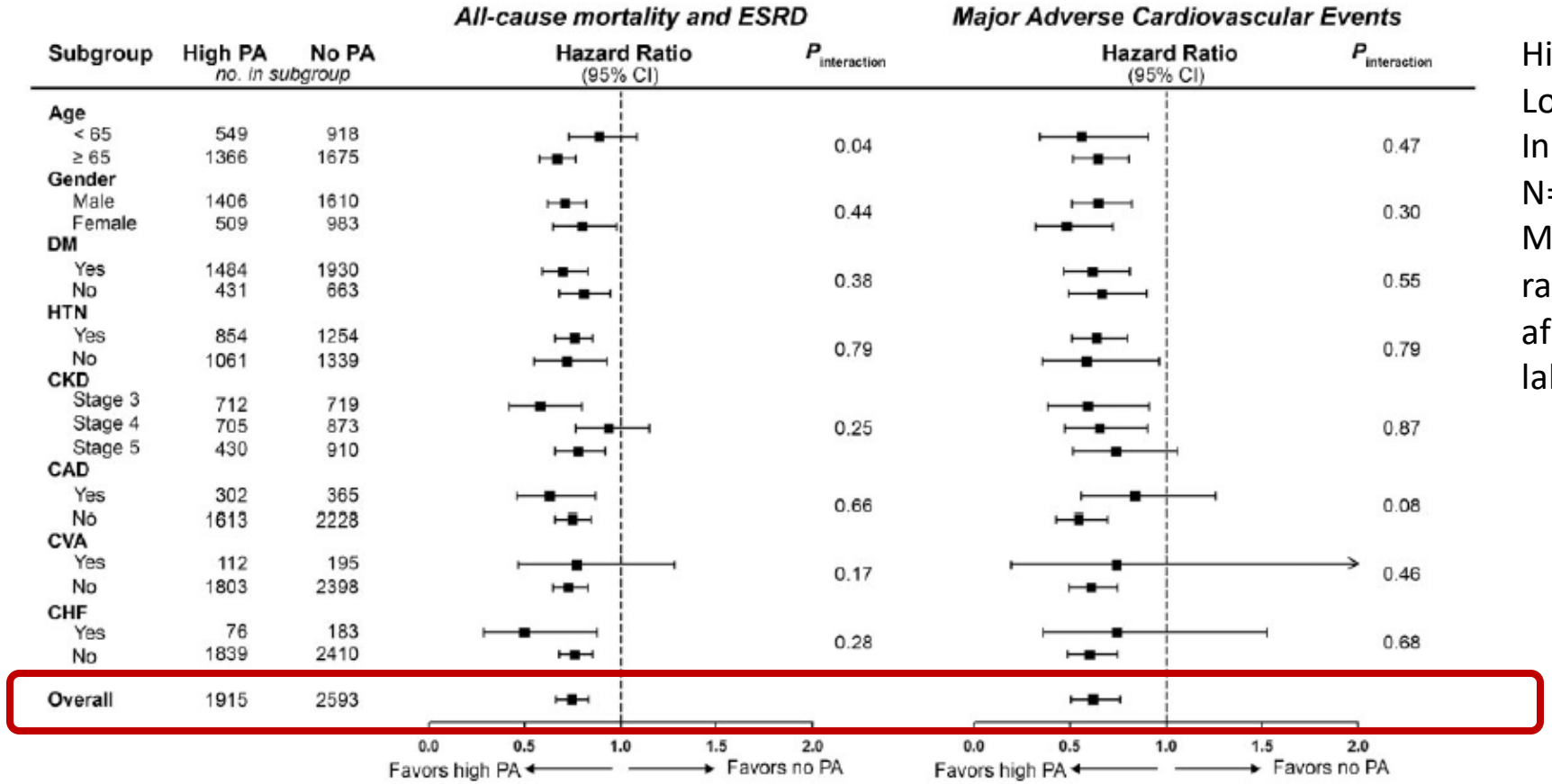


Figure 1 Kaplan–Meier curves for event-free survival of major cardiovascular and renal outcomes among chronic kidney disease patients. (*A*) Event-free survival rate for the composite outcome of death from any cause and end-stage renal disease. Highly active group vs. low-active group, $P < 0.001$; highly active group vs. inactive group, $P < 0.001$; low-active group vs. inactive group, $P = 0.015$ by log-rank tests. (*B*) Event-free survival rate for major adverse cardiovascular events. Highly active group vs. low-active group, $P < 0.001$; highly active group vs. inactive group, $P < 0.001$; low-active group vs. inactive group, $P = 0.510$ by log-rank tests.

High PA = ≥7,5 MET h/week
Low-active 0.1-7.5 MET h/week
Inactive 0 MET h/week
N= 4508
Multivariate adjusted hazard ratios after adjusting for 25 clinical and laboratory covariates

Kuo, CP et al. Eur Journ of Prev Card, 2022, 29:452-461.

Risk för den sammansatta endpointen: dödlighet och NEB respektive MACE

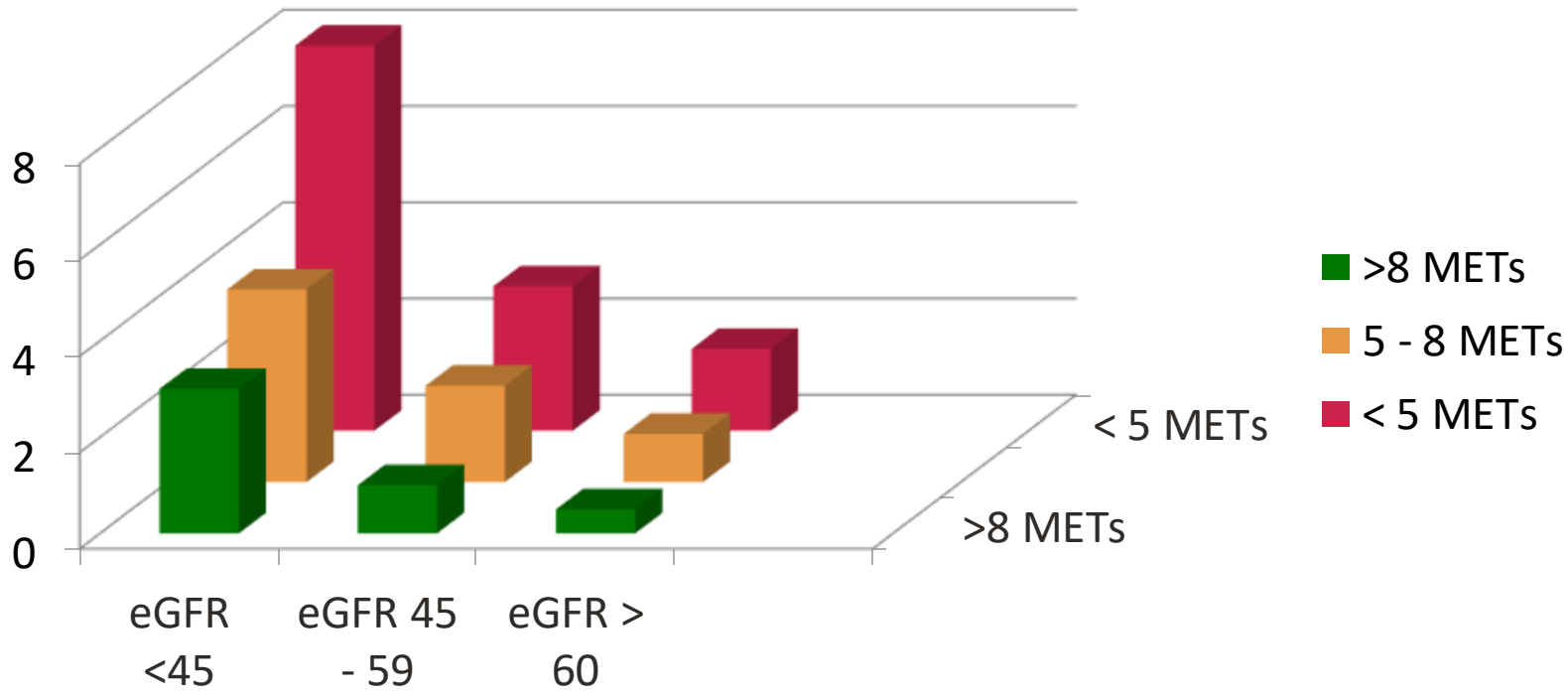


High PA = ≥7,5 MET h/week
Low-active 0.1-7.5 MET h/week
Inactive 0 MET h/week
N= 4508
Multivariate adjusted hazard ratios
after adjusting for 25 clinical and laboratory covariates

Kuo, CP et al. Eur Journ of Prev Card, 2022, 29:452-461.

Dödlighet stratifierad efter eGFR och kardiorespiratorisk förmåga

(n=5.716 women, mean follow-up 16 years)



Gulati et al, J of Women's Health, 21(9):917-924),2012

Låg fysisk aktivitet ökar dödligheten vid HD

Ökad risk < 4000 steg/dialysfri dag

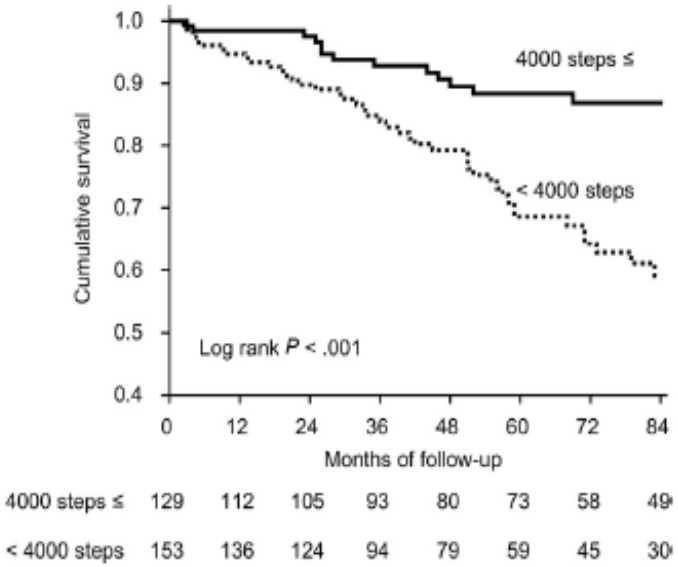


Figure 2. Kaplan–Meier analysis of survival for 282 patients undergoing hemodialysis. Patients with physical activity above the 4,000 steps per a nondialysis (thick dark line) at baseline had significantly better survival than those with lower values (dotted line; $P < .001$ by log-rank test).

N=282,

Matzusawa et al, J Renal Nutr 2018, 28(1):45-53

Association träningsfrekvens och dödlighet vid HD i DOPPS

Reference group: Exercise never or <1/week

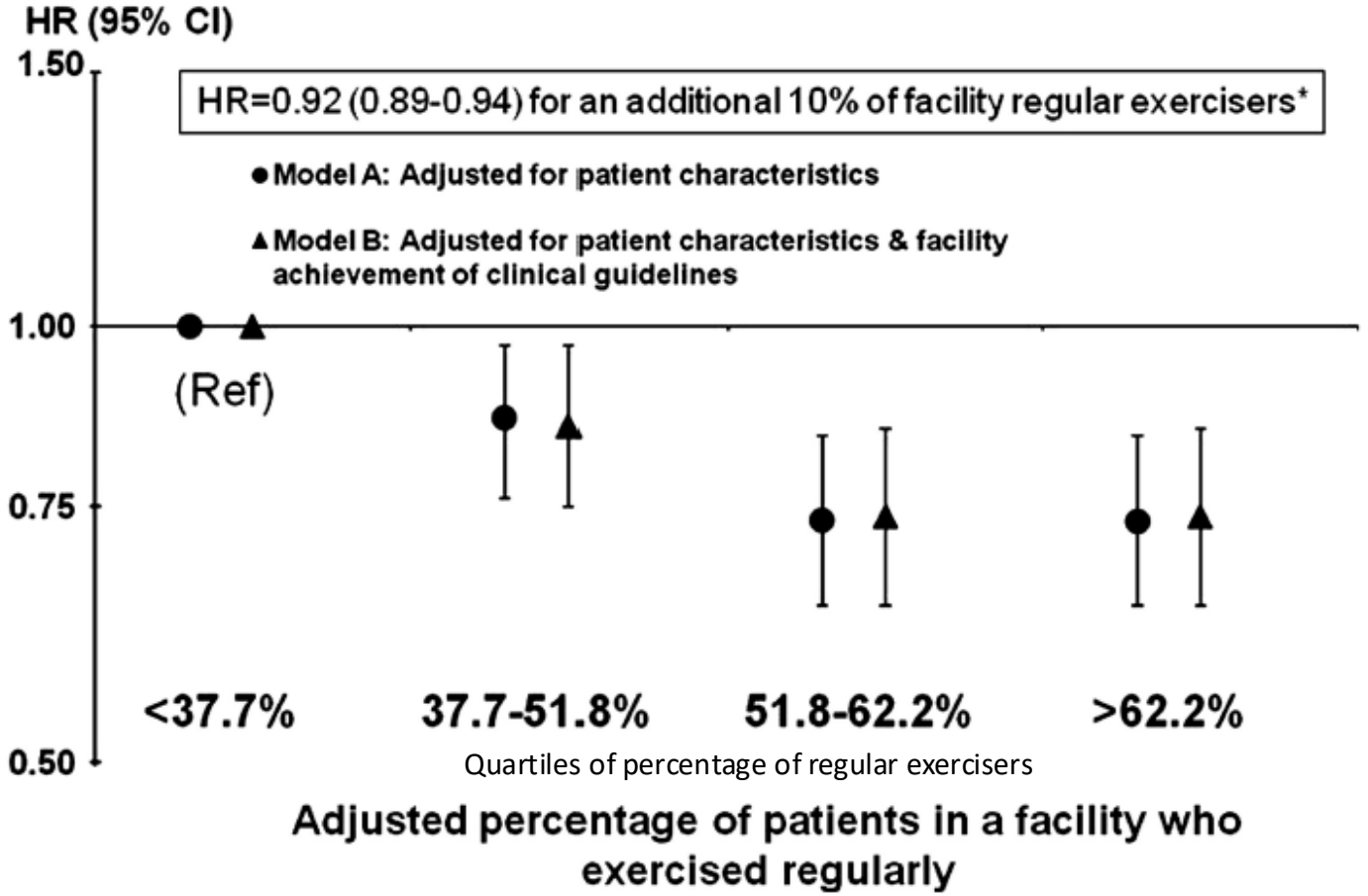
* p<0.0002 ** p<0.0001	1	2-3	4-5	6-7	Per increase in each ex fq category	≥1
Un adjusted	0.64** [0.58-0.71]	0.62** 0.56-0.68]	0.59** [0.50-0.69]	0.65** [0.50-0-69]	0.87** [0.85-0.89]	0.63** [0.59-0.67]
Max adjustment #	0.82* [0.73-0.91]	0.72** [0.66-0.79]	0.73* [0.62-0.86]	0.69** [0.63-0.76]	0.9** [0.88-0.92]	0.73** [0.69-0.78]

N= 20 912

age, sex, race, duration of ESRD, BMI, 14 summary comorbid condtions, lab values, catheter use, socio-economic indicators, ability to walk

Tentori et al, NDT 2010; 25:3050-3062.

Association mellan en dialysenhets procentuella andel patienter som tränar regelbundet och dödlighet, DOPPS

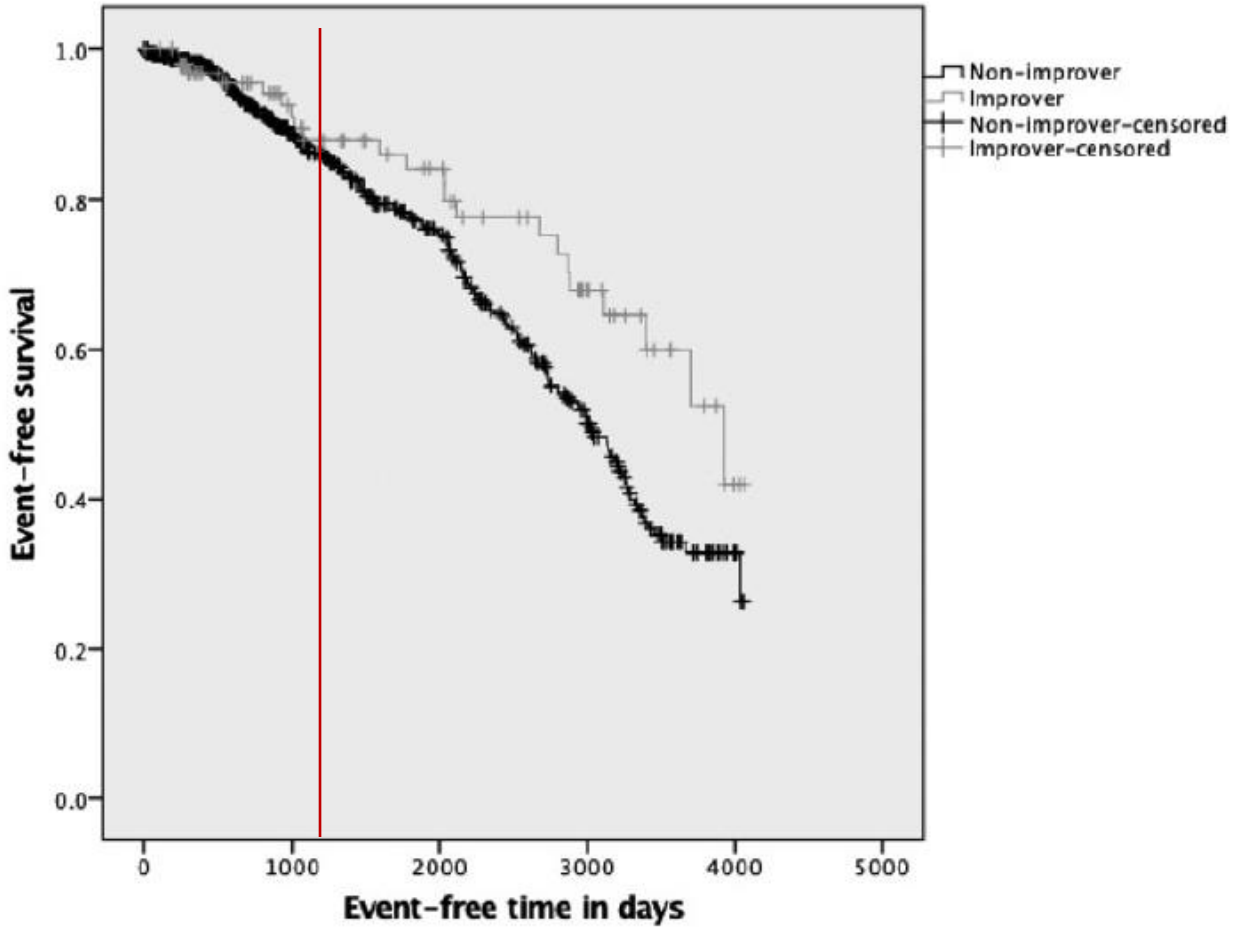


622 facilities
16 181 participants

age, sex, race, duration of ESRD, BMI, 14 summary comorbid condtions, lab values, catheter use, socio-economic indicators, ability to walk

Tentori et al, NDT 2010; 25:3050-3062.

Effekter av träning på den sammansatta endpointen död, stroke, hjärtinfarkt eller hjärtsvikt



N=335, age 58.4;
Non dialysis CKD n=138, eGFR 40.4 ml/min/1.73m^2
Dialysis n=108,
Tp n=89

Greenwood et al, NDT 34:618-625, 2019.

Effekter av träning på arytmirisk hos patienter i HD

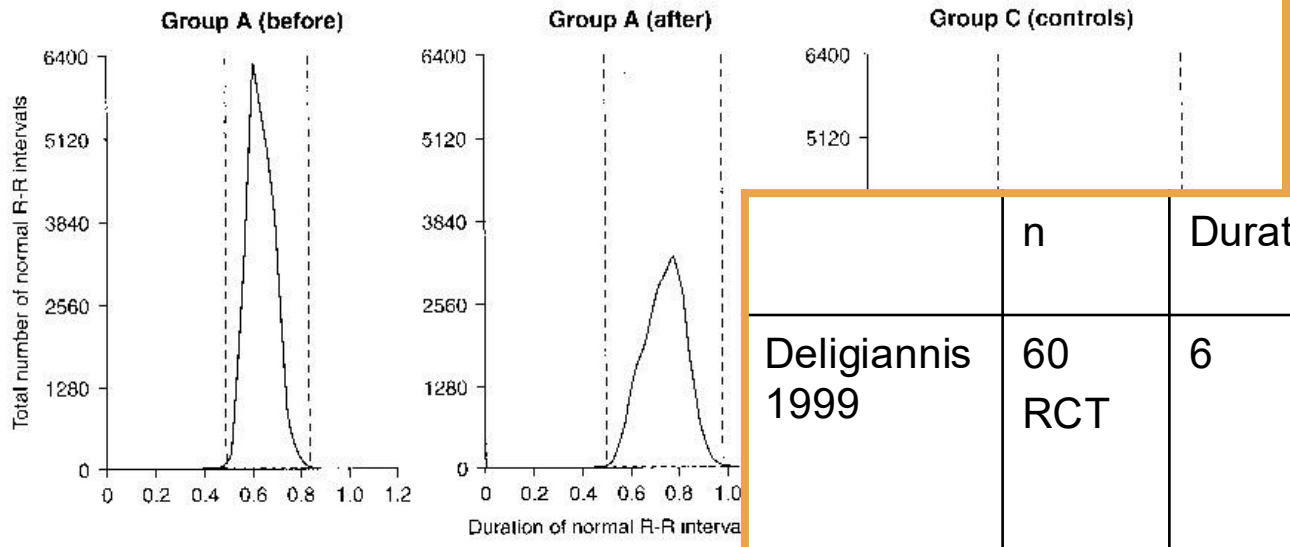


Fig. 1. The heart rate variability (HRV) index records of a haemodialysis patient
nondialysis days (group A) and of a non-uraemic control (group C) [adapted fr

Heart Rate Variability Index

	n	Duration, mo	Variable	change	Pvalue
Deligiannis 1999	60 RCT	6	HRV index	+31%	0.05
			SD of R-R interv	+18%	0.05
			N pat: HRV index<25	-40%	0.05
			N pat: arrythmias	-30%	0.05
Deligiannis 1999	38 RCT	6	LVM index	+11%	0.05
			EF	+12%	0.01
			SV index	+23%	0.05
			CO index	+20%	0.05

Deligiannis et al, Am J Cardiol 1999.

Effekter av träning på arteriell stelhelt och kalcifikation

12 weeks, exercise group n=19, control n=21

Effect of Moderate Aerobic Exercise Training on Endothelial Function and Arterial Stiffness in CKD Stages 3-4: A Randomized Controlled Trial

Amaryllis H. Van Craenenbroeck, MD,[1,2,3] Emeline M. Van Craenenbroeck, MD, PhD,[2,4] Katrijn Van Ackeren, MSc,[2] Christiaan J. Vrints, MD, PhD,[2,4] Viviane M. Conraads, MD, PhD,[2,4,†] Gert A. Verpooten, MD, PhD,[3] Evangelia Kouidi, MD, PhD,[5] and Marie M. Couttenye, MD, PhD[1]

AJKD 66(2):285-296, 2015

12 months, strength exercise n=53, balance exercise n=59

Twelve months of exercise training did not halt abdominal aortic Calcification in patients with CKD – a sub-study of RENEXC – a randomized controlled trial

Yunan Zhou, Matthias Hellberg, Thomas Hellmark, Peter Höglund,, Naomi Clyne

BMC Nephrology, 2020.

16 weeks, exercise group n=25, control n=21

Short-term Aerobic Exercise and Vascular Function in CKD Stage 3: A Randomized Controlled Trial

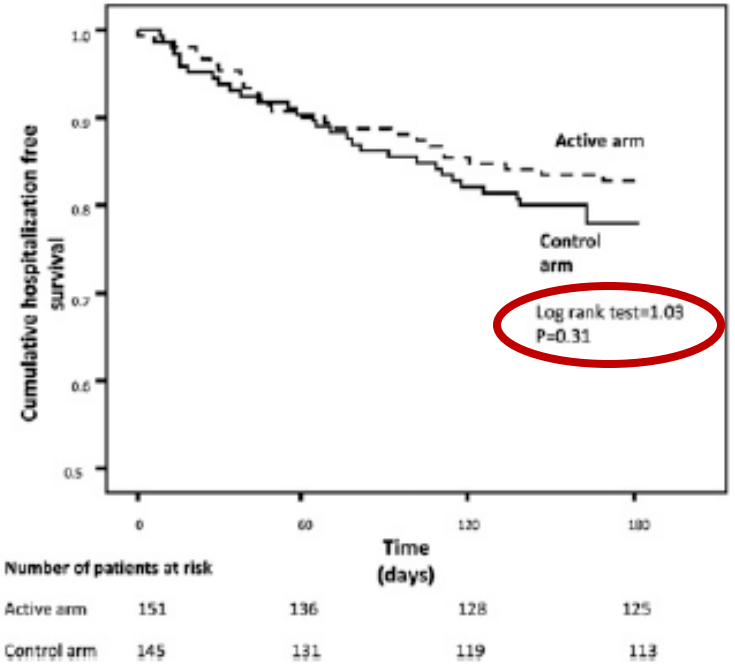
Samuel Headley, PhD,[1] Michael Germain, MD,[2] Richard Wood, PhD,[1] Jyovani Joubert, BS,[1] Charles Milch, PAC,[1] Elizabeth Evans, PhD,[1] Anthony Poindexter, MD,[2,3] Allen Cornelius, PhD,[3] Britton Brewer, PhD,[1] Linda S. Pescatello, PhD,[4] and Beth Parker, PhD[5]

AJKD 64(2):222-229, 2014.

Ingen effeKt

Risk för sjukhusvård efter 6 mån träning hos patienter i dialys, EXCITE

Intention to treat analysis



Per protocol analysis

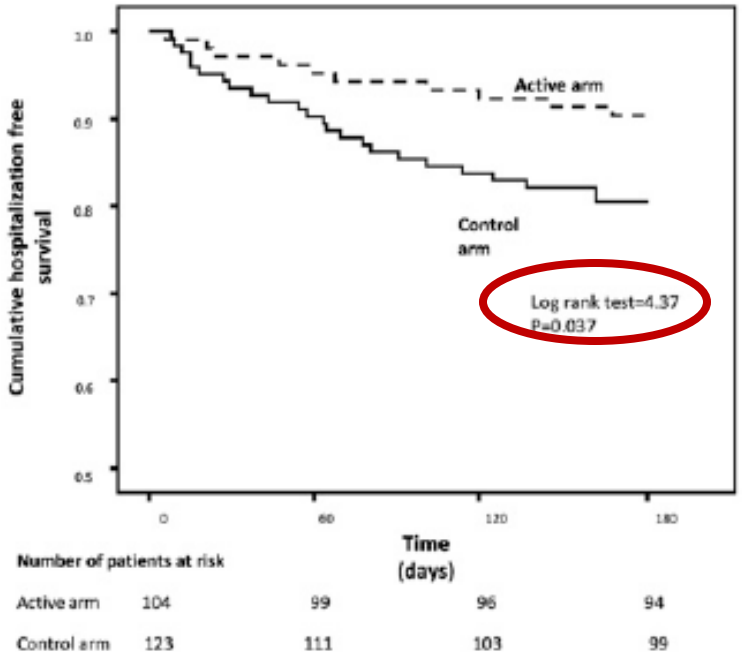


Figure 4. Kaplan–Meier survival curves of hospitalizations in the active and control arms of the trial. The left panel shows analysis of all randomized patients. The right panel shows analysis of patients who completed the 6-month trial.

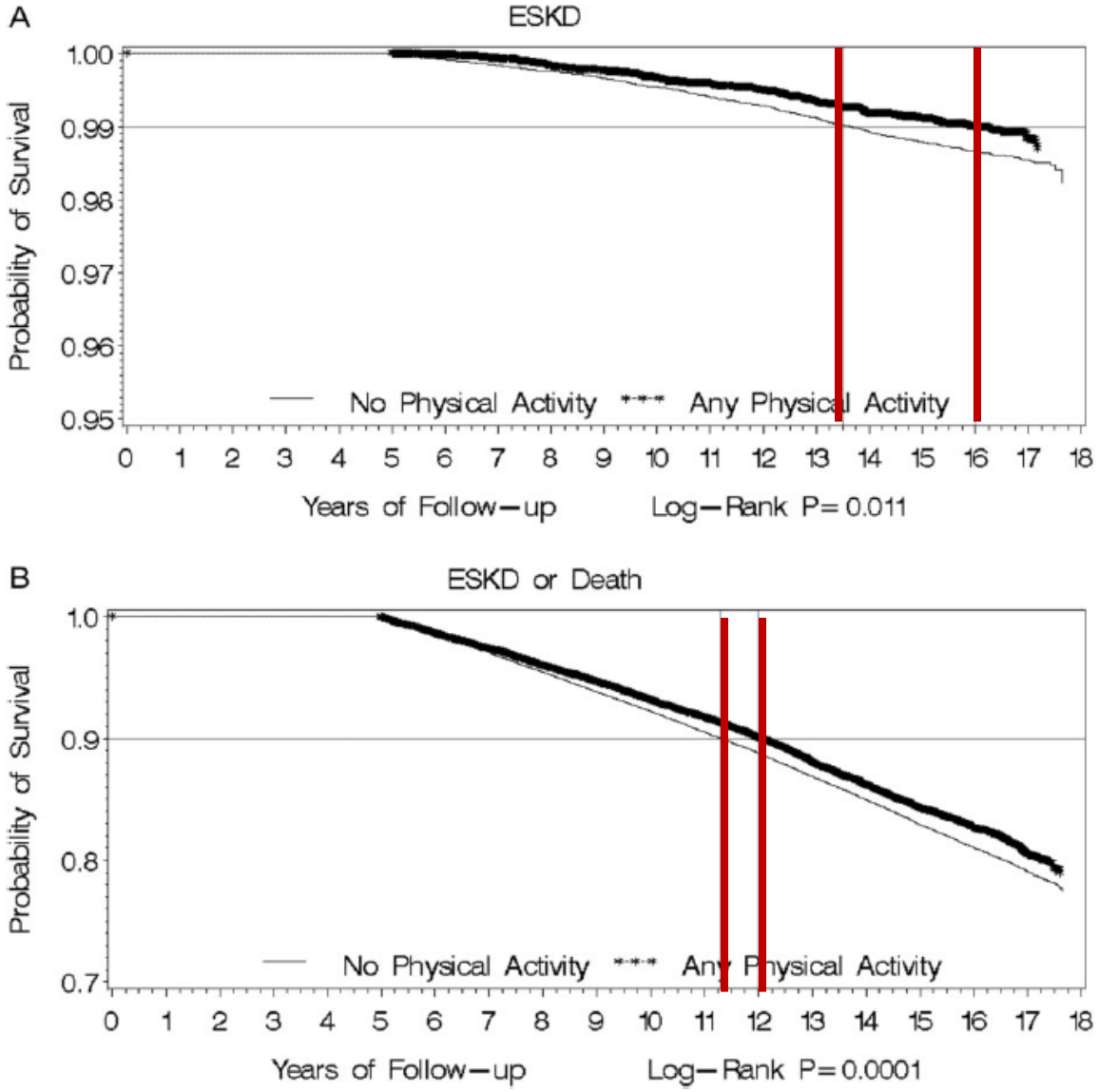
Manfredini et al, JASN 28, 2016

Risk för sjukhusvård efter 12 mån träning hos patienter i dialys, DiaTT

	Kontrollgrupp	Träningsgrupp	P värde
Episoder av sjukhusvård per patient	1,32±6.2	1,14±1,53	0,024
Dagar på sjukhus per patient	12,8±20,9	10,9±8,9	0,036

Anding Rost, K, von Gersdorff, G et al, NEJM Evidence, 2023

CKD - progressionstakt



Fysisk aktivitet och risk för NEB i Singapore Chinese Health study

N=59 552 Chinese adults age 45–74 years

Jafar et al. Nephrology 20 (2015) 61–67

Association mellan fysisk aktivitet per vecka och progressionstakt

N=256; age 61.8; eGFR 15 – 59 ml/min/1.73m^2

Table 2. Association of physical activity and annualized relative change in eGFR cystatin C

Leisure-Time Physical Activity Level (min/wk)	Percent Annual Change in eGFR Cystatin C (95% Confidence Interval)			
	Unadjusted	Model 1[a]	Model 2[b]	Model 3[c]
None	−9.6 (−12.0 to −7.1)	−10.1 (−12.4 to −7.7)	−9.4 (−11.8 to −6.9)	−9.4 (−12.0 to −6.9)
1–59	−8.2 (−10.3 to −6.1)	−8.0 (−10.0 to −6.0)	−8.1 (−10.2 to −6.0)	−8.7 (−10.9 to −6.5)
60–150	−6.8 (−9.4 to −4.3)	−7.1 (−9.5 to −4.7)	−7.2 (−9.7 to −4.7)	−8.4 (−10.7 to −6.2)
≥150	−6.2 (−8.3 to −4.2)	−5.9 (−7.9 to −3.9)	−6.4 (−8.4 to −4.3)	−6.6 (−8.8 to −4.4)
P value for trend	0.02	0.02	0.03	0.05
Per 60 min/week increment	1.3 (0.23 to 2.32)	0.61 (0.14 to 1.07)	0.52 (0.03 to 1.00)	0.50 (0.02 to 0.98)

P values for continuous association (per 60 min/wk increment in physical activity) were 0.02, 0.01, 0.03, and 0.04 for the unadjusted model and models 1, 2, and 3, respectively.

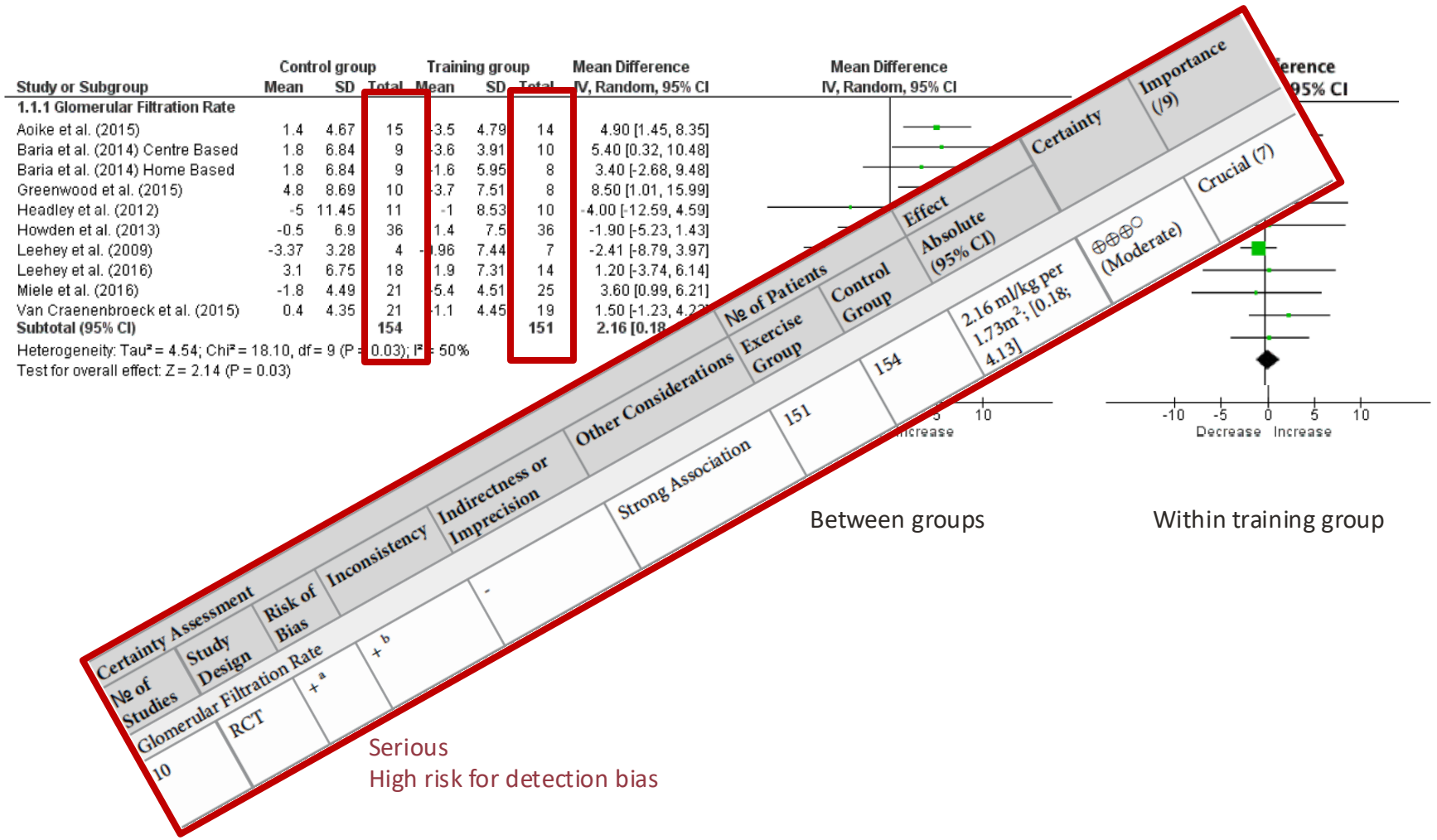
[a]Model 1 is adjusted for age, race, sex, and study site.

[b]Model 2 is adjusted for the variables in model 1 plus education, body mass index, diabetes, smoking status, alcohol, and prevalent coronary artery disease.

[c]Model 3 is adjusted for the variables in model 2 plus hemoglobin A1c, systolic BP, angiotensin-converting enzyme inhibitor use, angiotensin-receptor blocker use, statin use, and C-reactive protein.

Robinson-Cohen et al. JASN 25:399-406, 2014.

Meta-analys av effekter av träning på eGFR hos patienter med CKD 3-4



Van den Wyngaert et al. PLoS One 2018, 13(9).

Effekter av 12 mån träning på progressionstakt och albuminuri - RENEXC studien

	Strength group			Balance group		Group comparison
All randomized patients						
mG ml/min/1.73m²	**- 1,8 ml/min/1.73m² jämfört med 2,16[0,18-4,13] Van den Wyngaert**					
	12	21.9±9.7	0.01	21.2±7.8	0.01	NS
U-ACR g/mol	0	98±140		84±114		
	12	64±98	<0.001	71±99	0.5	0.02

Hellberg et al, KIR 4:963–976,2019.

Träning vid CKD 3-5

Genomförbarhet - Patienterna tränade!

EXERCISE TOLERANCE IN PATIENTS ON CHRONIC HEMODIALYSIS

Isr J Med Sci 16: 17–21, 1980

N. BARNEA, Y. DRORY, A. IAINA, C. LAPIDOT, E. REISIN, H. ELIAHOU* and J. J. KELLERMANN

Department of Nephrology and Cardiac Evaluation and Rehabilitation Institute, Chaim Sheba Medical Center, Tel-Hashomer, Israel

HD patients -1980 - Israel

Clinical Nephrology, Vol. 18, No. 1 – 1982 (pp. 17–22)

Long-duration submaximal exercise condition
in hemodialysis patients

P. M. ZABETAKIS[1, 2], G. W. GLEIM[2], F. L. PASTERNACK[3]
and M. F. MICHELIS[1]

[1] Nephrology Section, Departm
New York, New York
College, Valhall
[2] Institu

ical

82 - USA

Kidney International, Vol. 24, Suppl. 16 (1983), pp. S-303–S-309

Therapeutic benefits of exercise training for hemodialysis patients

ANDREW P. GOLDBERG, EDWARD M. GELTMAN, JAMES M. HAGBERG, JAMES R. G
JAMES A. DELMEZ, ROBERT M. CARNEY, ANNA NAUMOWICZ, MARY HA
and HERSCHEL R. HARTER

*Departments of Medicine, Preventive Medicine, and Psychiatry, the Lipid Research Cent
Applied Physiology, Metabolism, Nephrology, and Cardiolo
Washington University School*

HD pati

© 1986 S. Karger AG, Basel
0028-2766/86/0432-0087$2.75/0

Exercise Training during Hemodialysis

Patricia L. Painter, Jane N. Nelson-Worel, Maria M. Hill, Diane R. Thornbery, Weldon R. Shelp, Avery R. Harrington, Arvin B. Weinstein

Nephrology Section, Department of Medicine, University of Wisconsin Hospital and Hemodialysis Unit, Methodist Hospital, Madison, Wisc., USA

HD patients -1986 - USA

chronischer

RISCH, D. STRANGFELD, K. PRECHT und F. PRIEM

rologische Abteilung der Universitätsklinik für Innere Medizin des Bereiches Medizin (Charité) der Humboldt-Universität Berlin

CKD 5 patients -1987 - Germany

Nephron 1991;59:84–89

0028-

Effects of Exercise Training in Predialytic Uremic Patients

N. Clyne[a], J. Ekholm[d], T. Jogestrand[c], L.-E. Lins[a], S.K. Pehrsson[b]

[a] Division of Nephrology and [b] Cardiology, Department of Medicine; [c] Department of Clinical Physiology, and [d] Department of Physical Medicine and Rehabilitation, Karolinska Hospital, Stockholm, Sweden

CKD 5 patients -1991 - Sweden

Men, väldigt selekterade patienter.

Genomförbarhet:
Vissa patienter ville vara med och träna och andra inte!

Shesadri et al HD&PD: eligible 83, declined 23 (28%), 60 randomized. BMC Nephrol 2020;21:100 - USA

Hellberg et al: CKD 3-5; 217 eligible; 266 (30%) declined, 151 randomized. KIR 2019,4:963-976. Sweden

Manfredini et al: HD&PD; 497 eligible, 180 (36%) declined, 317 randomized. JASN 2016(28) - Italy

Cheema et al: HD 77 eligible, 77 (36%) declined; 49 randomized (AJKD 2007; 50(4):574-584 - USA

Bohm et al. HD: 167 eligible, 107 (64%) declined, 60 randomized (NDT 2014;29:1947-55) - Canada

Greenwood et al: 60 eligible, 40 (67%) declined, 20 randomized (AJKD 2015; 65(3):425-434 – UK

Watson et al: CKD 3-4; 403 eligible, 365 (90%) declined, 38 randomized (AJKD 2015;66:249-257) - UK

Träningsstudier– CKD 3-5

	Study design	Type of training	Study duration, mo	Training locality	Prescribed duration (min) /week
Weiner et al, 2022	RCT CKD 3-4	1) Aer + res 2) Control, lifestyle info	12	In-center - 6 mo In-center – 6 mo (optional at home 1 session/week)	140 min/week
Hellberg et al, 2019 (RENEXC)	RCT CKD 3-5	1) Aer + res 2) Aer + bal	12	At home/gym – 12 mo	150 min/week
Howden et al, 2015	RCT CKD 3-4	1) Aer + res 2) Controll	12	In-center- 2 mo At home -10 mo	150 min/week

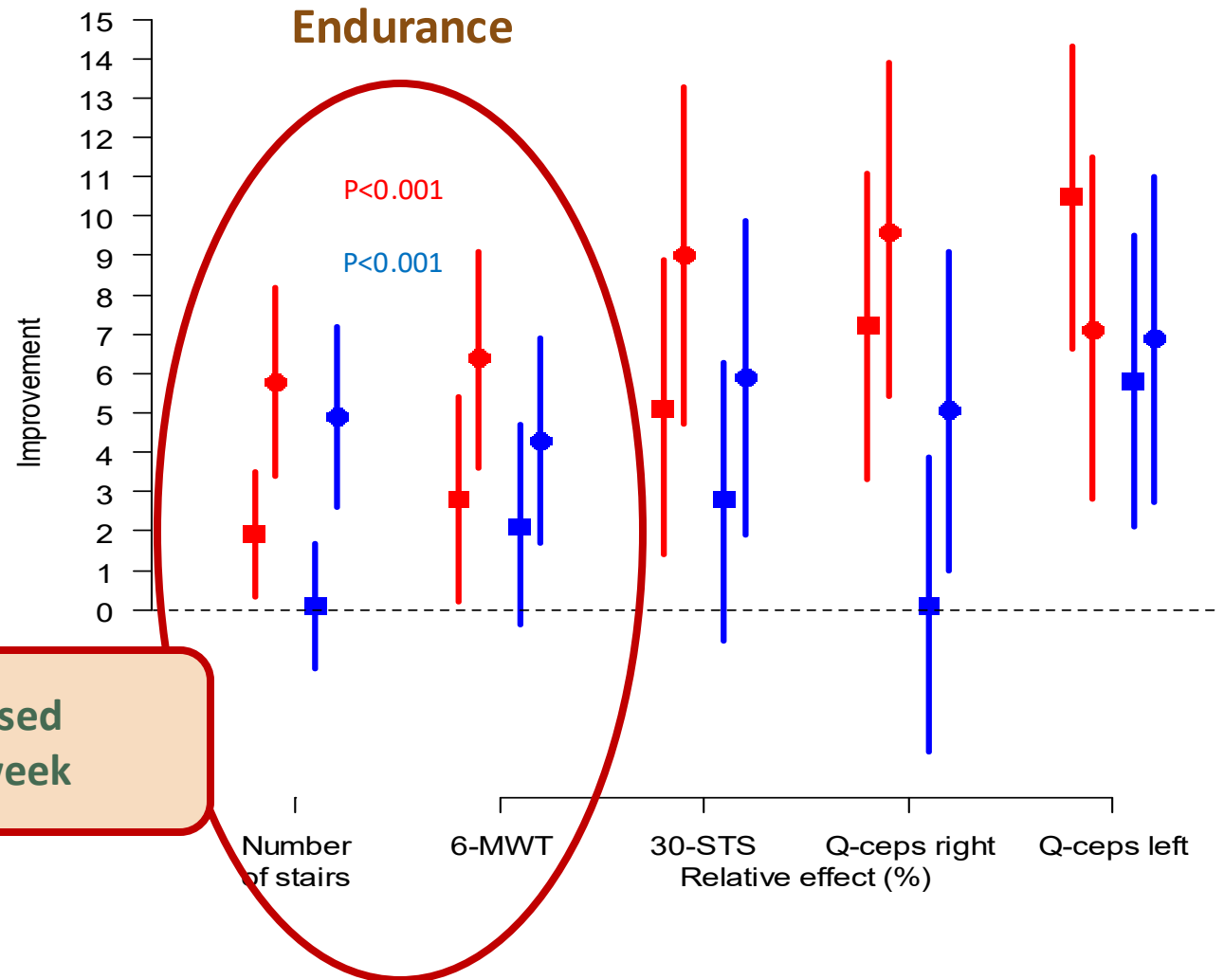
Träningsstudier– CKD 3-5

	No screened, n	No randomized, n (%)	No completed, n	No of sessions completed, %	Total adherence, %
Weiner et al, 2022	194	99 (51%)	68	6 mo: 60% 12 mo: 49%	6 mo: 60% 12 mo: 49%
Hellberg et al, 2019 (RENEXC)	217	151 (70%)	112	66 %	74%
Howden et al, 2015	90	83 (92%)	72	70 % in-center 57 % at home	86%

Självadministrerad träning

Självadministrerad: RENEXC – utfall CKD 3-5

Total adherence: 74%



Red= strength group
Blue=balance group

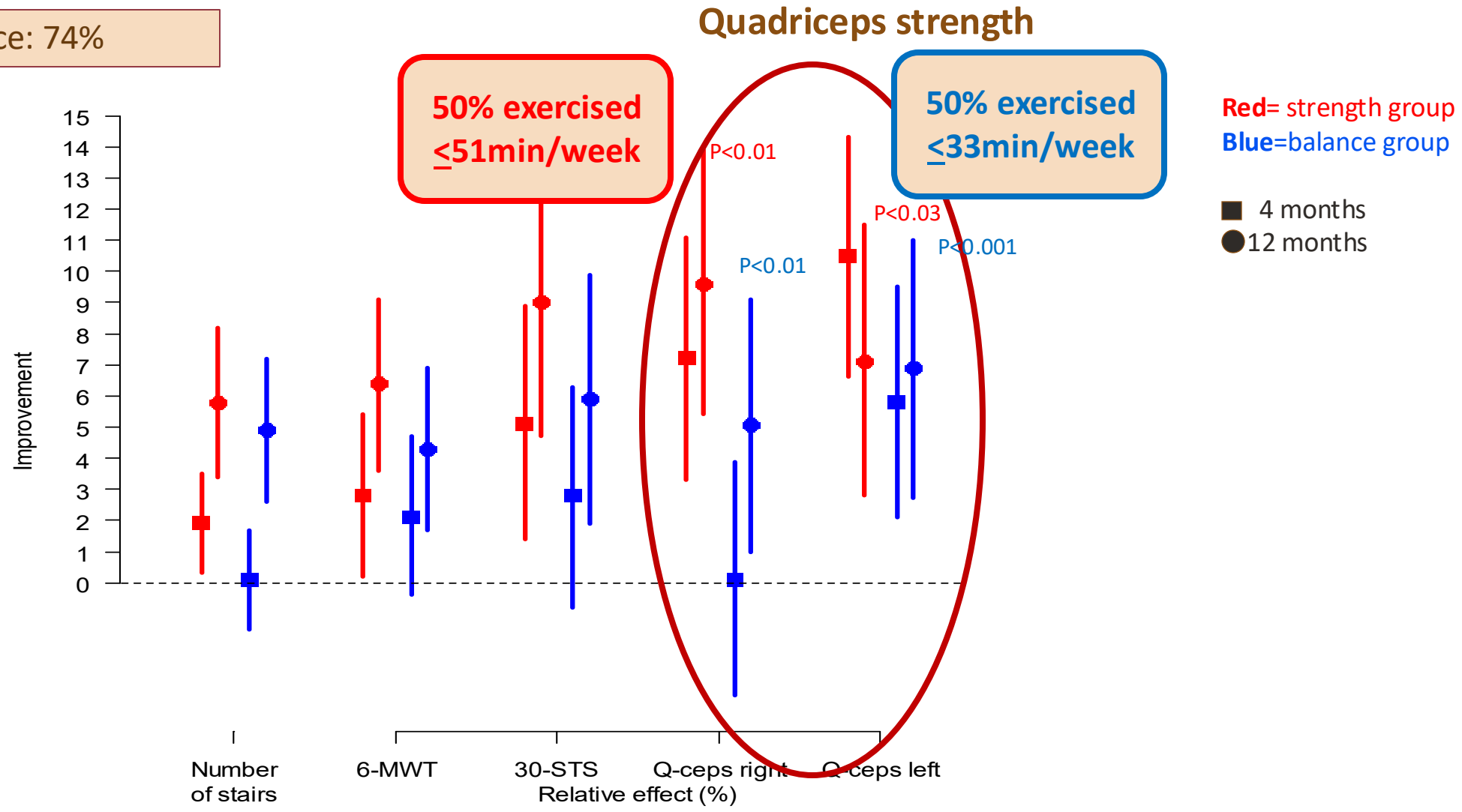
■ 4 months
● 12 months

50% exercised
≤ 60 min/week

Hellberg et al, Kidn Int Rep 4:963–976,2019

Självadministrerad: RENEXC – utfall CKD 3-5

Total adherence: 74%



Hellberg et al, Kidn Int Rep 4:963–976,2019

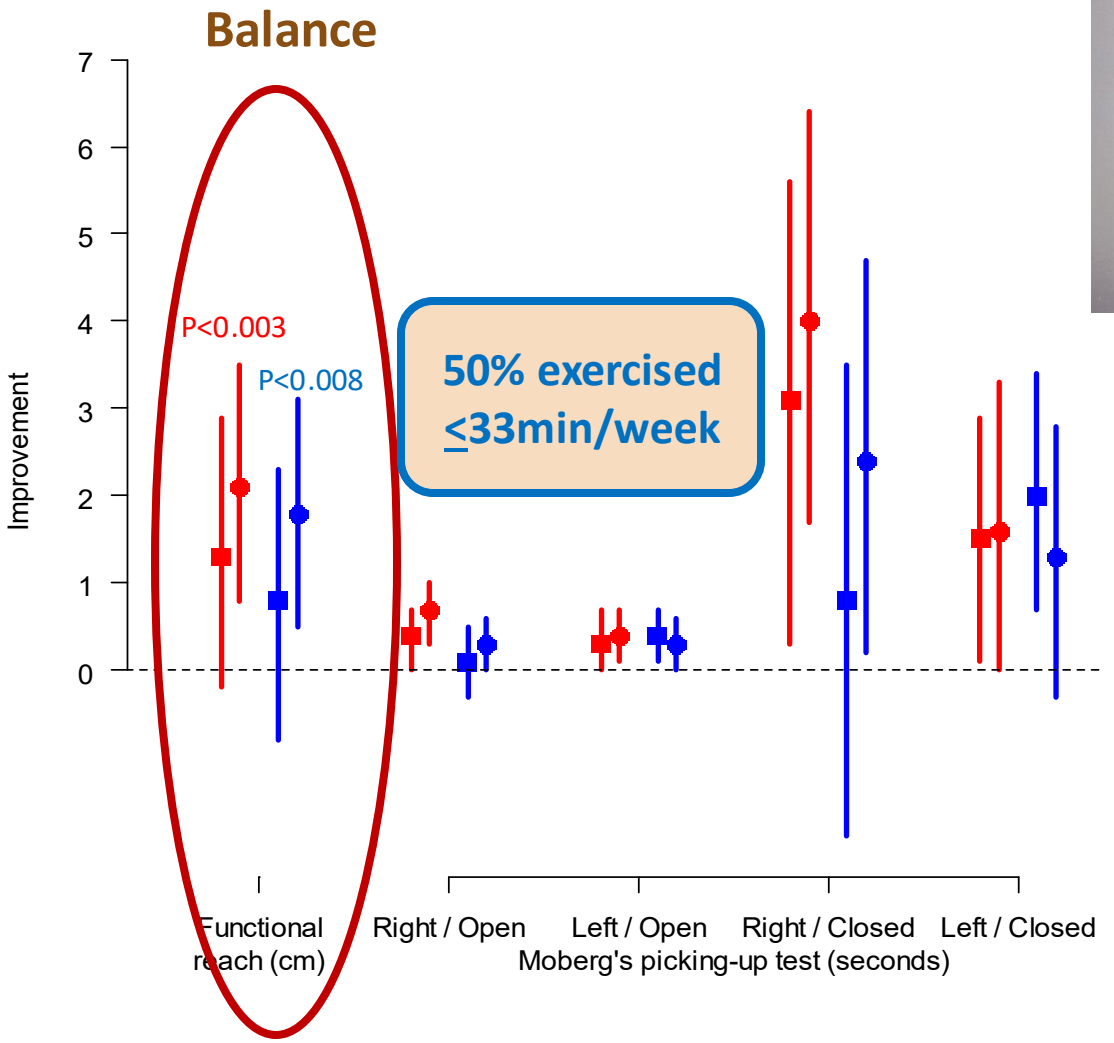
Självadministrerad: RENEXC – utfall CKD 3-5

Total adherence: 74%

Red= strength group
Blue=balance group

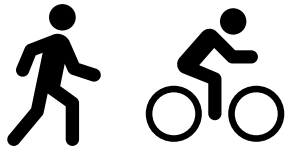
■ 4 months
● 12 months

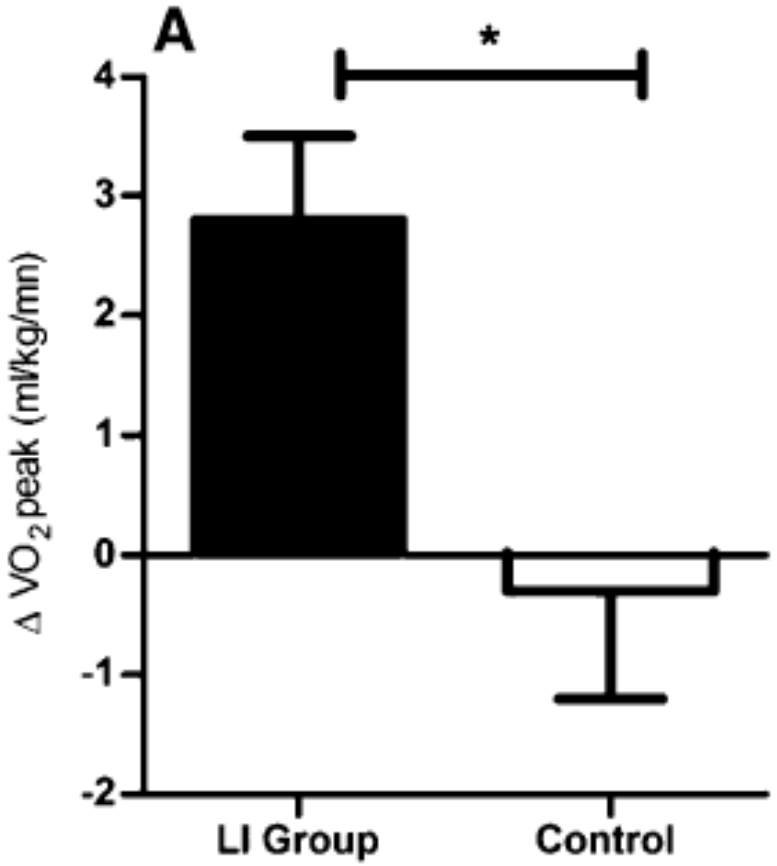
50% exercised ≤51min/week



Hellberg et al, Kidn Int Rep 4:963–976,2019

In-center 2 mån + självadministrerad : 10 mån utfall CKD 3-4





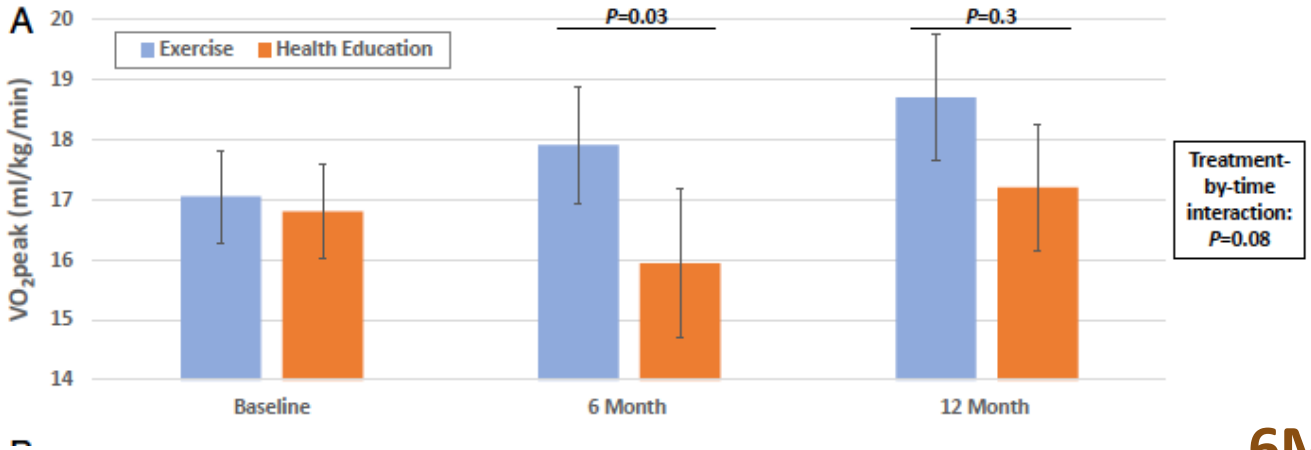
86% exercised

Howden, EJ et al, CJASN, 2013.

In-center träning

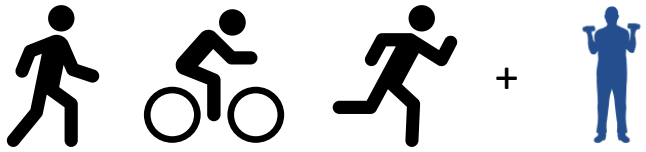
In-center: utfall CKD 3-4

VO_2max

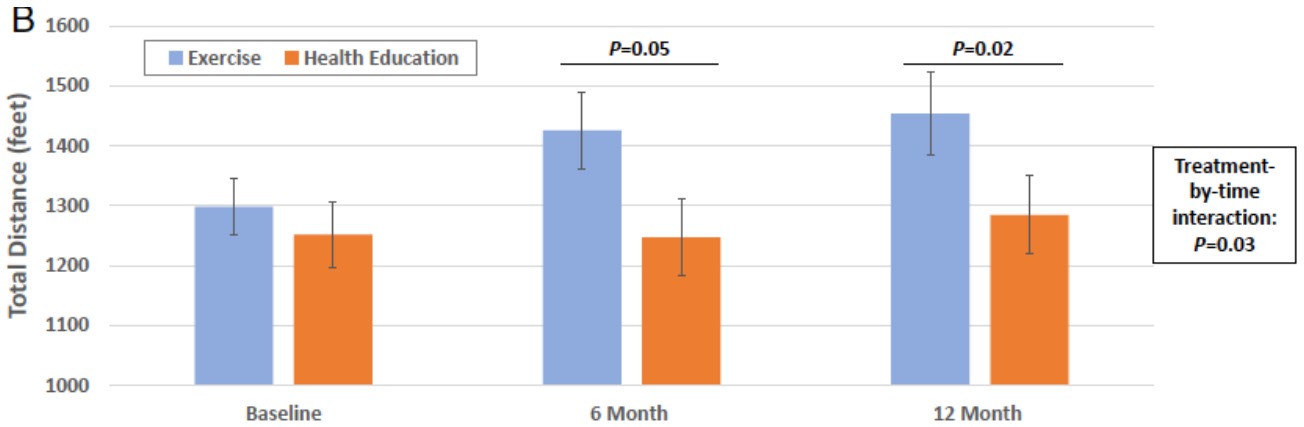


6 mo: 46% exercised >66% of all sessions

12 mo: 30% exercised >66% of all sessions



6MWT



Weiner, DE et al. AJKD 81(1):59-66,2022

Träning vid dialys

Träningsstudier - dialysis

	Study design	Type of training	Study duration, mo	Training locality	Prescribed duration (min) /week
Anding Rost et al, 2022 DiaTT	RCT, cluster design/center	1) Aer +res 2) Control	12	During HD	180 min/week
Greenwood, S et al, 2021 PEDAL	RCT	1) Aer + res 2) Control	6	During HD	90 min aer + res/week
Graham-Brown et al, 2021 CYCLE	RCT, cluster design/skift	1) Aer 2) Control	6	During HD	90 min/ week
Manfredini et al, 2017 EXCITE	RCT HD and PD	1) Aer 2) Control	6	At home	60 min/week

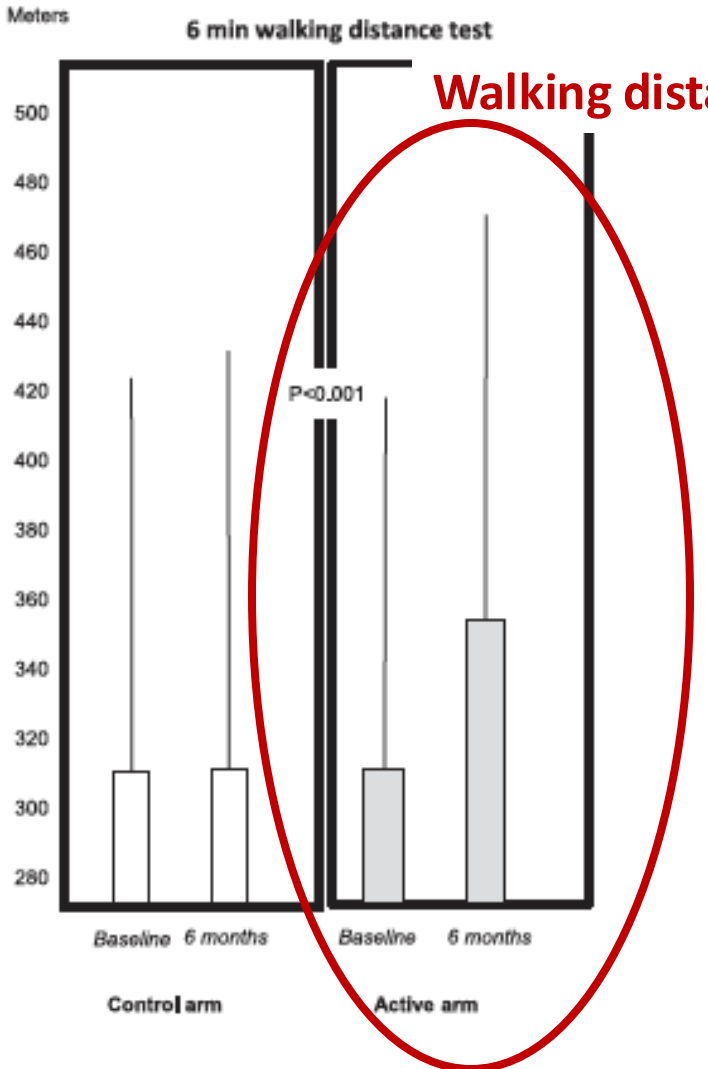
Träningsstudier- dialysis

	No screened (n)	No randomized(n) (%)	No completed (n)	No of sessions completed (%) or median (IQR)	Total adherence (%)
Anding Rost et al, 2022 DiaTT	2118	1083 (51%)	937	88%	72%
Greenwood, S et al, 2021 PEDAL	2409	335 (14%)	243	47 (28-77)	42%
Graham-Brown et al, 2021 CYCLE	406	130 (32%)	101	-	61
Manfredini et al, 2017 EXCITE	714	296 (41%)	227	83%	77%

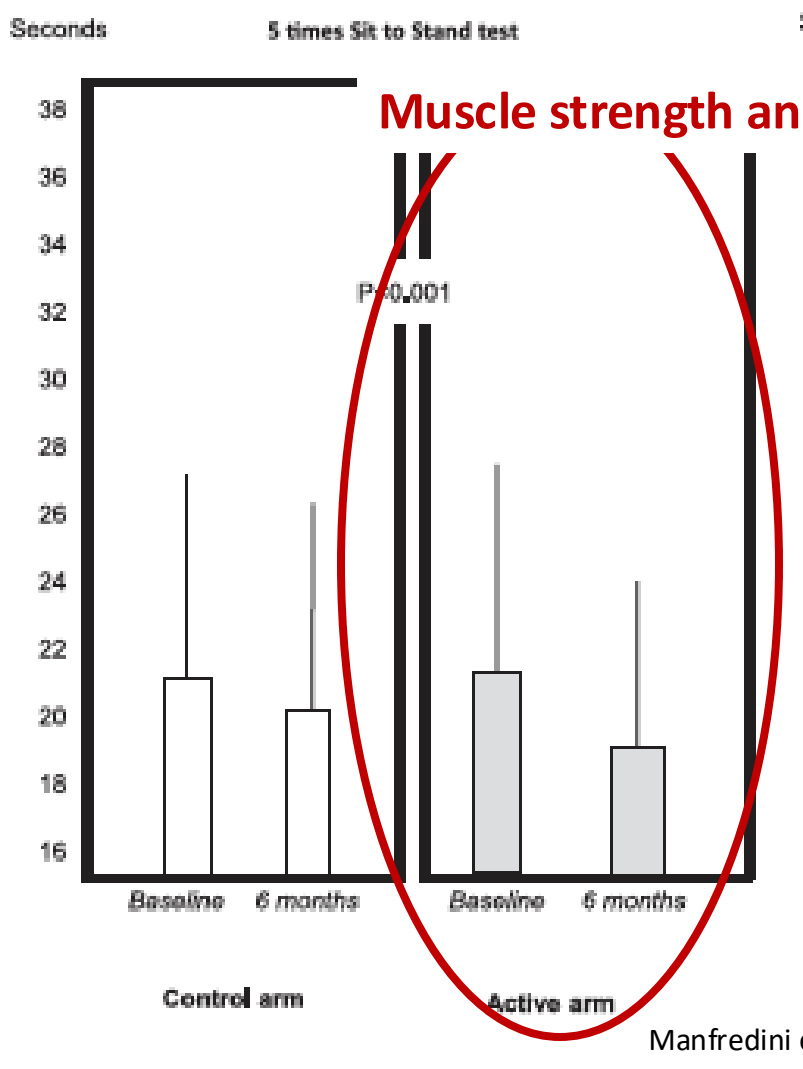
Självadministrerad träning

Självadministrerad: EXCITE studien utfall

Total adherence: 77%



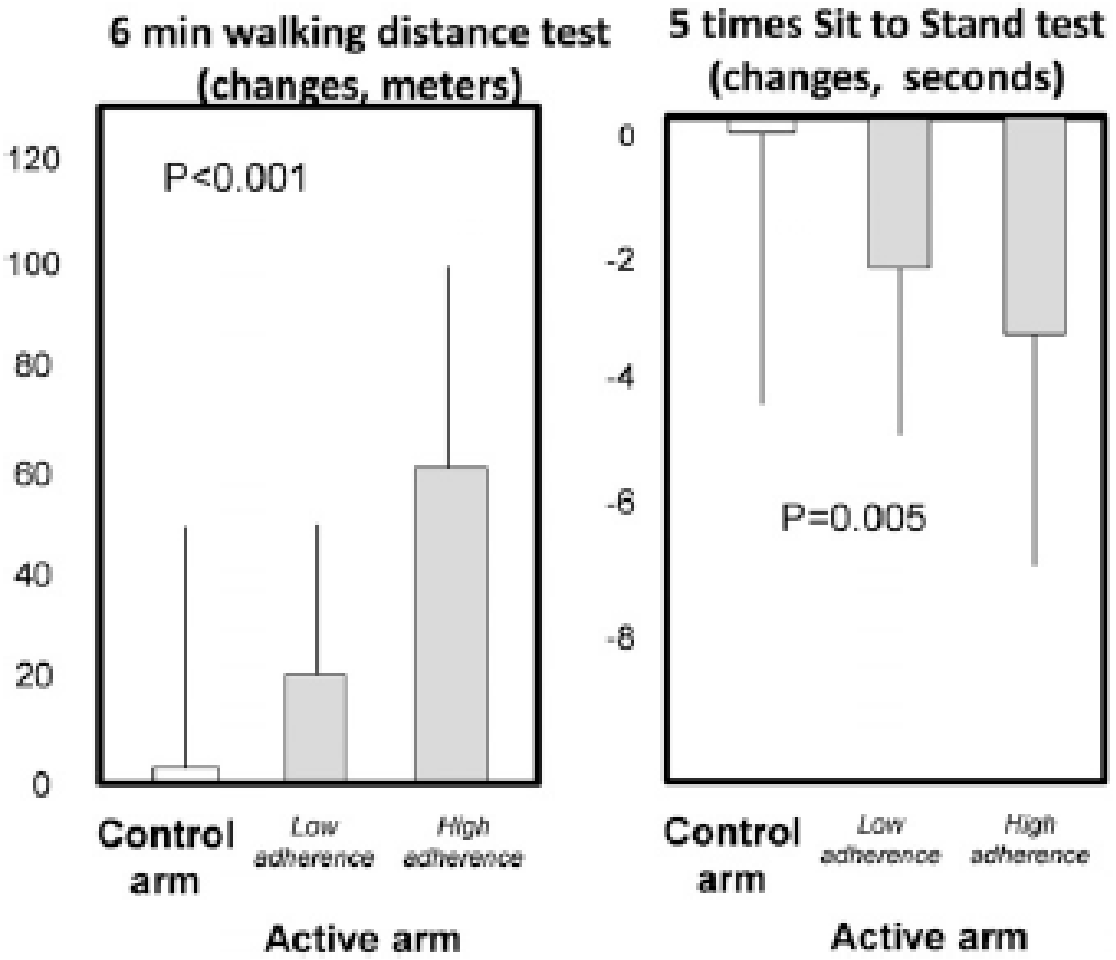
Walking distance



Muscle strength and endurance

Manfredini et al, JASN 28, 2016

Självadministrerad: EXCITE studien – dos - respons

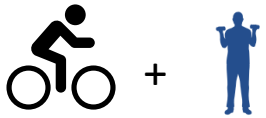


High participation (≥60%) – higher effect
Low participation(<60%) – lower effect

Manfredini et al, JASN 28, 2016

Intradialytisk träning

Intradialytisk: PEDAL studien utfall



	6 months
KDOQL-SF36 physical component score	0.06
$V0_{2max}$	NS
Gait speed	NS
Sit-to-Stand	NS

Total adherence: 42%
Adherence to prescribed exercise type, intensity and duration:18%

Greenwood S, et al. Kidn Int Rep 6:2159-2170, 2021.

Intradialytisk: CYCLE HD studien utfall

	Control group	Exercise group	Between group difference
ISWT	NS	NS	0.08
ESWT	0.06	NS	0.06
SPPB	0.06	0.07	0.08
Step count per day	NS	NS	NS

Total adherence: 61%

ISWT=Incremental Shuttle Walk Test; ESWT=Endurance Shuttle Walk Test;
SPPB=Short Physical Performance Battery

Graham-Brown, M et al. Kidn Int 99:1478-1486,2021

Intradialytisk: DiaTT – utfall

Total adherence: 72%

	Control		Training		95% CI	Between group difference
	Baseline	12 mo	Baseline	12 mo		
STS60	16.2±7.1	14.7±7.9	16.2±7,6	19.2±9.1	3.85 (2.22 – 5.48)	0.0001
6MWT	283±156	288±159	293±146	337±173	37.5 (14.69 – 60.38)	

Anding Rost, K, von Gersdorff, G et al, NEJM Evidence, 2023

Sammandrag av redovisade CKD 3-5 studierna

	Howden et al 12 months	Weiner et al 12 months	Hellberg et al, RENEXC, 12 months
Frequency/week	3	3	5
Intensity	RPE 11-13	HR target 70-80% (endurance)	RPE 13-15(endurance) RPE 13-17 (res/balance)
Duration/week, prescribed, min	150 90 endurance 60 min res	140 120 endurance 20 res	60 endurance 90 res/bal
Type of Exercise			
Total adherence, %	86%	6 mo: 60% 12 mo: 49%	74%
Outcome, physical function			

Sammandrag av redovisade dialys studierna

	EXCITE, 6 months	PEDAL, 6 months	CYCLE HD, 6 months	DiatTT, 12 months
Frequency/week	3	3	3	3
Intensity	According to 6MWD at baseline	40-75% of $V0_{2max}$	RPE 12-14	Target HR(endurance) RPE 12-13(res)
Duration/week, prescribed, min	30	90 (endurance) + resistance	90	180 (30 aer, 30 res)
Type of Exercise				
Total adherence, %	83	42	61	72
Outcome, physical function		=	=	

Träningsstudie hos patienter med PD

Japan, frequency, intensity, time, type walking + resistance, n=47, RCT, 12 weeks

	Endurance training,	Strength training,
Time goal, min/week	90	3 times/week
Frequency of training, times/week	3	3
Intensity of training, RPE	11-13	70% of 1RPM

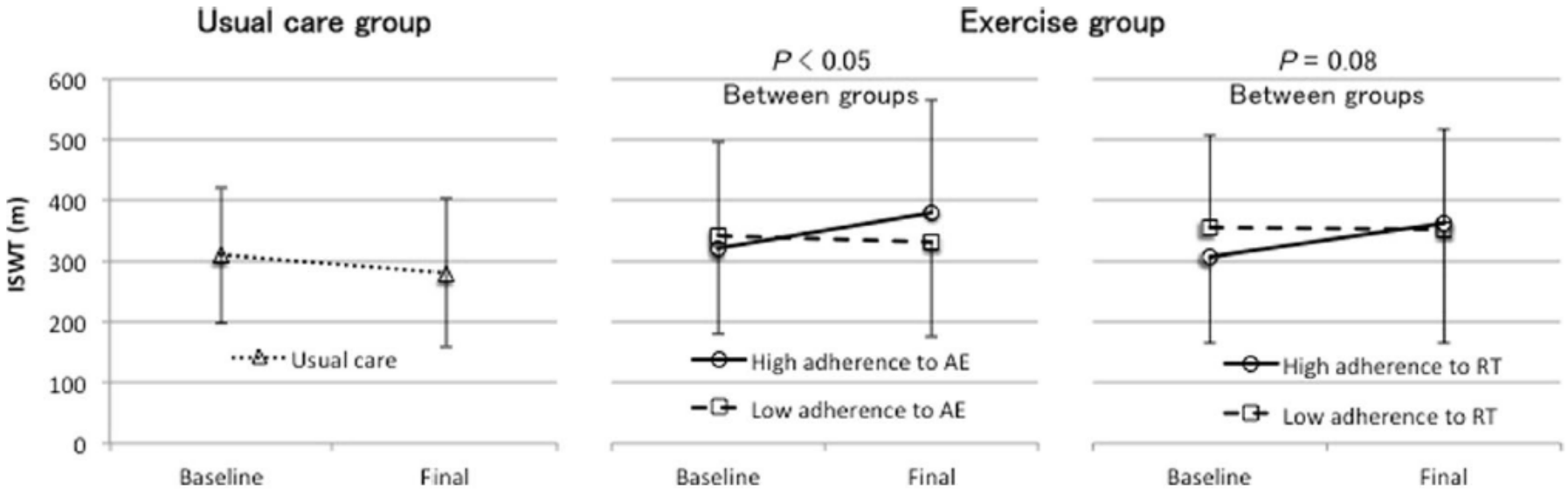
Hemma

Uchiyama, K et al. Scientific Reports, 9:2632, 2019.

Träningsstudie hos patienter med PD

Japan, 12 weeks – dose – response, intention to treat analysis

Incremental shuttle walk test



Aerobic exercise

Resistance exercise

Uchiyama, K et al. Scientific Reports, 9:2632, 2019.

PD feasibility study,
n=36, RCT

- Endurance exercise 3-5 d/week
- Resistance training 1-2days/week
- 12 weeks
- Exercise physiologist visit 1/month + 4 telephone calls

Bennett, PN et al. Kidn Med 2(3):267-275, 2020

PD feasibility study,

USA – frequency, intensity, time, type: endurance + strength, n=36 –RCT – 12 weeks

Hemma

	Endurance training,	**Strength training,**
Time goal, min/week	300	2 times/week
Frequency of training,	30-60 min x 3-5 times/week	1-2 times/week
Intensity of training,	moderate	moderate

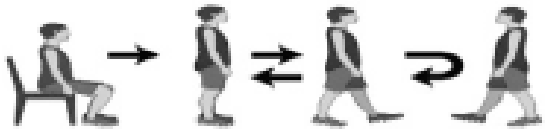
Bennett, PN et al. Kidn Med 2(3):267-275, 2020

PD feasibility study

USA – frequency, intensity, time, type: endurance + strength, n=36 –RCT – 12 weeks

Timed-Up-And-Go test: significant improvement in exercise group

Chair and
object at 8 ft



Bennett, PN et al. Kidn Med 2(3):267-275, 2020

Sammandrag av redovisade PD studier

	PD ex study, Japan, 3 months	PD feasibility, USA, 3 months
Frequency/week	3	3-5
Intensity	Moderate intensity	Moderate intensity
Duration/week, prescribed, min	150 (endurance) + resistance	150-300 (endurance) + resistance
Type of Exercise		
Adherence at end of study, %	 52  76	77
Outcome, physical function		

Globalt har 5‰ av alla med CKD NEB

Patienter på alla nivåer av CKD och NEB kan träna!

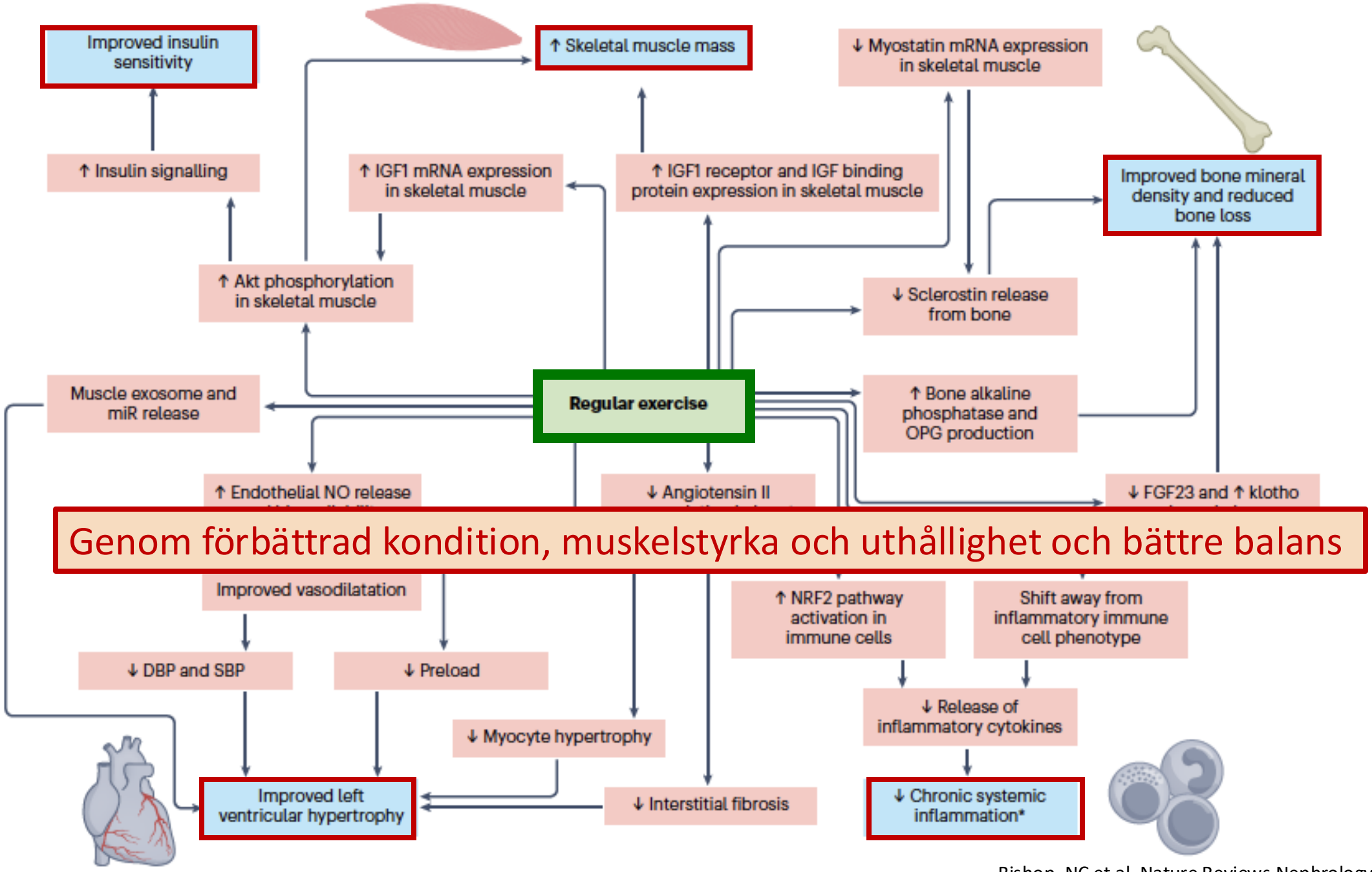
Det är dags att även majoriteten av alla med CKD får träning!

Patientrapporterade effekter

Hur känns det att vara njursjuk?

LUND UNIVERSITY

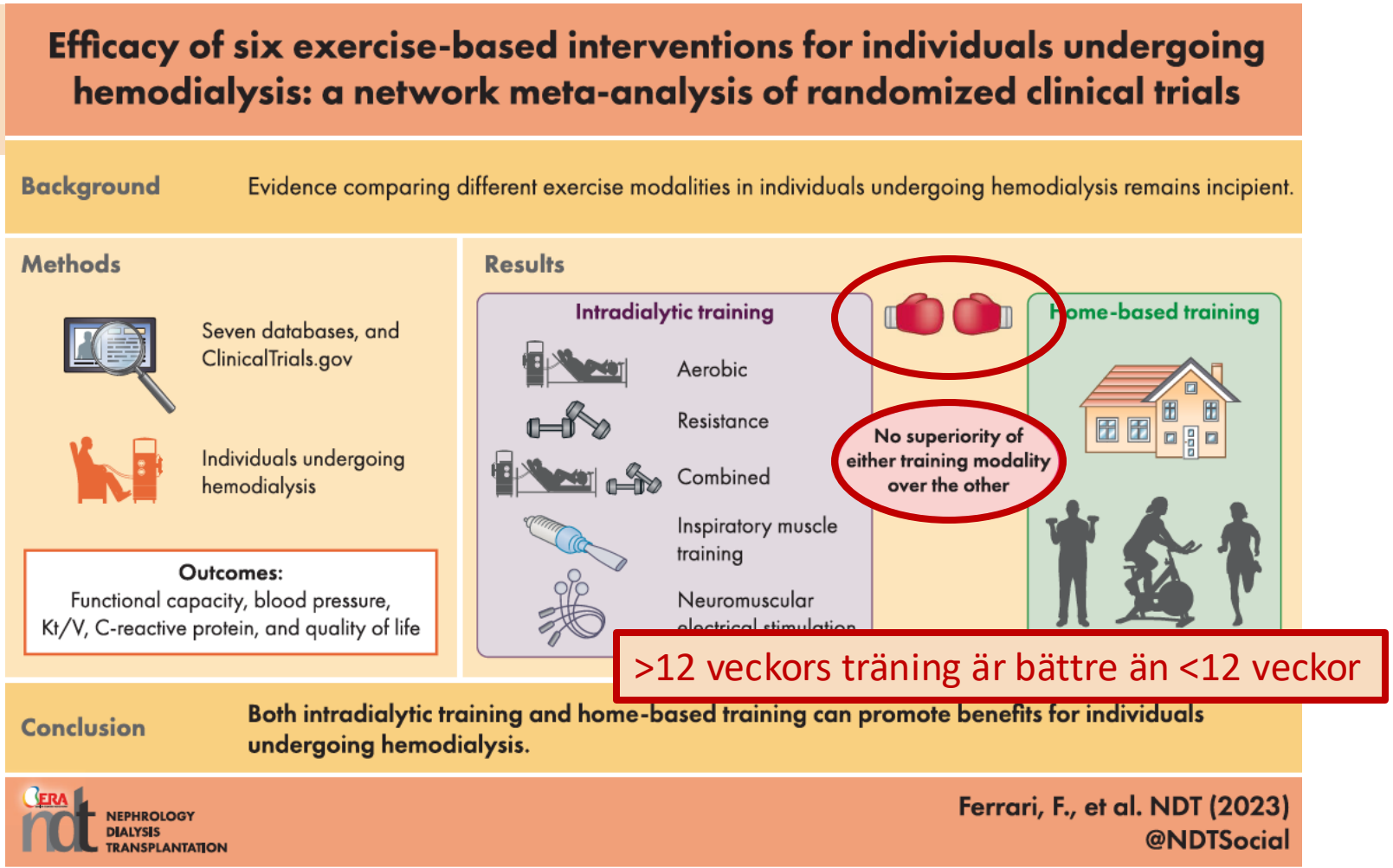
Sammanfattning



Bishop, NC et al. Nature Reviews Nephrology, 2023

Meta-analys av olika effekterna av olika träningsprogram för patienter i HD

78 RCT
3326 patienter



Meta-analysis: effektiviteten av träning hemma jfrt med kontroller på 6-MWT

Duration: 3-6 months

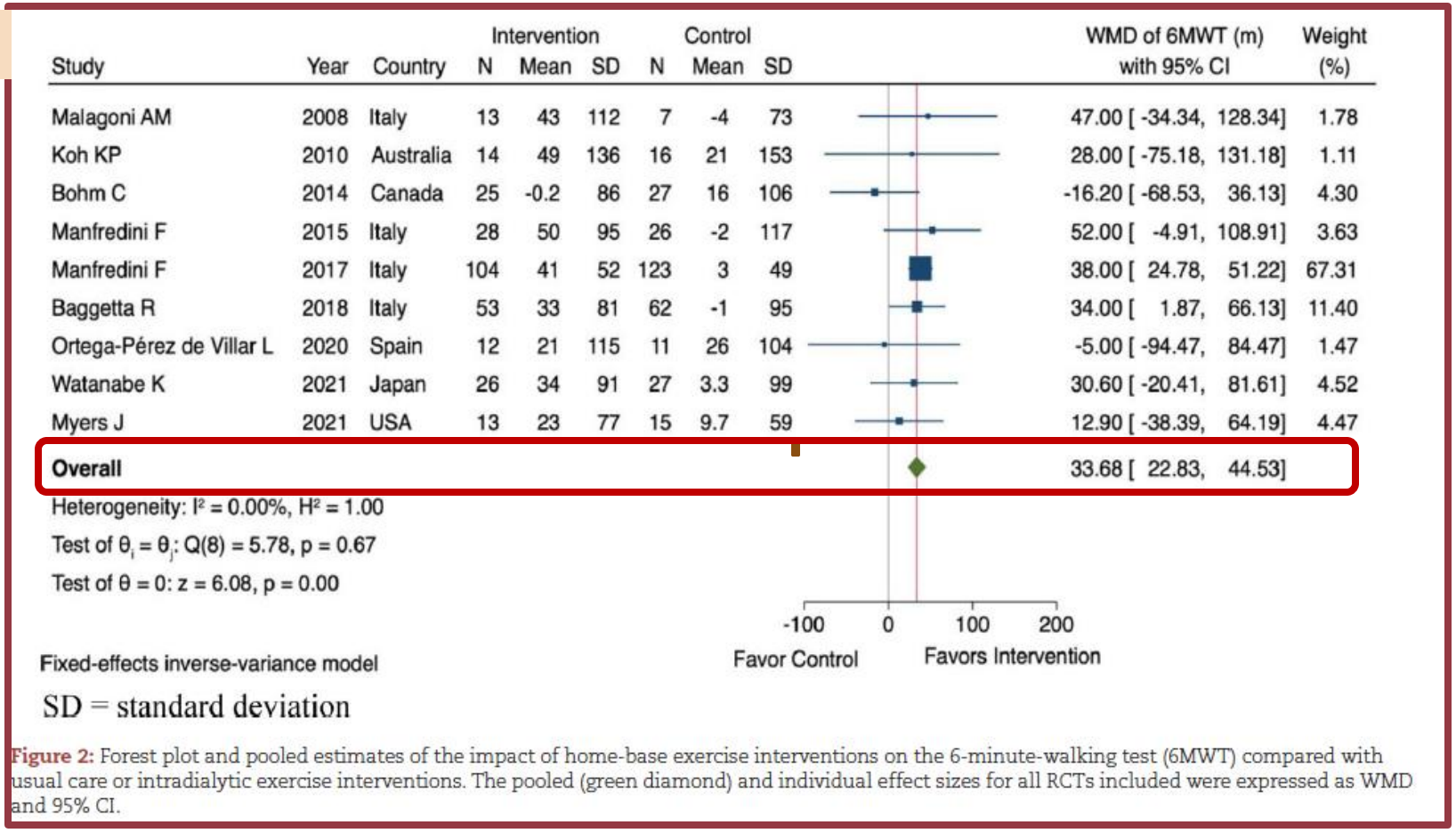
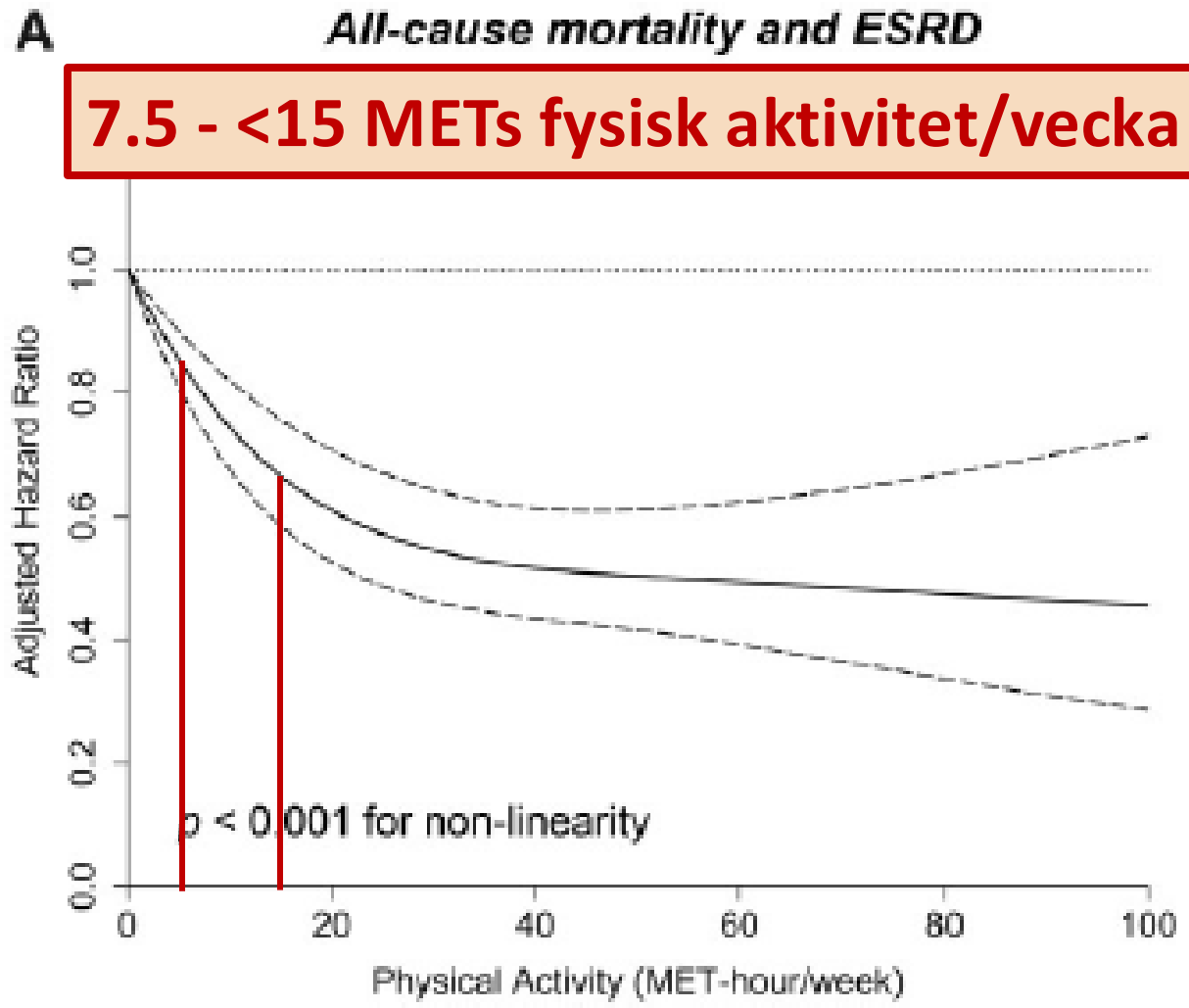


Figure 2: Forest plot and pooled estimates of the impact of home-base exercise interventions on the 6-minute-walking test (6MWT) compared with usual care or intradialytic exercise interventions. The pooled (green diamond) and individual effect sizes for all RCTs included were expressed as WMD and 95% CI.

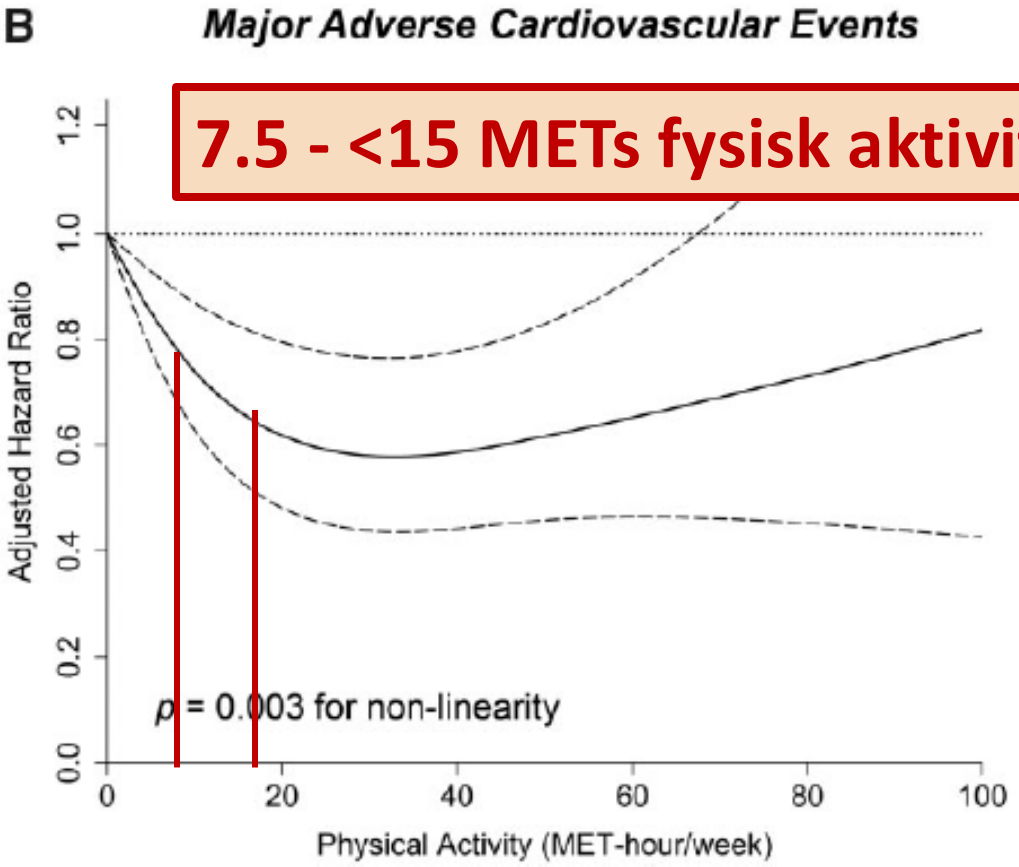
Battaglia, Y et al, NDT , 2023,38:2550-2561.

Association mellan fysisk aktivitet och dödlighet och behov av NEB



Kuo, CP et al. Eur Journ of Prev Card, 2022, 29:452-461.

Association mellan fysisk aktivitet och MACE



7.5 - <15 METs fysisk aktivitet/vecka = lägre risk

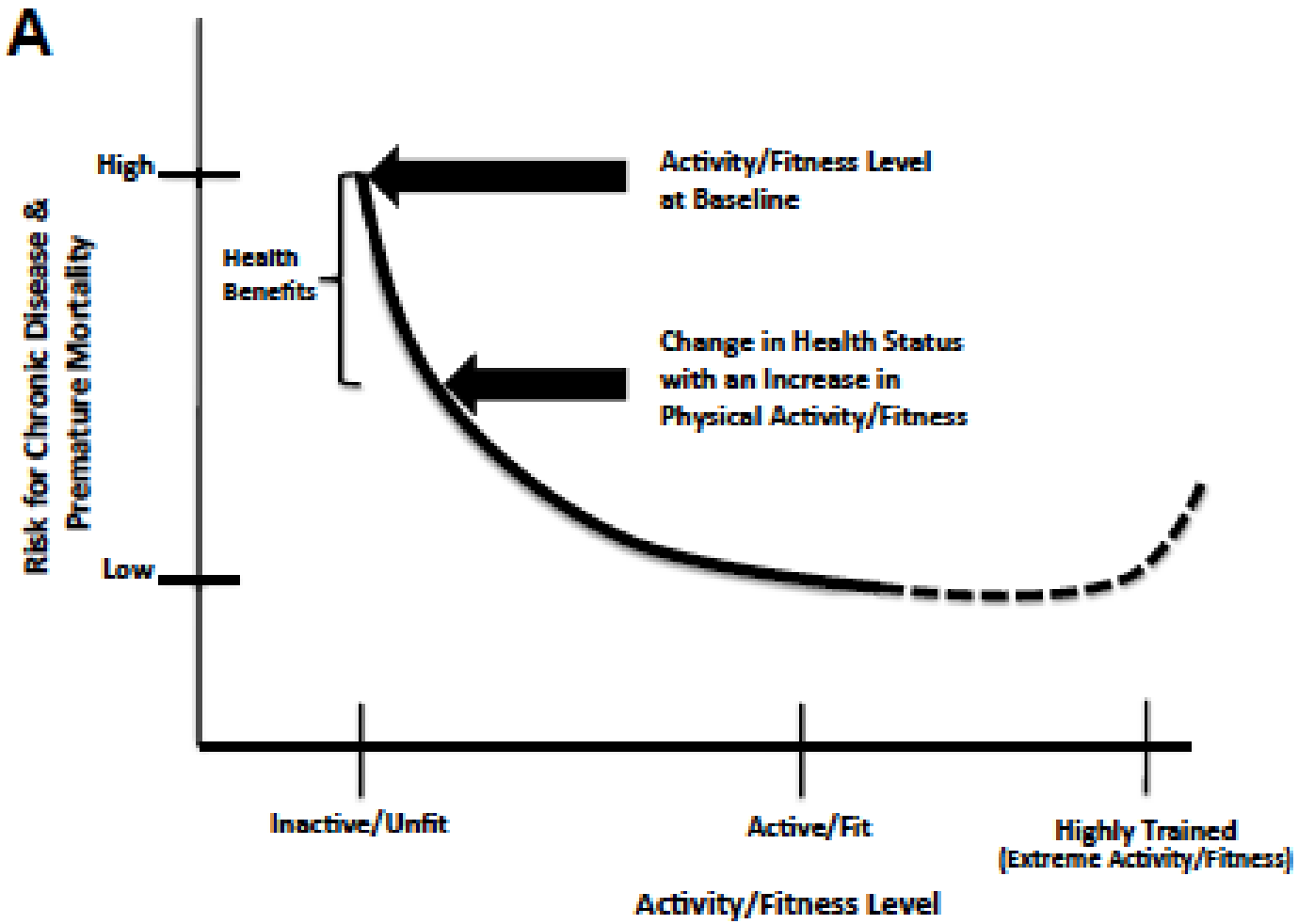
adjusted hazards
95% CI

N= 4508

Multivariate adjusted hazard ratios after adjusting for 25 clinical and laboratory covariates.

Kuo, CP et al. Eur Journ of Prev Card, 2022, 29:452-461.

Teoretisk dos-respons relation mellan fysisk aktivitet /fitness och hälsa/prematur dödlighet



Warburton, D & Bredin, S. Canadian J of Card 32:495-504, 2016

Mmh, jag har inte hittat den träningsrekommendationen än!

Tack!