Physical Activity as a health behaviour in the context of CKD and current local (UK), national and global guidelines and efforts

Pelagia Koufaki (PhD)
School of Health Sciences
Queen Margaret University
Pkoufaki@qmu.ac.uk

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Physical Activity (PA) as a Health Behaviour

Why?

How much?

How often?

What type?

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Why do we need to be physically active?

- Humans are genetically designed to be physically active
- Deviations from our normal genetic behaviour promote physical and psychological disorders

Diabetes **Cancer**
Cardiovascular disease
Obesity **depression**
osteoporosis independent living
quality of life

Defining PA and related terms

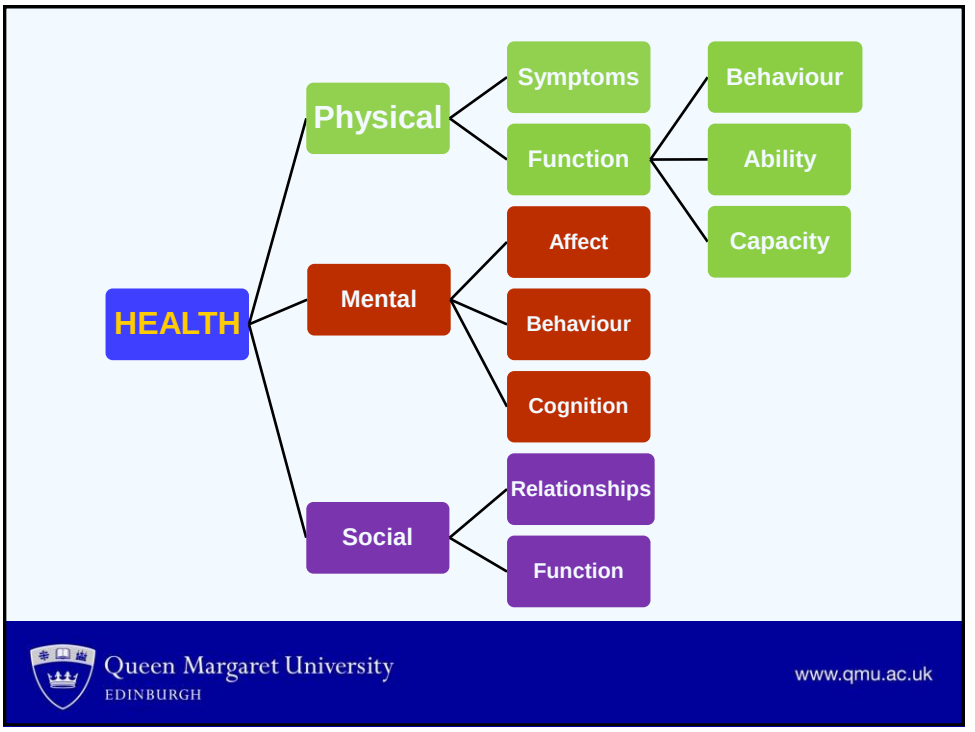
1. What is your personal definition of PA?
2. What is your personal definition of exercise
3. What is your personal definition of sedentary behaviour
4. What is your personal definition of health?
5. What is your personal definition of physical fitness?

Defining PA and related terms

- **Physical activity** – any bodily movement that is produced by the contraction of skeletal muscles and results into energy expenditure above the resting metabolic rate
- **Exercise** – planned, structured, and repetitive bodily movement done to improve or maintain one or more components of physical fitness such as endurance, flexibility, and strength

Defining PA and related terms

- **Health**- Good health is characterised by a state of physical, social and psychological well being and not just the absence of disease
- **Physical fitness** – the ability to carry out daily tasks with vigour and alertness without undue fatigue and with plenty of energy to enjoy leisure time pursuits and to respond to emergencies


HEALTH
Physical
Symptoms
Function
Behaviour
Ability
Capacity
Mental
Affect
Behaviour
Cognition
Social
Relationships
Function
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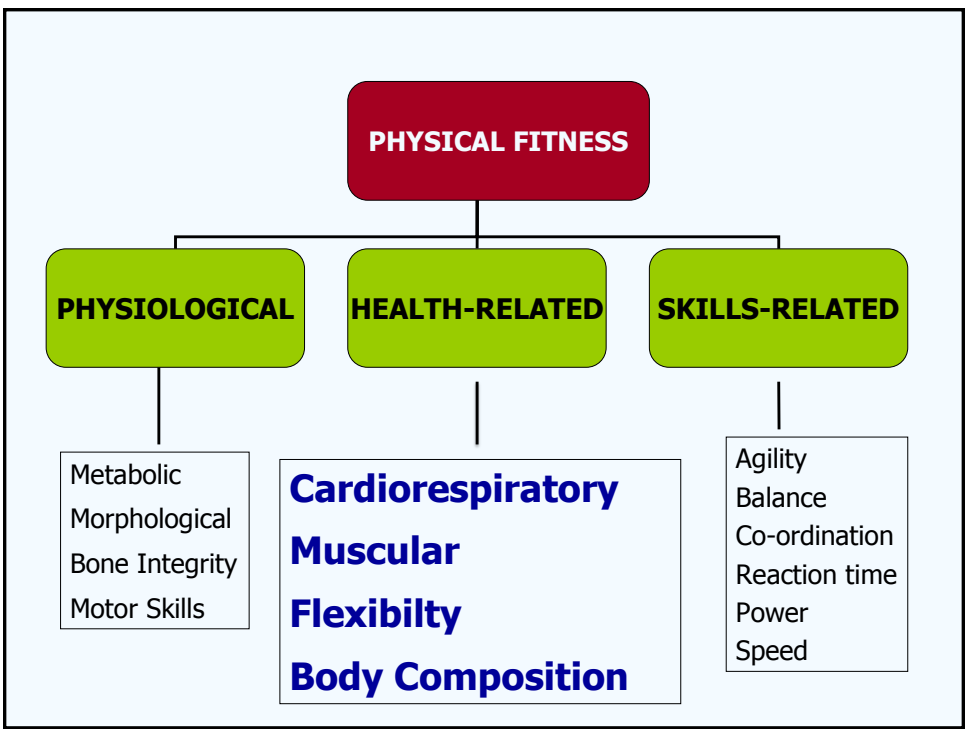
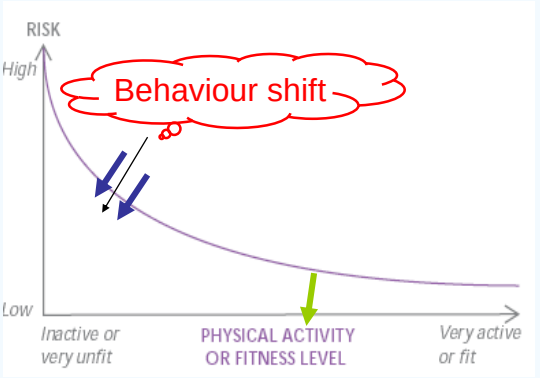

PHYSICAL FITNESS
PHYSIOLOGICAL
HEALTH-RELATED
SKILLS-RELATED
Metabolic
Morphological
Bone Integrity
Motor Skills
Cardiorespiratory
Muscular
Flexibilty
Body Composition
Agility
Balance
Co-ordination
Reaction time
Power
Speed

Defining PA and related terms

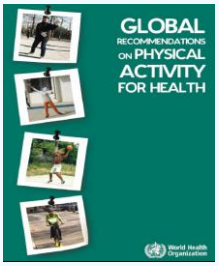
- **Sedentary Behaviour**- Any waking behaviour characterised by energy expenditure <1.5 metabolic equivalents (METs). i.e. sitting, driving, reading
- **Physical Inactivity-** An absence or insufficient level of physical activity required to meet the current physical activity recommendations.

WHY Physical Activity?

Relationship between PA/ fitness and risk of disease



Is there a min amount of PA below which we do not gain health benefits?



WHY Physical Activity?

Global and UK guidelines

MISSION

Ensure that all people have access to safe and enabling environments and to diverse opportunities to be physically active in their daily lives

- Reduce insufficient levels of PA by 15% by 2030
- Reduce sedentary behaviour through promotion of incidental PA

Physical activity for health
More active people for a healthier world:
draft global action plan on physical activity 2018–2030

UK PA guidelines-2010
(https://www.gov.uk/government/publications/uk-physical-activity-guidelines)

The ABC of Physical Activity for Health: A consensus statement from The British Association of Sport and Exercise Sciences
Journal of Sports Sciences, April 2010; 28(6): 573–591

The BASES expert statement On exercise therapy for people with Chronic Kidney Disease-2015
(Journal of Sports Sciences, 33:18, 1902-1907)

Current MIN criteria for PA for health

Total volume:	>1000 kcal/week or	2000-4000 kcal/week
	>580 MET-min/week or	
Duration/ intensity	150 min at moderate intensity/week	In bouts ≥10min
	75 min at vigorous intensity/week	In bouts ≥10min
Frequency	>4 days/week (aerobic) >2 days (muscle strength)	
Type	An type for aerobic, muscle strengthening, flexibility, mobility	
Steps	>10000 /day (healthy) >7500 /day (disability and chronic illness	
Sedentary behaviour	<5000 steps/day	With frequent breaks

Physical Activity as a Health Behaviour in CKD

Why?

How much?

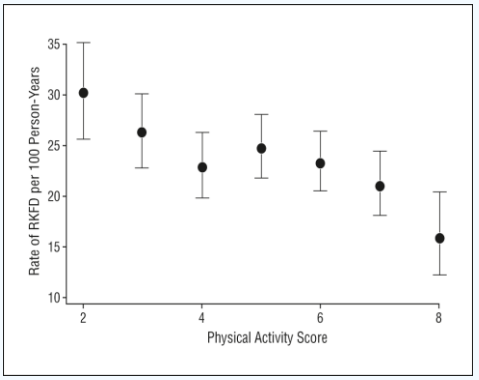
How often?

What type?

CKD specific Clinical Practice Guidelines

- K/DOQI Clinical Practice Guidelines for Cardiovascular Disease in Dialysis Patients http://www.ajkd.org/article/S0272-6386(05)00092-2/fulltext#Regular physical activity
- NICE guidelines for Chronic kidney disease: early identification and management of chronic kidney disease in adults in primary and secondary care (http://www.nice.org.uk/guidance/cg182/chapter/1-Recommendations)
- Clinical Practice Guideline on management of patients with diabetes and chronic kidney disease stage 3b or higher(http://www.european-renal-best-practice.org/content/erbp-official-documents)

Greater PA level is associated with lower risk of rapid kidney function decline



Robinson-Cohen *et al.*(2009). Arch Intern Med: 2116-2123

- Spending >2000 kcal/week in leisure time activities significantly reduced risk of RKFD by 25%
- Walking at a pace >3m/h (or 1.3 m/s) significantly reduced risk of RKFD by 18-26%
- People in the highest PA group and CKD-2 experienced the lowest RKFD (37% reduction in risk)

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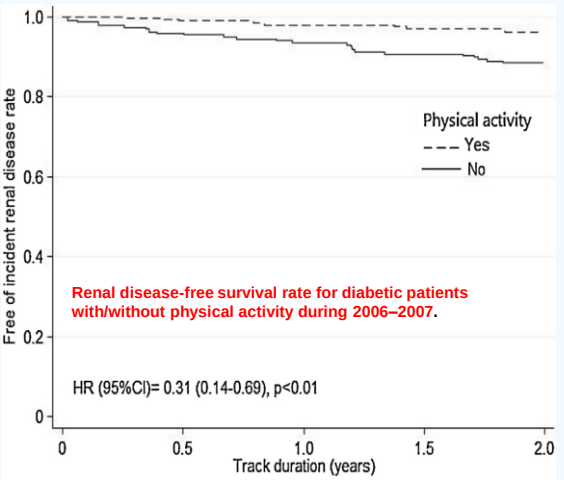
PA can delay the onset of diabetic CKD

- Physically active diabetic patients had ~67% reduced risk of developing CKD over a period of 2 years
- This protective effect remained even when adjusting for multiple factors (hypertension, CCI, age, sex, education, smoking, drinking, BMI, marital status, diet)



Renal disease-free survival rate for diabetic patients with/without physical activity during 2006–2007.

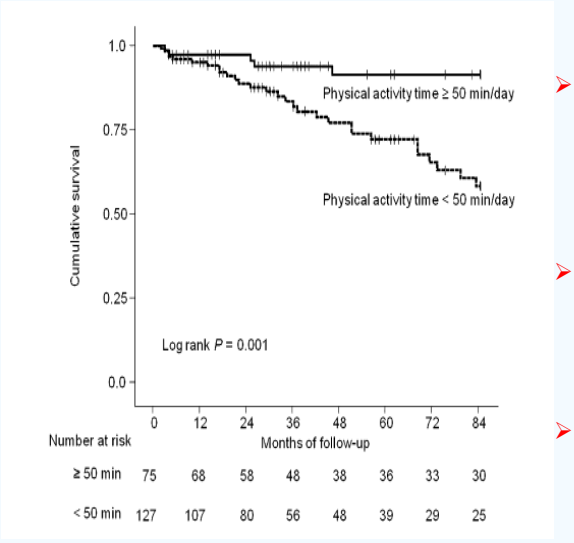
Lin H-C *et al*. (2014). Prim Care Diab: 315-321

PA (patient reported) is associated with better morbidity/mortality indices

Walking frequency	mortality SHR (95%CI)	RRT SHR (95%CI)
Overall compared to walking of 0 ref (1)	**0.67** (0.53 0.84)	**0.79** (0.73-0.85)
1-2/week	**0.83** (0.79-0.89)	**0.81** (0.68-0.98)
3-4/week	**0.72** (0.67-0.82)	**0.73** (0.63-0.84)
5-6/week	**0.42** (0.30-0.57)	**0.57** (0.51-0.63)
>7/week	**0.41** (0.27-0.62)	**0.56** (0.42-0.67)

Chen *et.al.* (2014), Clin J Am Soc Nephrol;1183-1189

Objectively measured PA & mortality



- People spending more than 50min/day in PA had 93.3% survival rate over 7 years vs 77.2% for people with less than that
- Higher levels of PA (increments of 10min/day) reduced all cause-mortality by 28% at 7 years
- PA beneficial effect remained even when controlling for age, HD vintage, sex, comorbidity score, albumin, c-creat

Matzuzawa R *et al.* (2012); Clin J Am Soc Nephrol, 7:2010

Sedentary behaviour and renal function The Maastricht study

Table 3. Associations of physical activity and sedentary behavior variables with $eGFR_{crcys}$.

	Model 1 Beta (95%CI)	Model 2 Beta (95%CI)	Model 3 Beta (95%CI)	Model 4 Beta (95%CI)
Total physical activity (h/day)	**2.30 (1.46; 3.14)**	N/A	N/A	**1.55 (0.69; 2.40)**
Lower intensity physical activity (h/day)	**2.10 (1.08; 3.12)**	N/A	N/A	**1.49 (0.47; 2.50)**
Higher intensity physical activity (10 min/day)	**0.70 (0.39; 1.02)**	N/A	**0.53 (0.21; 0.85)**	0.31 (-0.02; 0.64)
Sedentary time (h/day)	**-0.88 (-1.23; -0.53)**	**-0.71 (-1.08; -0.35)**	N/A	**-0.47 (-0.84; -0.10)**
Sedentary breaks (10/day)	**0.93 (0.26; 1.61)**	**0.80 (0.12; 1.47)**	0.59 (-0.10; 1.27)	0.51 (-0.17; 1.19)
Prolonged sedentary bouts (#/day)	**-0.96 (-1.32; -0.61)**	**-0.82 (-1.19; -0.46)**	**-0.66 (-1.23; -0.09)**	**-0.57 (-1.14; -0.01)**
Average sedentary bout duration (min)	**-0.41 (-0.57; -0.26)**	**-0.35 (-0.51; -0.20)**	**-0.27 (-0.45-0.08)**	**-0.23 (-0.41; -0.04)**

more daily prolonged sedentary bouts and longer sedentary bout duration were associated with a lower eGFRcr-cys

(Martens *et al*. (2018), PLOS ONE 1-18)

PA & mortality- DOPPS

Table 3. Minimally and extensively adjusted hazard ratios for all-cause mortality by level of aerobic physical activity: Results of Cox regression analyses

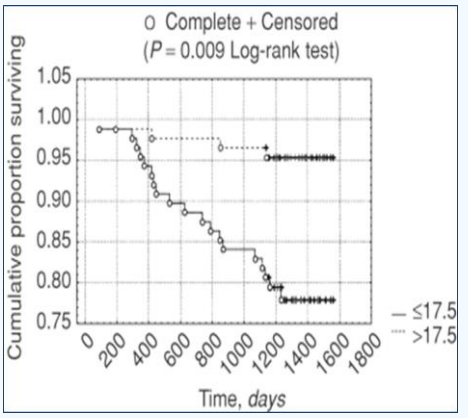
Aerobic Activity Level	Number of Deaths/Total	Hazard Ratio (95% CI)	
		Minimally Adjusted	Extensively Adjusted
Never/rarely active	427/1649	1 (reference)	1 (reference)
Infrequently active	93/599	0.92 (0.76 to 1.13)	0.89 (0.72 to 1.10)
Sometimes active	143/969	0.87 (0.70 to 1.08)	0.84 (0.67 to 1.05)
Often active	191/1373	0.82 (0.69 to 0.98)	0.81 (0.68 to 0.96)
Very active	119/1173	0.61 (0.48 to 0.77)	0.60 (0.47 to 0.77)
Total	973/5763		
P for trend		<0.001	<0.001

The minimally adjusted models included geographic region, age, sex, race, smoking, employment status, education, living conditions, assistance with walking, number of years on dialysis, and muscle strength/flexibility. The extensively adjusted models included body mass index, comorbidities (diabetes, hypertension, coronary disease, heart failure, other cardiovascular disease, peripheral vascular disease, cerebrovascular disease, recurrent cellulitis, gastrointestinal bleed, lung disease, neurologic disorder, psychiatric disorders, nonskin cancer, and HIV), catheter use, blood hemoglobin, dialysis dose by Kt/V, systolic BP<120 mmHg, systolic BP>160 mmHg, serum creatinine, serum albumin, serum calcium, serum phosphorus, parathyroid hormone, and normalized protein catabolic rate. All models accounted for facility clustering effects. 95% CI, 95% confidence interval.

Lopez AA, *et al.* (2014); Am J Kidney Dis: 912-921

Cardiorespiratory fitness & survival

Survival as function of baseline VO_{2peak} for 175 ambulatory CKD5 patients



Dialysis patients with VO_2 peak >17.5 $ml.^{-1}kg.^{-1}min.$ had significantly better survival over 3.5 years compared to those with lower exercise capacity

Sietsema *et al.* (2004) Kidney Int :719-724

PA & QoL- DOPPS

Table 2. Differences in health-related quality of life and depression symptoms scores (both as continuous and dichotomous variables) by aerobic physical activity level

Outcome	Physical Activity Levels									
	Minimally Adjusted Mean Difference (95% CI)					Extensively Adjusted Mean Difference (95% CI)				
	Never/ Rarely	Infrequently	Sometimes	Often	Very	Never/ Rarely	Infrequently	Sometimes	Often	Very
PCS score	Ref=0	1.59 (0.64 to 2.55)	3.66 (2.73 to 4.60)	4.05 (3.17 to 4.94)	7.18 (6.25 to 8.11)	Ref=0	1.60 (0.69 to 2.52)	3.55 (2.62 to 4.48)	3.82 (2.96 to 4.68)	6.67 (5.79 to 7.56)
MCS score	Ref=0	2.25 (1.17 to 3.33)	3.58 (2.66 to 4.50)	3.09 (2.22 to 3.95)	4.06 (3.10 to 5.02)	Ref=0	2.15 (1.09 to 3.22)	3.60 (2.69 to 4.51)	2.92 (2.07 to 3.78)	3.70 (2.76 to 4.65)
KDB score	Ref=0	0.92 (−1.47 to 3.32)	7.13 (5.04 to 9.22)	5.84 (3.89 to 7.79)	10.28 (8.15 to 12.42)	Ref=0	1.00 (−1.38 to 3.37)	7.05 (4.98 to 9.11)	5.65 (3.72 to 7.59)	9.87 (7.75 to 11.99)
CES-D score	Ref=0	−1.04 (−1.59 to −0.49)	−2.27 (−2.76 to −1.79)	−2.00 (−2.45 to −1.55)	−2.68 (−3.23 to −2.13)	Ref=0	−0.97 (−1.51 to −0.44)	−2.24 (−2.72 to −1.76)	−1.90 (−2.34 to −1.46)	−2.45 (−3.00 to −1.91)
CES-D ≥10	Ref=1	0.77 (0.63 to 0.95)	0.53 (0.44 to 0.63)	0.52 (0.44 to 0.61)	0.41 (0.34 to 0.50)	Ref=1	0.79 (0.64 to 0.97)	0.52 (0.43 to 0.62)	0.53 (0.45 to 0.62)	0.43 (0.35 to 0.52)

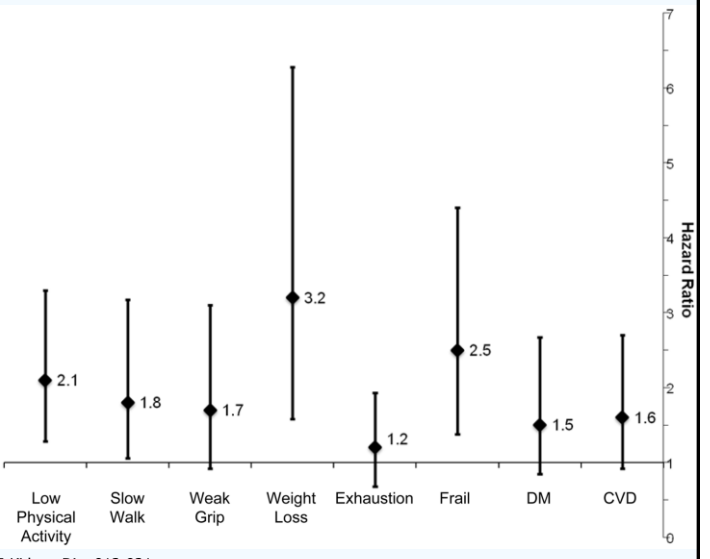
Never Active: 28.6%
Infrequently: 10.4%
Sometimes: 16.8%
Frequently: 23.8%
Very active: 20.4%

- Dose-response relationship with higher levels of PA associated with larger differences in PCS
- Higher PA associated with lower mean depressive symptoms
- Higher PA is associated with 50% reduction in odds of CES-D >10

Lopez AA, *et al.* (2014); Am J Kidney Dis: 912-921

Physical inactivity is the most prevalent component of the Fried's frailty index

Addressing physical inactivity per se will have the strongest impact on managing frailty in CKD



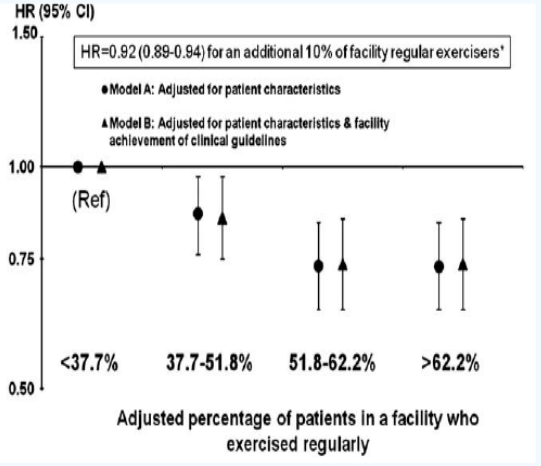
Roshanravan *et al.* (2012); Am J Kidney Dis: 912-921

Are PA/Exercise interventions effective enough to positively impact on health related outcomes?

Research Evidence

- Macdonald JH, *et al*. (2009), Adv Chronic Kidney Dis:482-500
- Segura-Orti E. (2010). *Nefrologia;* 236-24,
- Heiwe and Jacobson (2011), Cochrane Database Syst Rev.
- Smart N. & Steele M. (2011), *Nephrology (Carlton);*626-632.
- Koufaki P, *et a*l. (2013), Ann Rev Nurs Res; 235-275
- Cheema B, *et al. (*2014), Sports Med; 1125-1138
- Sheng K, *et al.* (2014), Am J Nephrol:478-90
- Heiwe S and Jacobson (2014), Am J Kidney Dis:383-93
- Koufaki et al. (2015), J Sports Sci:1902-1907
- Phan K, *et al.* (2016), Br J Sports Med:317-8
- Young H *et al. (*2018), Nephrol Dial Transplant;1–10

Practice-Based Evidence-DOPPS



Patients who regularly exercise >1 time/week have a 37% reduced risk of all cause mortality and 27% reduced risk of hospitalisation due to fractures compared to patients exercising <1/week

(Tentori *et al*. 2010, Nephrol Dial Transplant; 3050-3062)

In Summary.....

- Higher levels of PA are strongly associated with better outcomes of kidney function, mortality, dialysis initiation, physical function, mental health
- Sedentary behaviour indices are also predictors of poorer kidney function outcomes
- Targeting physical inactivity as a health behaviour will have the strongest impact on all dimensions of the physical function component of Health

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