Supplementary Material

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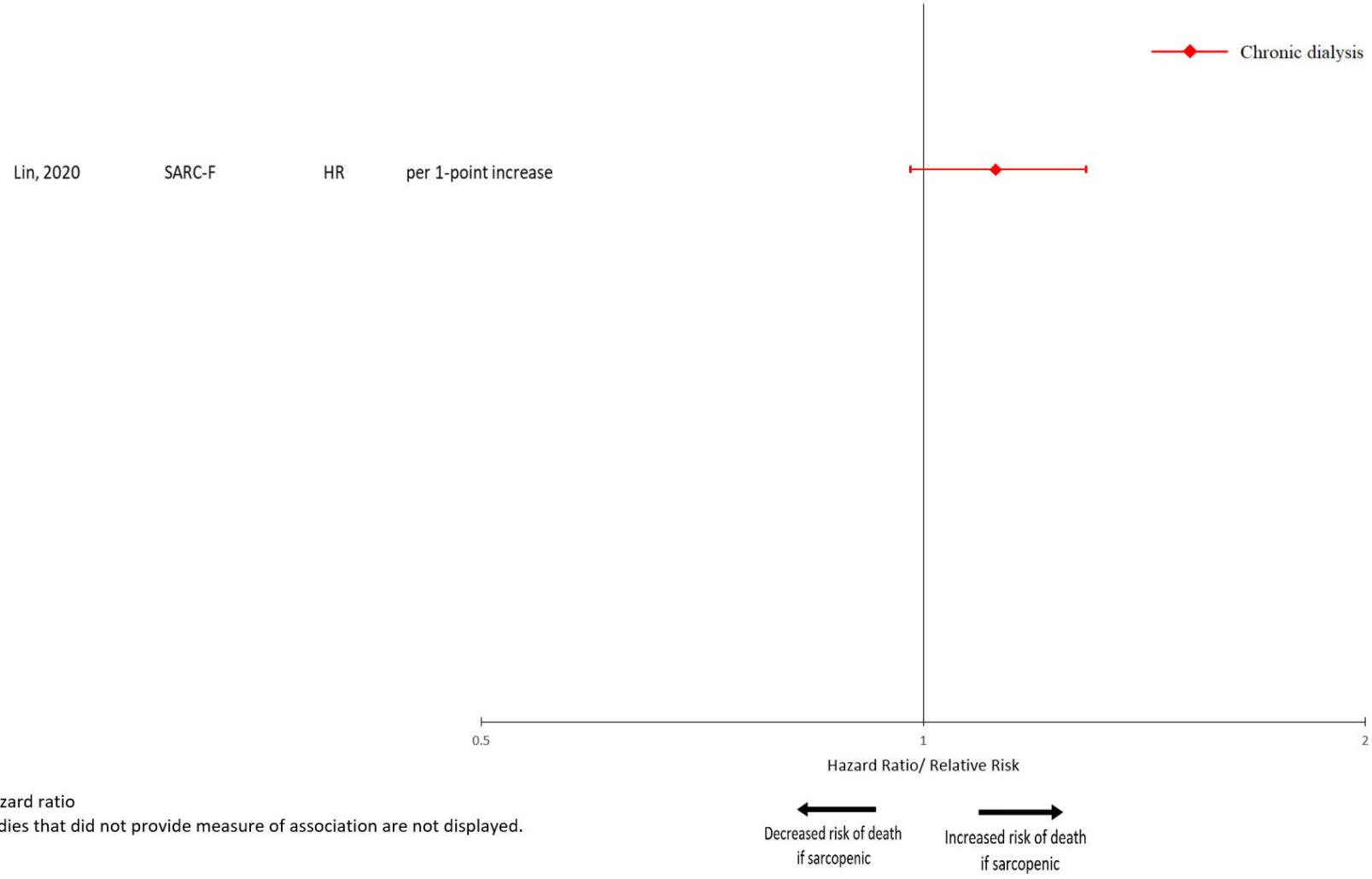
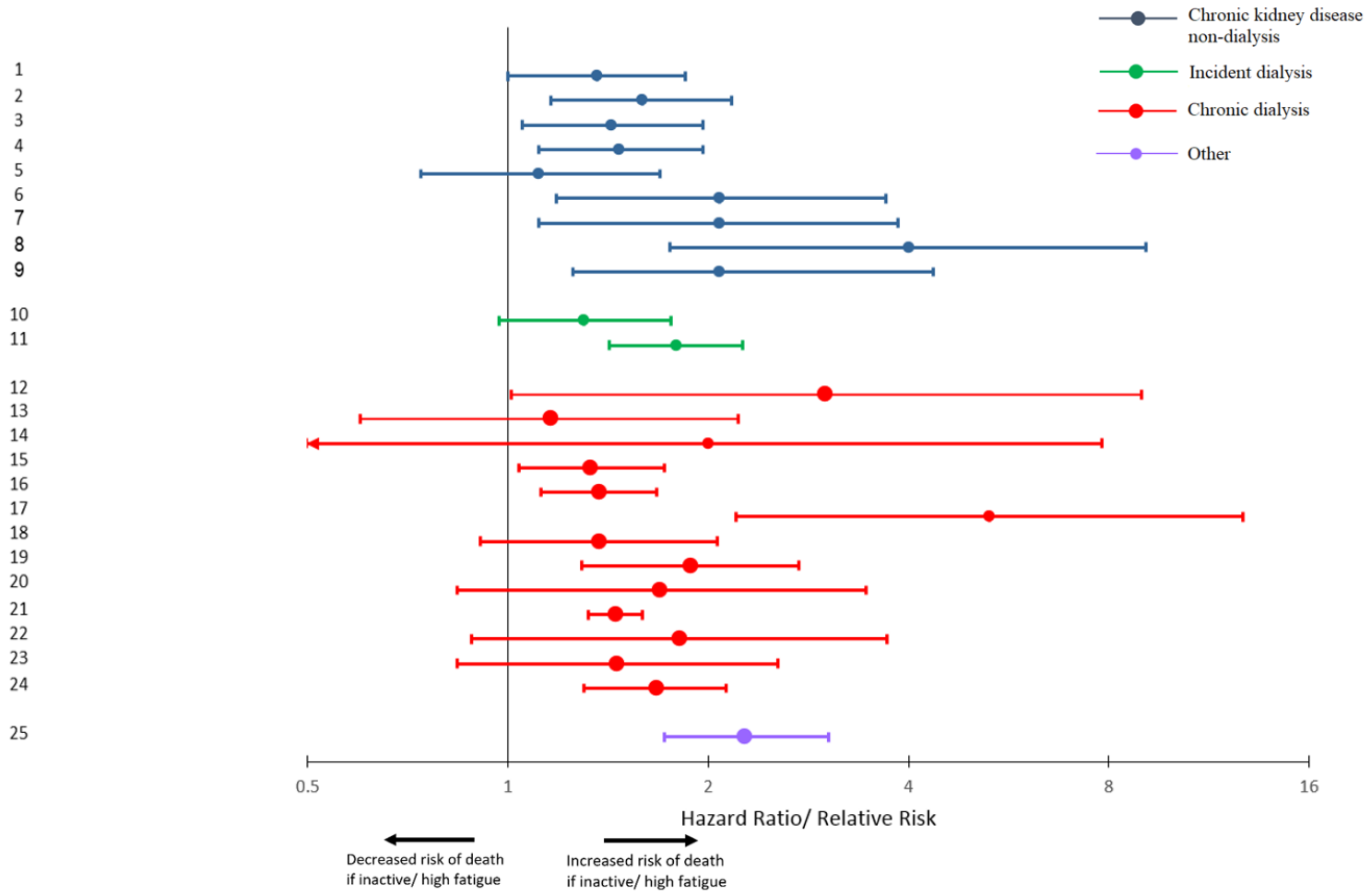
Figure S1. Forest plot of the association between sarcopenia examined as a continuous variable and mortality[§]



HR= hazard ratio
§ = Studies that did not provide measure of association are not displayed.

Figure S2. Forest plot of the association between physical activity and fatigue as a categorical variable and mortality[§]



Note: Full legend provided on following page
§ = Studies that did not provide measure of association are not displayed.

Legend: The association between physical activity and fatigue as a categorical variable and mortality

1	Navaneethan, 2014	LTPA	HR	<450 MET/week vs. ≥450 MET/week
2	Androga, 2017	LTPA	HR¥	0 MET-min/week vs. >2000 MET-min/week
3	Androga, 2017	LTPA	HR¥	0 MET-min/week vs. 500-2000 MET-min/week
4	Androga, 2017	LTPA	HR¥	0 MET-min/week vs. <500 MET-min/week
5	Rampersad, 2021	PASE	HR¥	Low activity vs. Light activity
6	Rampersad, 2021	PASE	HR¥	Low activity vs. Moderate to high activity
7	Clarke, 2019	Walking	HR¥	0 walking hours/week vs. <1 walking hour/week
8	Clarke, 2019	Walking	HR¥	0 walking hours/week vs. 1-3 walking hours/week
9	Clarke, 2019	Walking	HR¥	0 walking hours/week vs. ≥3 walking hours/week
10	Johansen, 2007	SF-36 Vitality Scale	HR	Score <55 vs. ≥55
11	Johansen, 2007	Physical Activity	HR	Inactive vs. active
12	Valenzuela, 2019	30-Second Chair Stand	RR, unadj.	Less repetitions vs. More repetitions
13	Brar, 2019	Center for Epidemiologic Studies Depression Scale – Exhaustion	HR	Exhaustion vs. No exhaustion
14	Ducharlet, 2019	Palliative Care Outcome Scale Symptoms (POS-S) Renal – Weakness	HR, unadj.	Weakness/low energy vs. No weakness/low energy
15	Jhamb, 2009	SF-36 Vitality Scale	HR¥	Score ≤55 vs. >55
16	Jhamb, 2011	SF-36 Vitality Scale	HR	Lowest vs. highest quartile of vitality
17	Bossola, 2015	SF-36 Vitality Scale	HR	Low vs. high fatigue
18	van Loon, 2017	SF-36 Vitality Scale	HR	Score ≤66 vs. >66
19	Kalantar, 2019	SF-36 Vitality Scale	HR	Lowest vs. highest quartile of vitality
20	Kurita, 2019	SF-12 Vitality Scale	HR¥	Energy none of the time vs. all the time
21	Tentori, 2010	Exercise Frequency	HR¥	Inactive vs. very active
22	Brar, 2019	PASE	HR	Low vs. normal physical activity
23	Kang, 2017	Physical Activity-WHO Recommendations	RR*, unadj.	Inactive vs. active
24	Lopes, 2014	Rapid Assessment of Physical Activity	HR¥	Inactive vs. very active
25	Beddhu, 2009	LTPA	HR¥	Inactive vs active

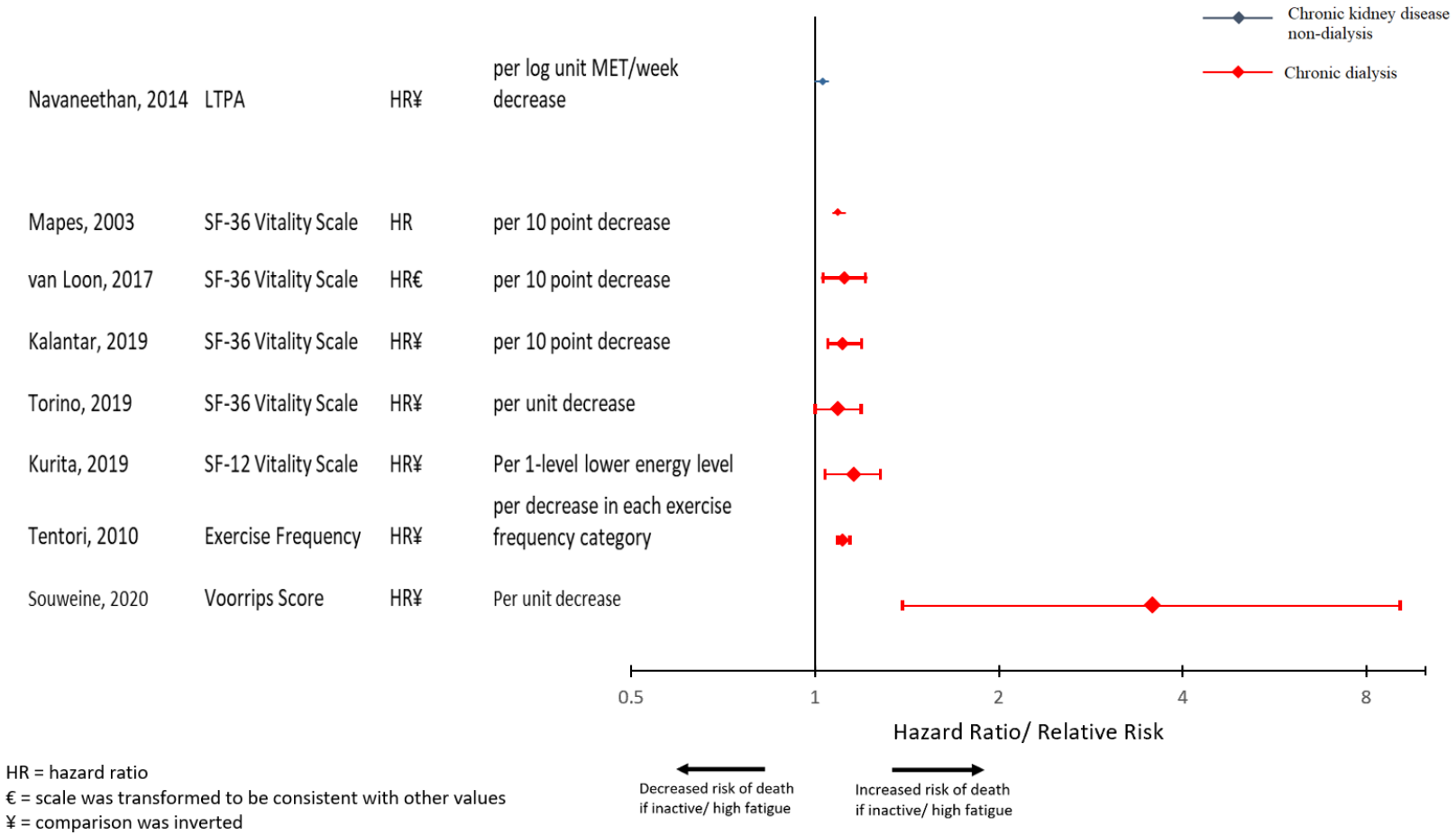
HR = hazard ratio

RR* = relative risk calculated from event data

¥ = comparison was inverted

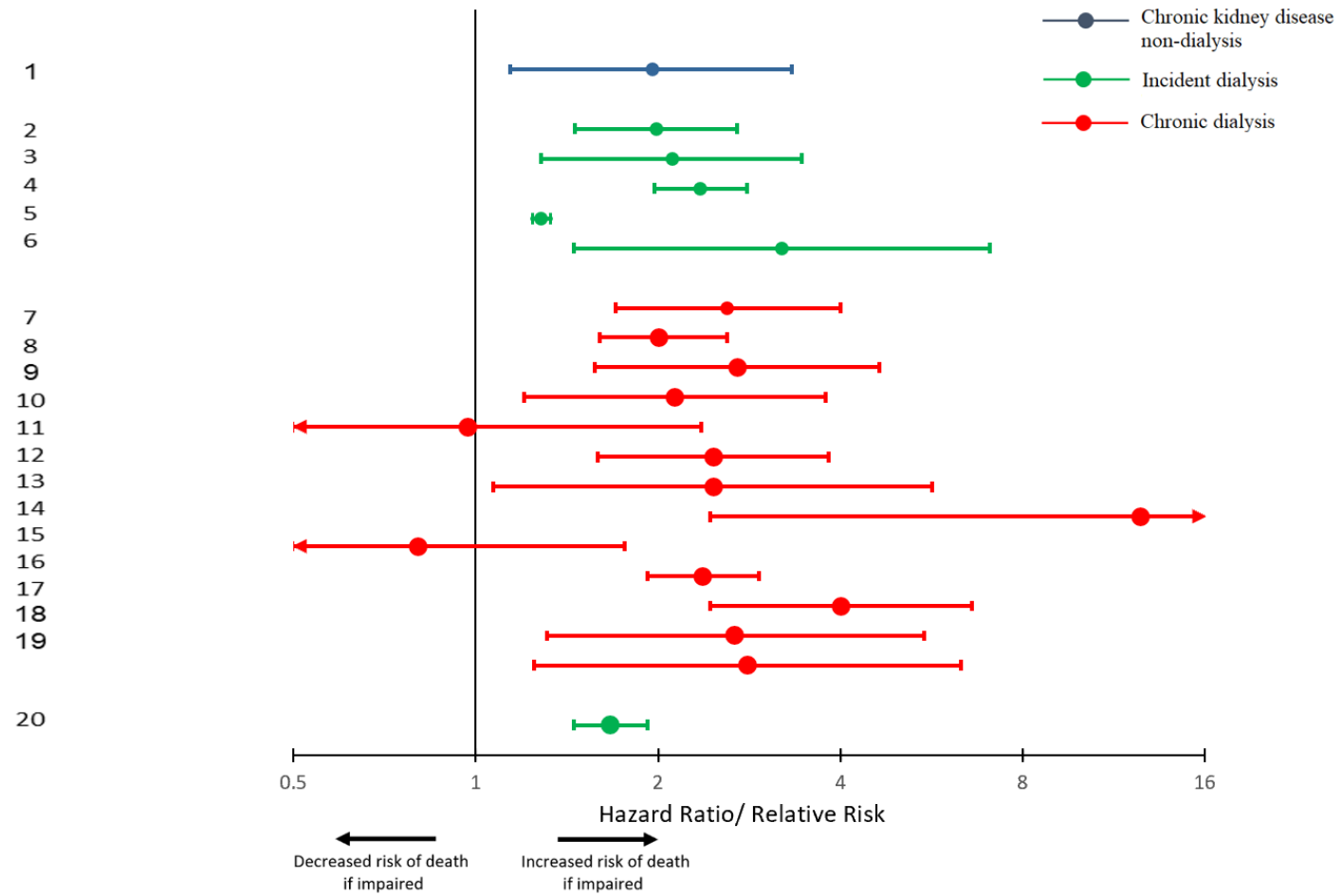
Unadj; unadjusted model

Figure S3. Forest plot of the association between physical activity and fatigue as a continuous variable and mortality§



HR = hazard ratio
€ = scale was transformed to be consistent with other values
¥ = comparison was inverted
§ = Studies that did not provide measure of association are not displayed.

Figure S4. Forest plot of the association between ADL impairment as a categorical variable and mortality[§]



Note: Full legend provided on following page

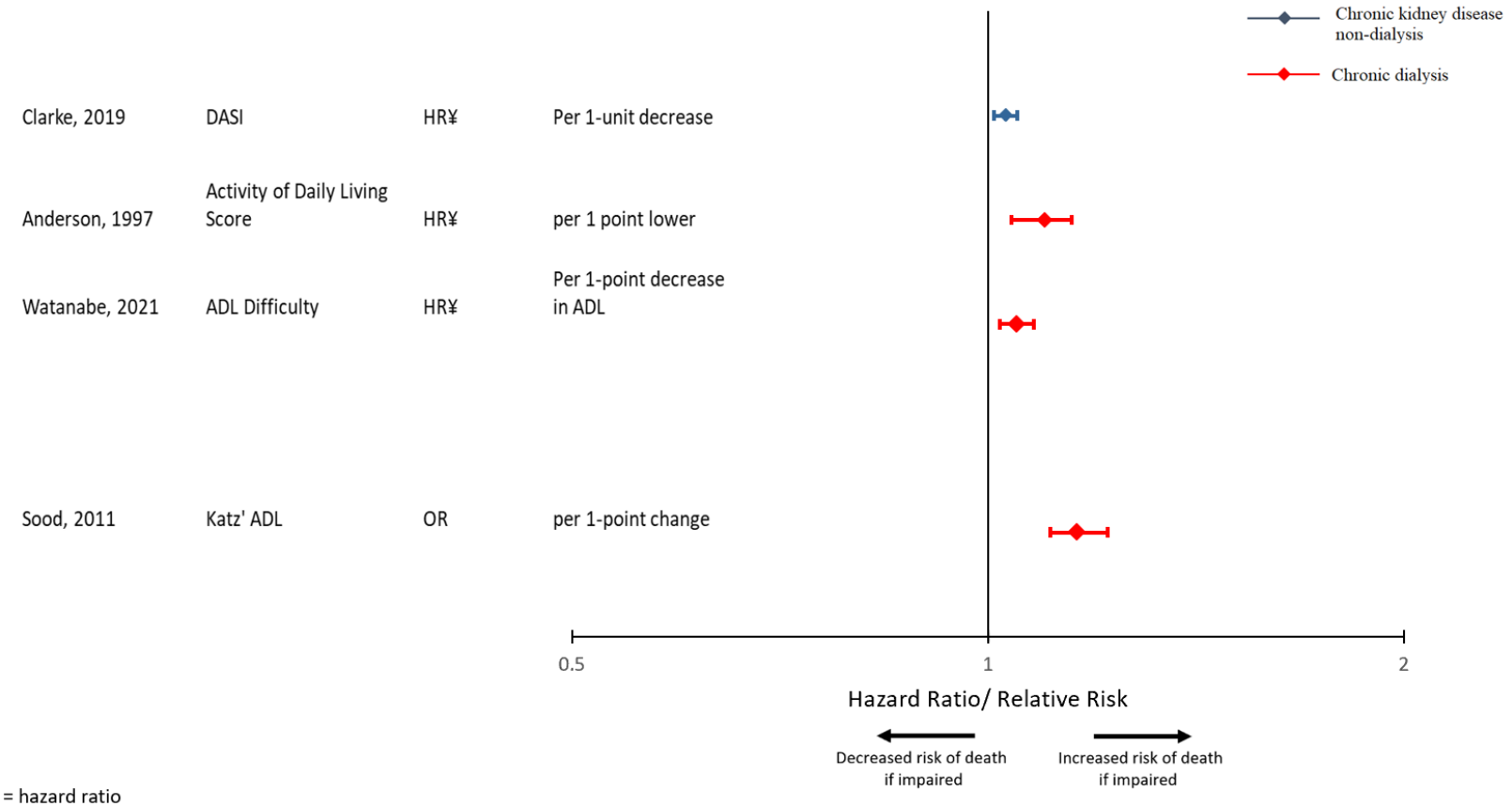
§ = Studies that did not provide measure of association are not displayed.

Legend: The association between ADL impairment as a categorical variable and mortality

1	Clarke, 2019	DASI	HR¥	≤19.2 summed METs vs.>19.2 summed METs
2	Inaguma, 2016	Barthel Index	HR	Low vs. High BI
3	Shum, 2014	Basic Activities of Daily Living	HR, unadj.	Impaired vs. Independent
4	Yazawa, 2016	Functional status - ability to perform ADL	RR	Severe vs. Mild disability/none
5	Shah, 2018	Functional status- form CMS 2728	HR	Poor vs. good functional status
6	van Loon, 2019	Katz' ADL	HR	Impaired vs. Not impaired
7	Anderson, 1990	Activity of Daily Living Score	HR	Score <9.6 vs. ≥ 9.6
8	Anderson, 1993	Activity of Daily Living Score	HR	Score ≤8 vs. >8
9	Watanabe, 2021	ADL Difficulty	HR	Lower vs. Higher ADL
10	Kang, 2017	Disability	HR	Disability vs. no disability (HD patients)
11	Kang, 2017	Disability	HR	Disability vs. no disability (PD patients)
12	Lee, 2017	Disability	HR, unadj.	Disability vs. no disability
13	Bossola, 2016	Katz' ADL	HR	Impaired vs. not impaired
14	Farrokhi, 2013	4-Item Essential ADL Score	HR	Severe vs. no disability
15	Bossola, 2016	Lawton and Brody's IADL scale	HR	Impaired vs. not impaired
16	Jassal, 2016	Functional Status Score (ADL & IADL)	HR	Impaired vs. not impaired
17	Tennankore, 2019	Functional Status Score (ADL & IADL)	HR	Score <8 vs. Score 13
18	Matsuzawa, 2019	Functional Status Score (ADL & IADL)	HR	Decline vs. No decline
19	Matsuzawa, 2019	Functional Status Score (ADL & IADL)	HR	Decline in at least 1/3 of tasks vs. No decline
20	Wetmore, 2019	Functional Status Score	OR	Score ≥ 7 vs. Score ≤ 0

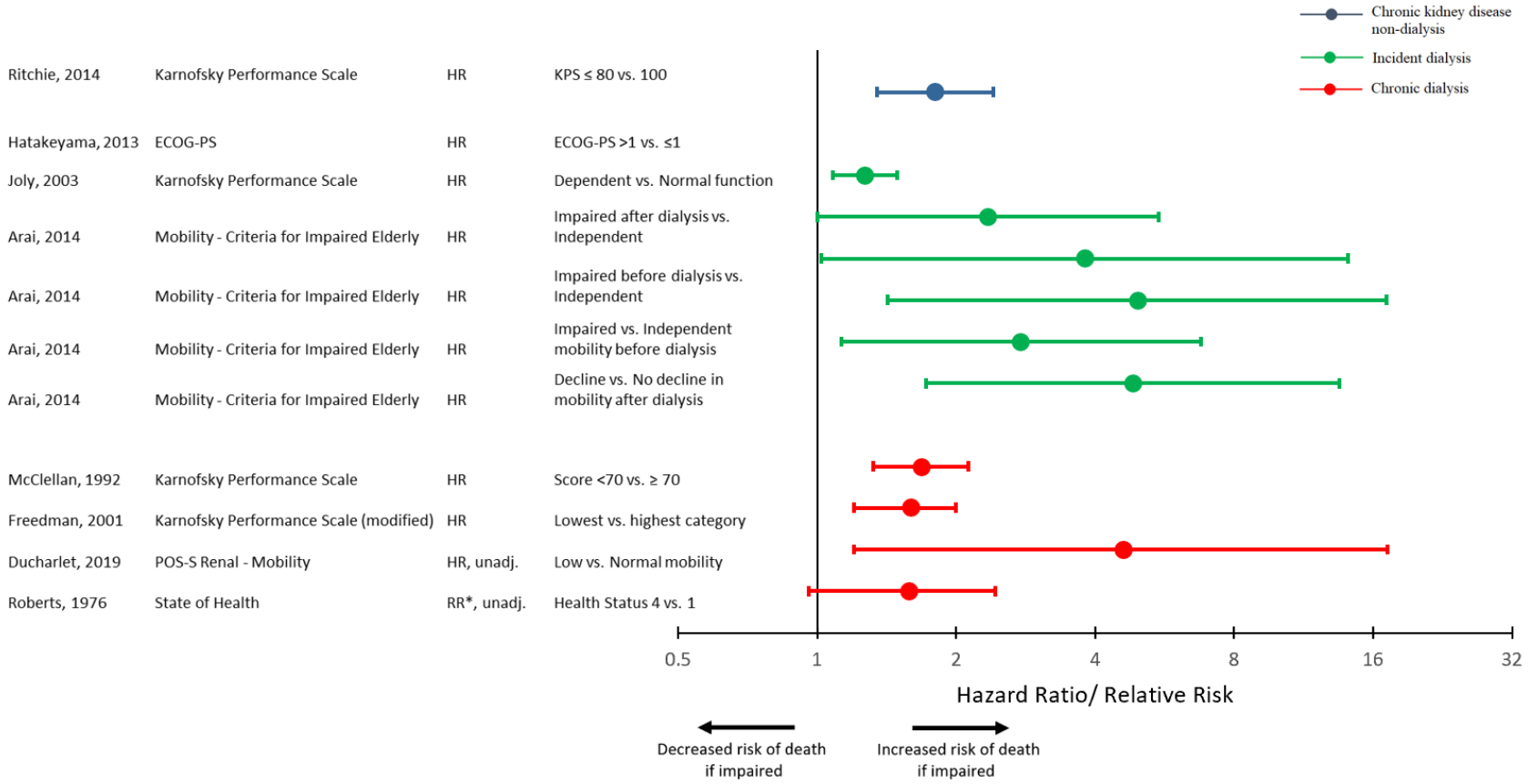
HR = hazard ratio
RR = relative risk
OR= odds ratio
¥ = comparison was inverted
Unadj; unadjusted model

Figure S5. Forest plot of the association between ADL impairment as a continuous variable and mortality[§]



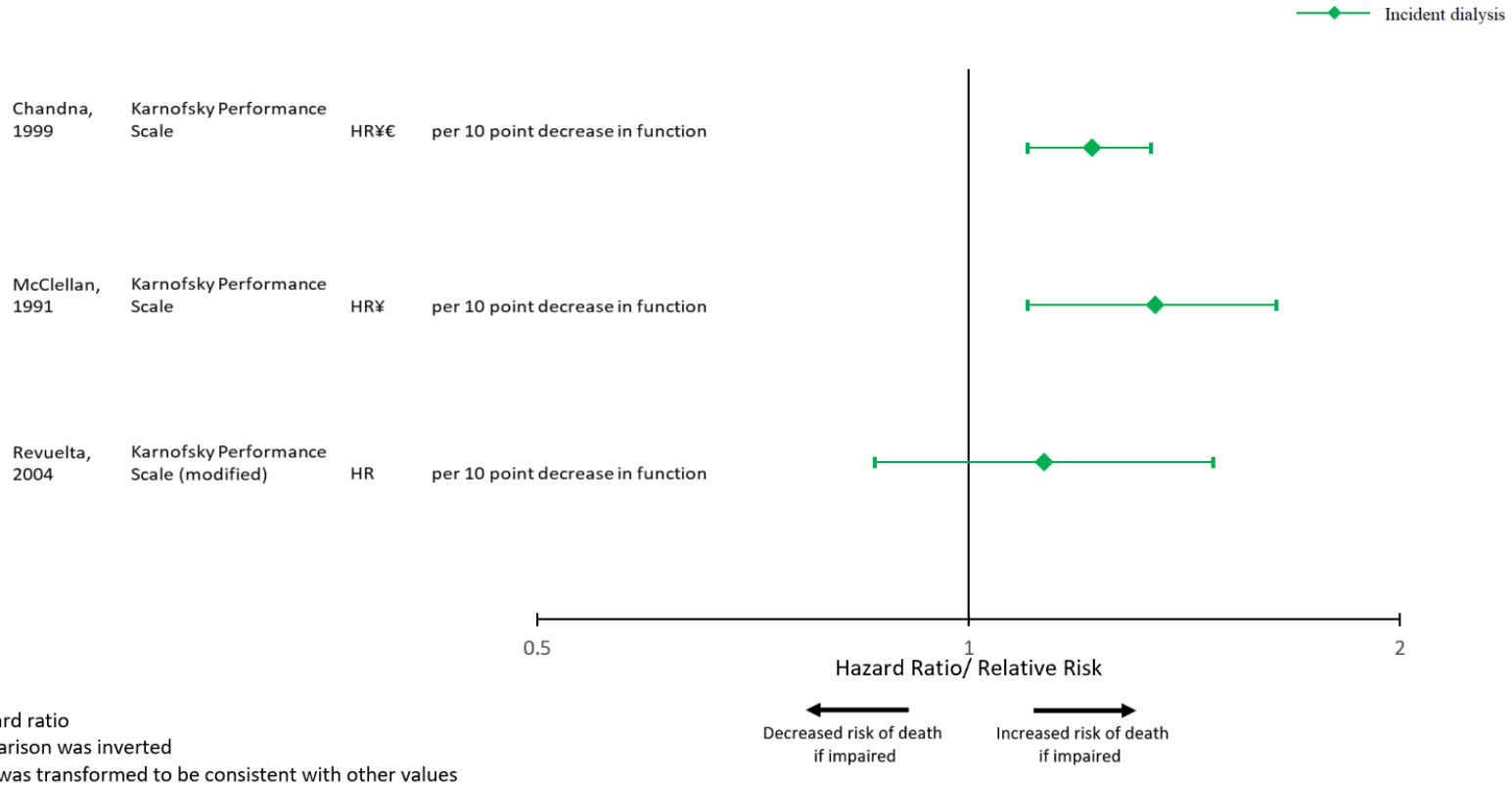
HR = hazard ratio
OR = odds ratio
¥ = comparison was inverted
§ = Studies that did not provide measure of association are not displayed.

Figure S6. Forest plot of the association between performance scale as a categorical variable and mortality[§]



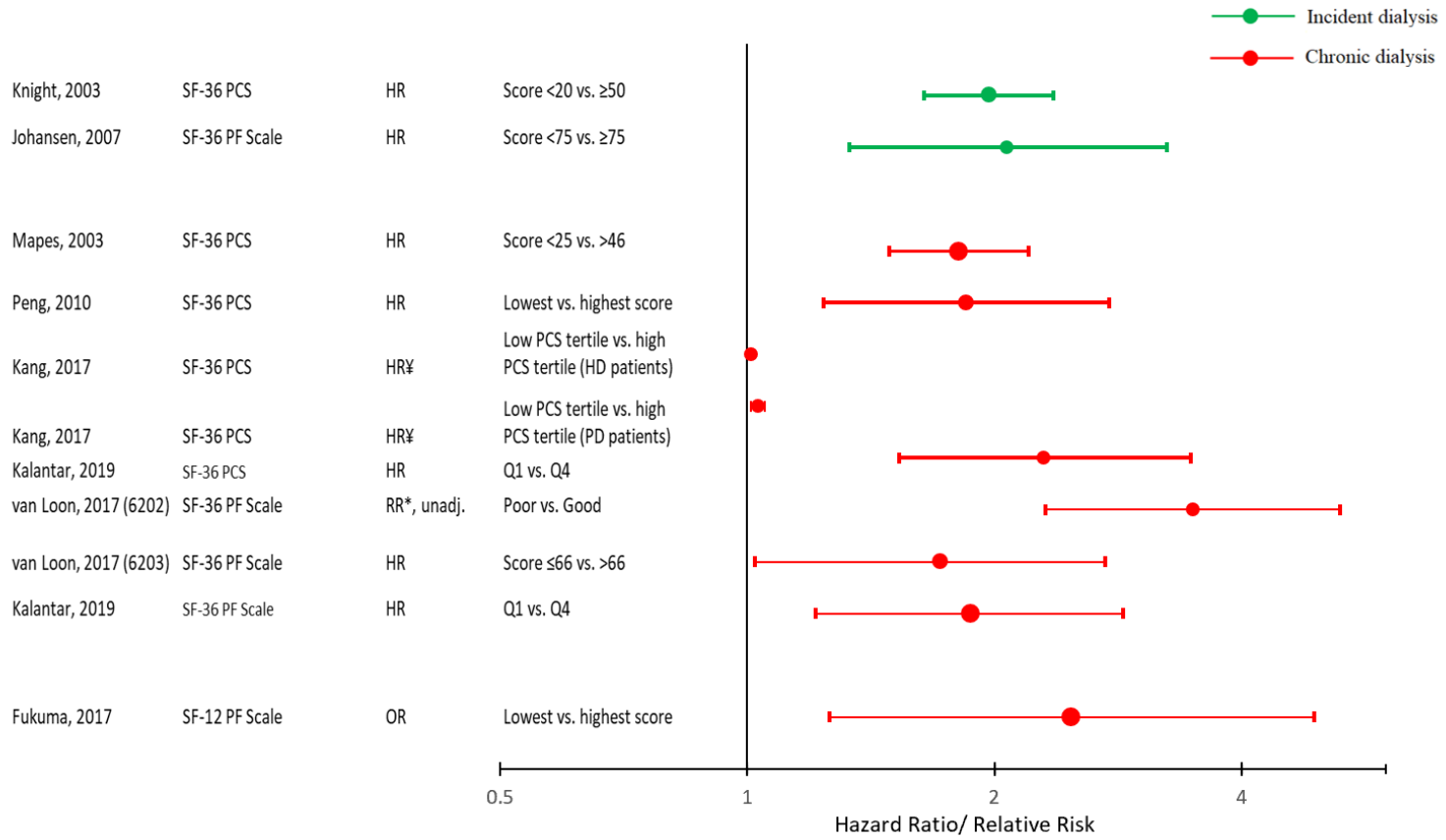
HR = hazard ratio
RR* = relative risk calculated from event data
Unadj; unadjusted model
§ = Studies that did not provide measure of association are not displayed.

Figure S7. Forest plot of the association between performance scale as a continuous variable and mortality[§]



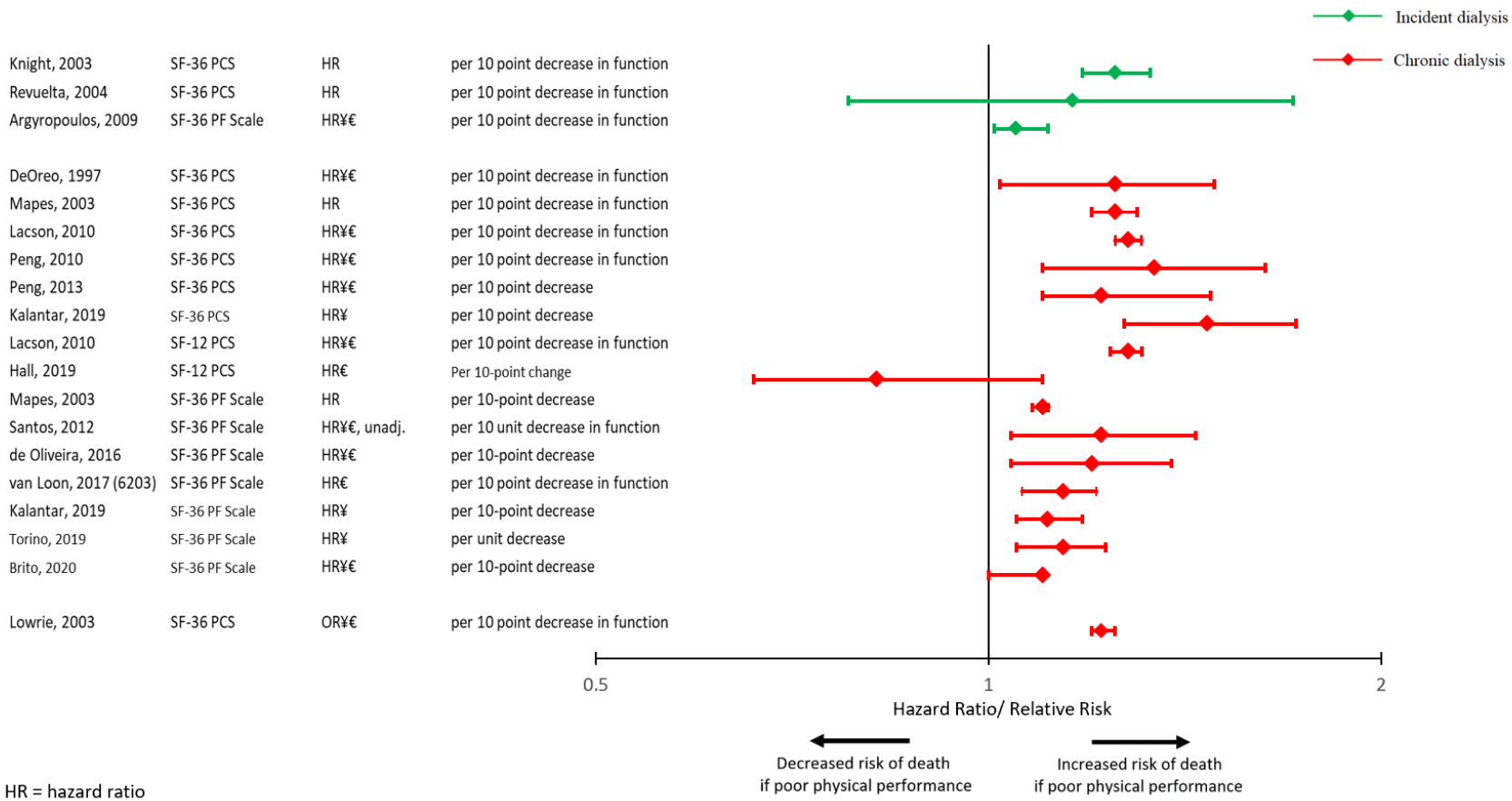
HR = hazard ratio
¥ = comparison was inverted
€ = scale was transformed to be consistent with other values
§ = Studies that did not provide measure of association are not displayed.

Figure S8. Forest plot of the association between physical performance as a categorical variable and mortality[§]



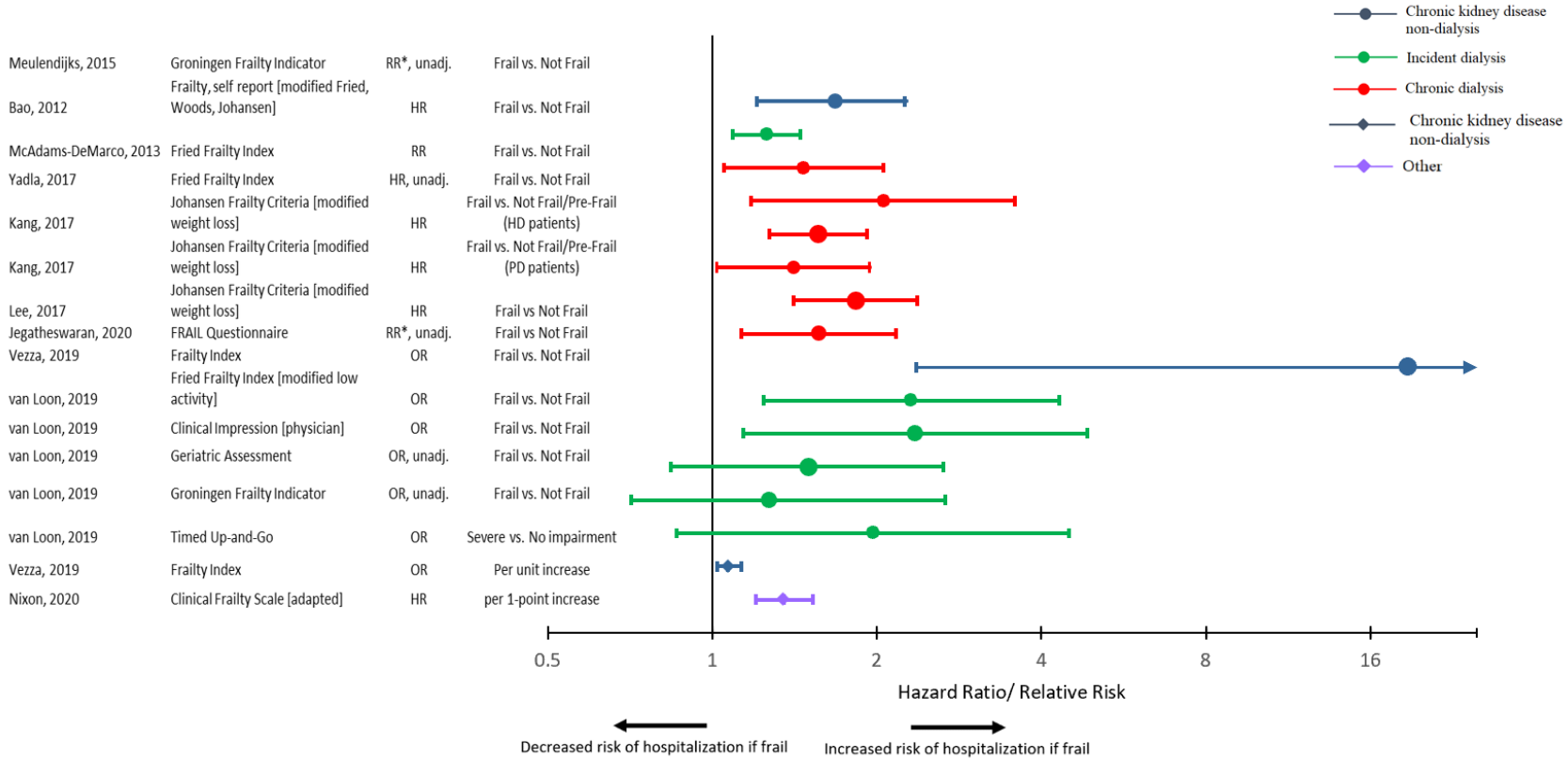
HR = hazard ratio
RR* = relative risk calculated from event data
OR = odds ratio
¥ = comparison was inverted
§ = Studies that did not provide measure of association are not displayed.

Figure S9. Forest plot of the association between physical performance as a continuous variable and mortality[§]



HR = hazard ratio
OR = odds ratio
¥ = comparison was inverted
€ = scale was transformed to be consistent with other values
Unadj; unadjusted model
§ = Studies that did not provide measure of association are not displayed.

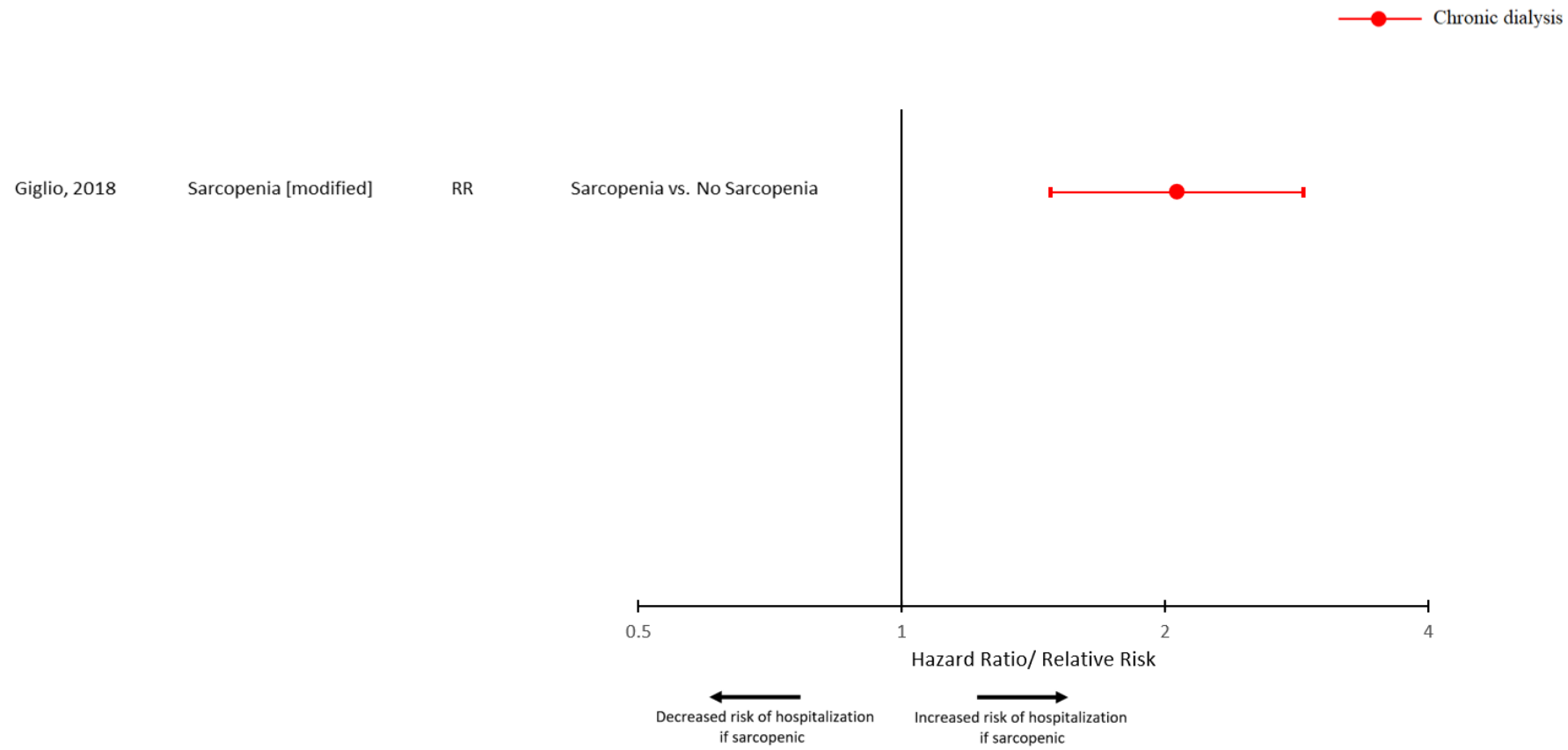
Figure S10. Forest plot of the association between frailty as a categorical or continuous variable and hospitalization[§]



HR = hazard ratio
RR = relative risk
RR* = relative risk calculated from event data
OR= odds ratio
Unadj.; unadjusted model

● = categorical scale
♦ = continuous scale
§ = Studies that did not provide measure of association are not displayed.

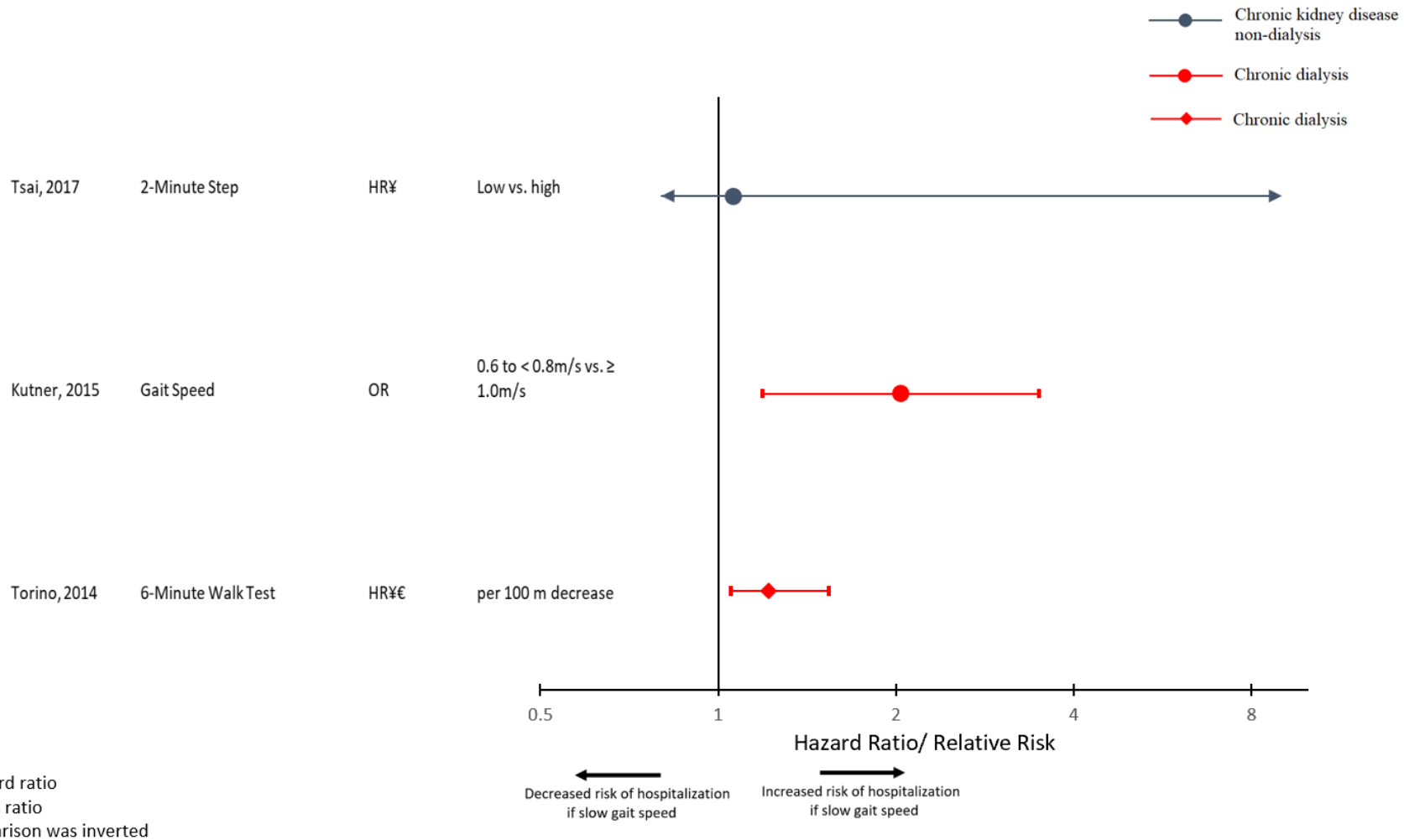
Figure S11. Forest plot of the association between sarcopenia as a categorical variable and hospitalization[§]



RR = relative risk

§ = Studies that did not provide measure of association are not displayed.

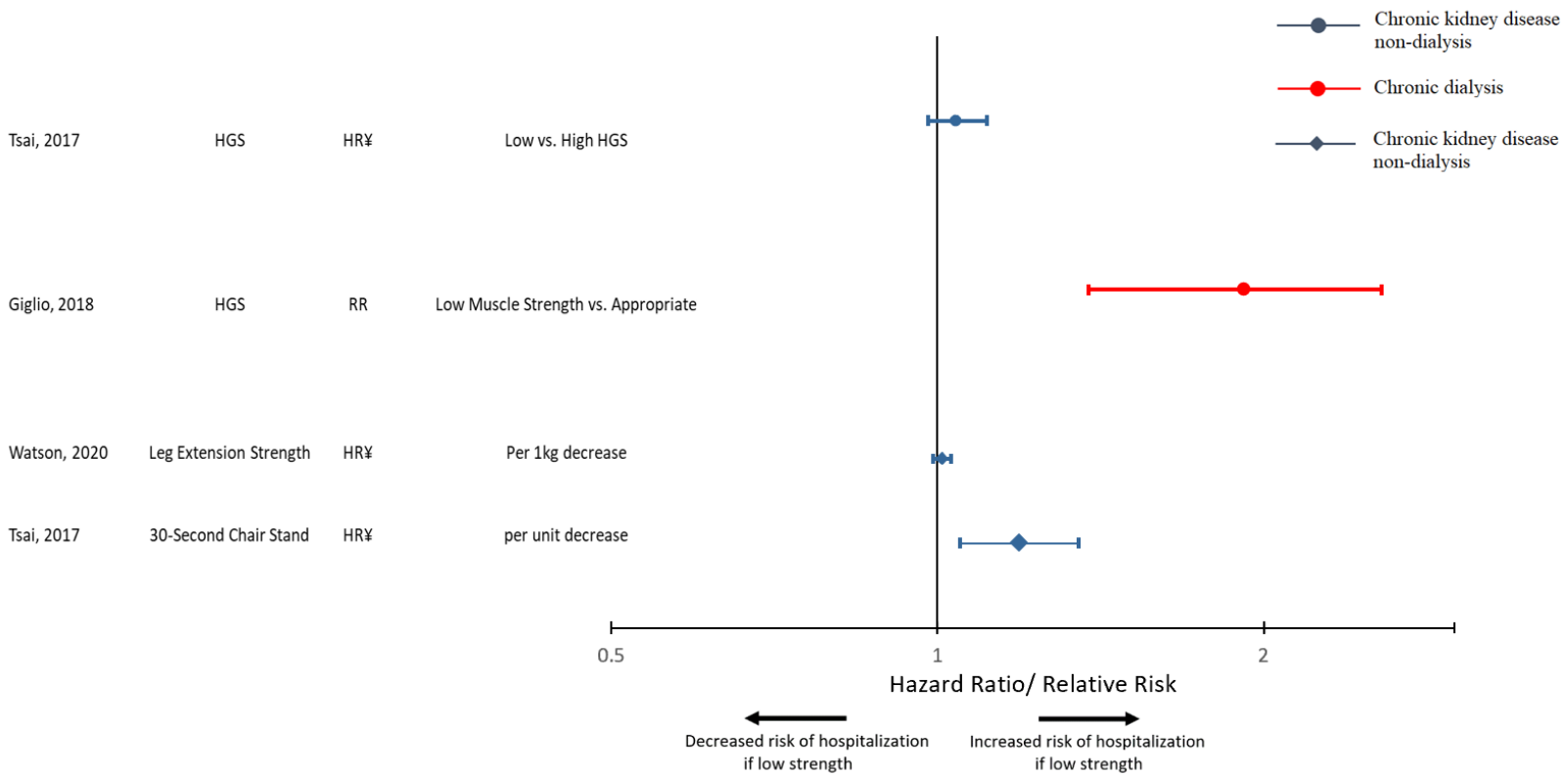
Figure S12. Forest plot of the association between gait speed as a categorical and continuous variable and hospitalization[§]



HR = hazard ratio
OR = odds ratio
¥ = comparison was inverted
€ = scale was transformed to be consistent with other values

● = categorical scale
♦ = continuous scale
§ = Studies that did not provide measure of association are not displayed.

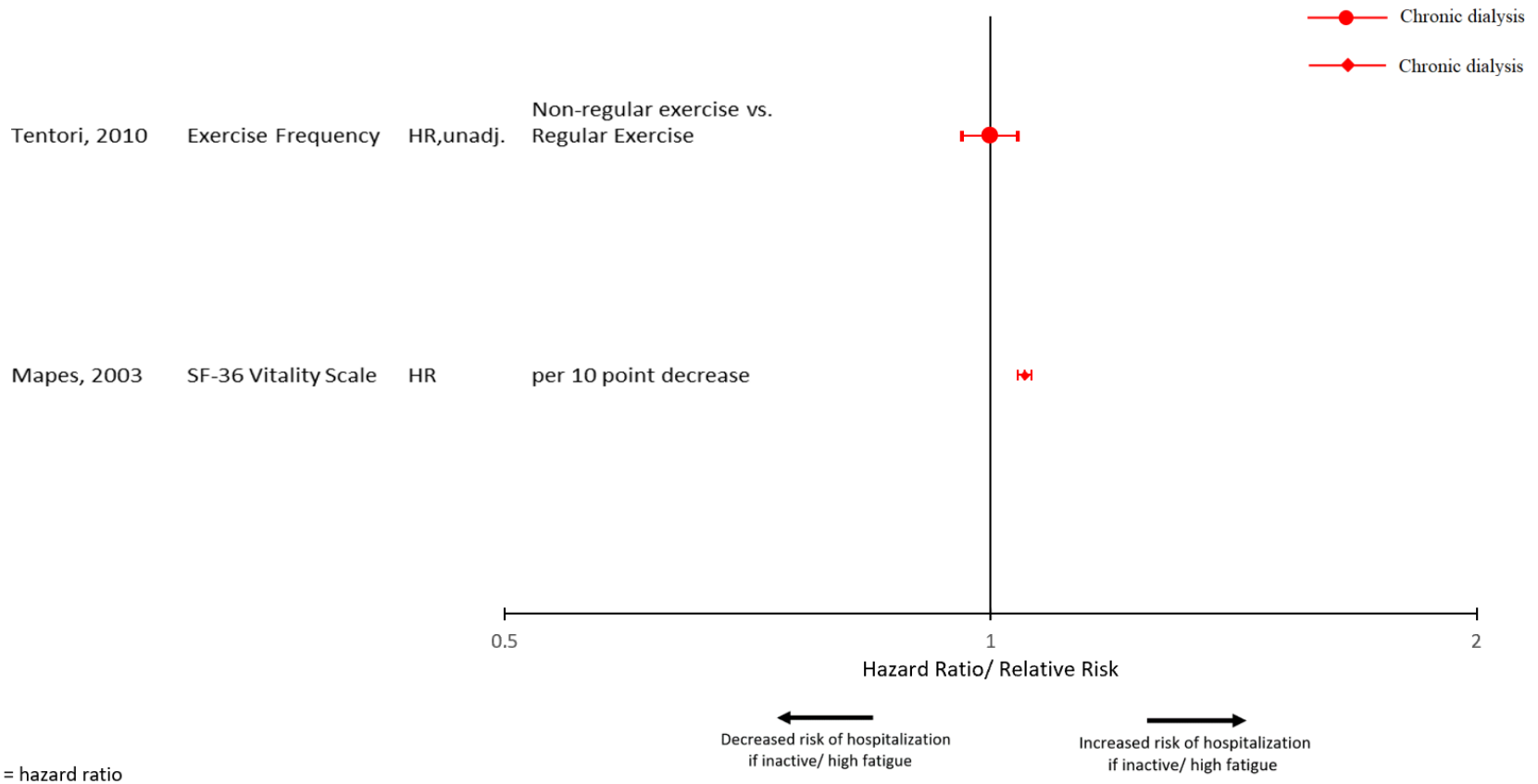
Figure S13. Forest plot of the association between strength measurement as a categorical and continuous variable and hospitalization[§]



HR = hazard ratio
RR = relative risk
¥ = comparison was inverted

● = categorical scale
♦ = continuous scale
§ = Studies that did not provide measure of association are not displayed.

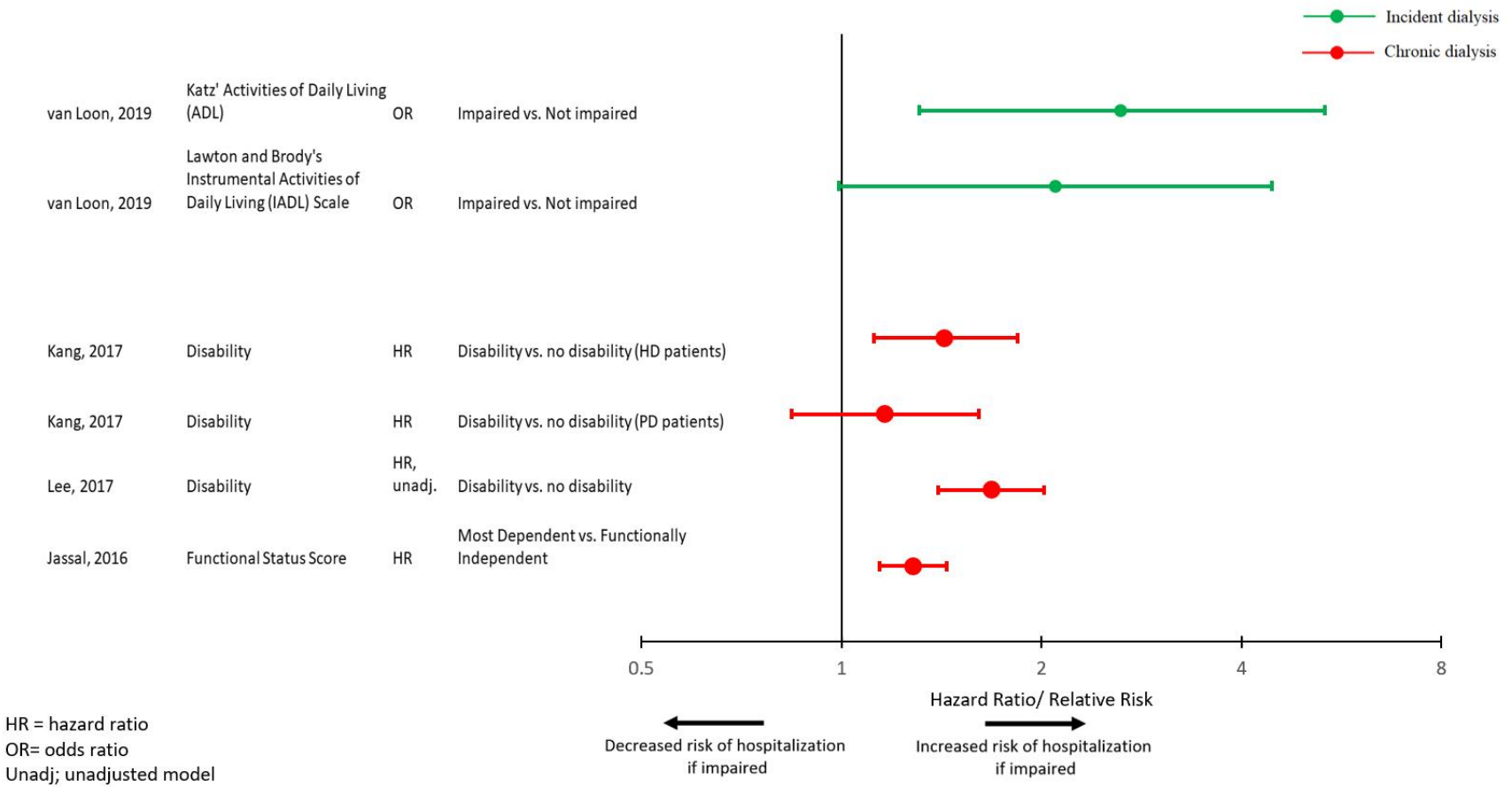
Figure S14. Forest plot of the association between physical activity and fatigue as a categorical and continuous variable and hospitalization



HR = hazard ratio
Unadj; unadjusted model

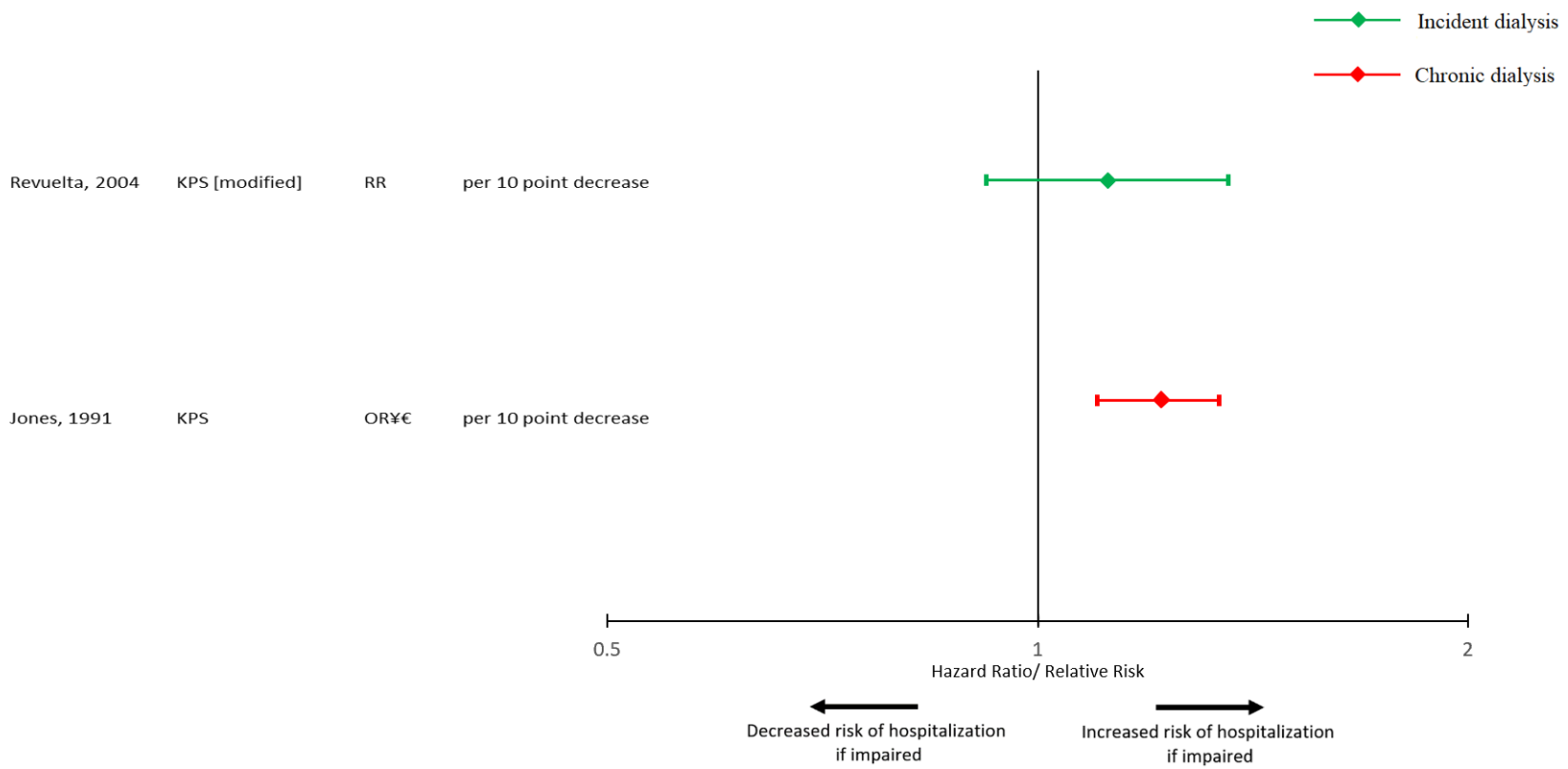
● = categorical scale
♦ = continuous scale

Figure S15. Forest plot of the association between ADL impairment as a categorical variable and hospitalization[§]



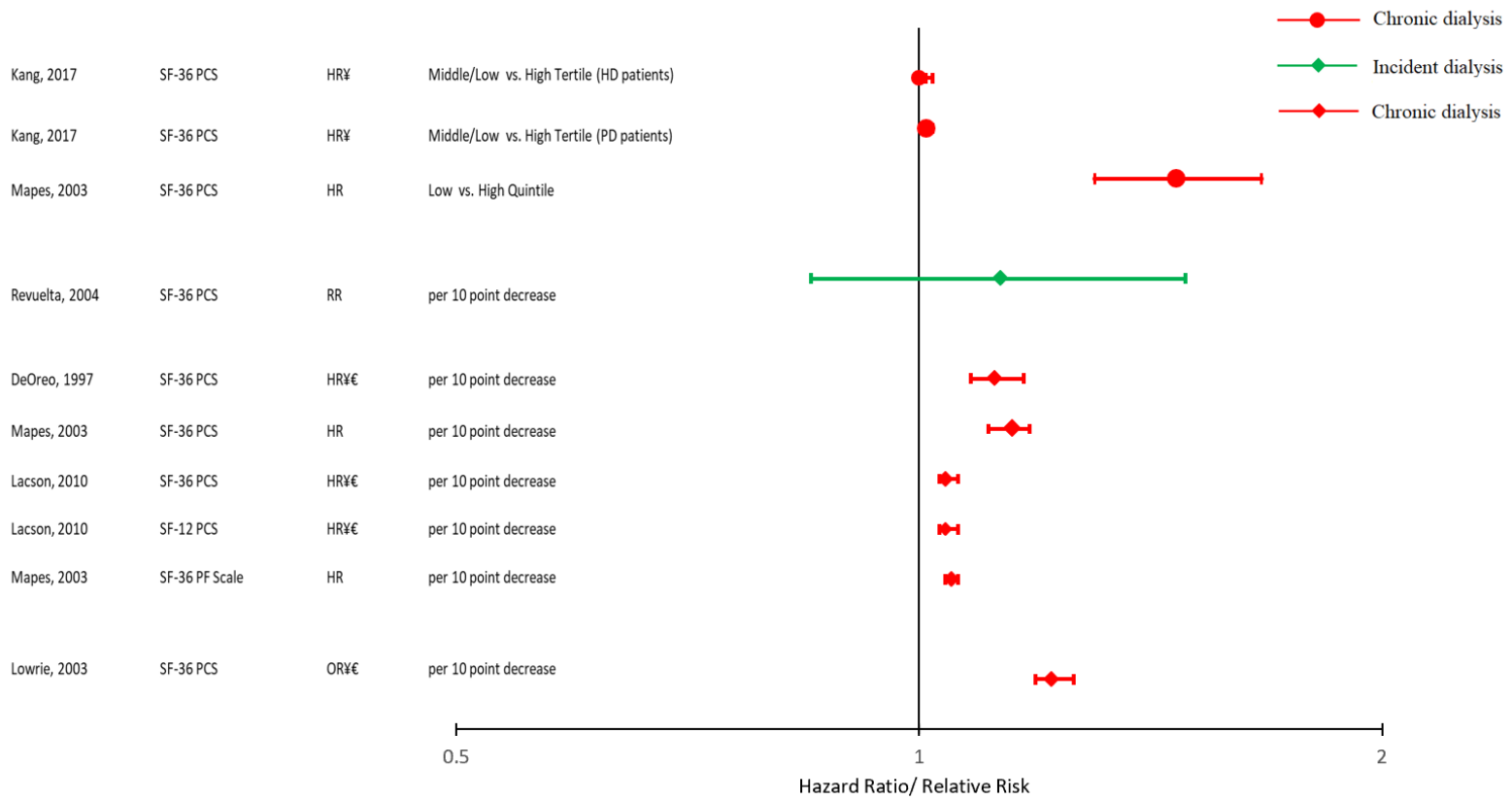
HR = hazard ratio
OR= odds ratio
Unadj; unadjusted model
§ = Studies that did not provide measure of association are not displayed.

Figure S16. Forest plot of the association between performance scale as a continuous variable and hospitalization



RR = relative risk
OR = odds ratio
¥ = comparison was inverted
€ = scale was transformed to be consistent with other values

Figure S17. Forest plot of the association between physical performance as a categorical or continuous variable and hospitalization



HR = hazard ratio
RR = relative risk
OR = odds ratio
¥ = comparison was inverted
€ = scale was transformed to be consistent with other values

● = categorical scale
♦ = continuous scale

Item S1. MEDLINE Search strategy

Ovid MEDLINE(R) ALL 1946 to March 17, 2021

1. renal insufficiency/ or renal insufficiency, chronic/ or kidney failure, chronic/
2. renal replacement therapy/ or renal dialysis/ or peritoneal dialysis/ or kidney transplantation/
3. ((renal or kidney*) adj2 (transplant* or graft* or replac* or artificial* or allograft* or dialys*)).tw,kw.
Peritoneal Dialysis, Continuous Ambulatory/
4. h?emodialysis.tw,kw.
5. esrd.tw,kw.
6. esrf.tw,kw.
7. pre-esrd.tw,kw.
8. CKD.tw,kw.
9. ((kidney* or renal) adj (failure* or disease* or insufficien* or disorder*)).tw,kw.
10. ((kidney* or renal) adj replacement therap*).tw,kw.
11. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10
12. Frail Elderly/
13. Geriatric Assessment/
14. muscle weakness/
15. sarcopenia/
16. Fatigue/
17. (frail* or strength).tw,kw.
18. Sarcopenia*.tw,kw.
19. Fatigue.ti,kw.
20. (muscle* adj2 weak*).tw.
21. Walking/
22. "Activities of Daily Living"/
23. mobility limitation/
24. (functional adj (status or performance or capacity or dependence or independence or ability or decline or disability)).tw,kw.
25. (physical adj (performance or capacity or ability or disability or function* or fatigue)).tw,kw.
26. ((limit* or decline) adj2 mobility).tw,kw.
27. activit* of daily living.tw,kw.
28. daily living activit*.tw,kw.
29. 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28
30. 11 and 29
31. "reproducibility of results"/
32. "Predictive Value of Tests"/
33. Psychometrics/
34. (reliability or reproducib* or measurement* or measure or scale* or index or indices or predict* or psychometric* or instrument* or score* or validity or validat* or test or prognos* or associat*).tw,kw.
35. Validation Studies/
36. phenotype*.tw.
37. risk.tw.
38. 31 or 32 or 33 or 34 or 35 or 36 or 37
39. 30 and 38
40. limit 39 to English

Item S2. References for the included studies

1. Alfaadhel TA, Soroka SD, Kiberd BA, et al. Frailty and mortality in dialysis: evaluation of a clinical frailty scale. Clin J Am Soc Nephrol 2015; 10: 832-840. DOI: 10.2215/CJN.07760814.

2. Ali H, Abdelaziz T, Abdelaal F, et al. Assessment of prevalence and clinical outcome of frailty in an elderly predialysis cohort using simple tools. Saudi journal of kidney diseases and transplantation : an official publication of the Saudi Center for Organ Transplantation, Saudi Arabia 2018; 29: 63-70. 2018/02/20. DOI: 10.4103/1319-2442.225175.

3. Anderson JE. Ten years' experience with CAPD in a nursing home setting. Perit Dial Int 1997; 17: 255-261. 1997/05/01.

4. Anderson JE, Kraus J and Sturgeon D. Incidence, prevalence, and outcomes of end-stage renal disease patients placed in nursing homes. Am J Kidney Dis 1993; 21: 619-627. DOI: 10.1016/s0272-6386(12)80034-5.

5. Anderson JE, Sturgeon D, Lindsay J, et al. Use of continuous ambulatory peritoneal dialysis in a nursing home: patient characteristics, technique success, and survival predictors. Am J Kidney Dis 1990; 16: 137-141. 1990/08/01. DOI: 10.1016/s0272-6386(12)80568-3.

6. Androga L, Sharma D, Amodu A, et al. Sarcopenia, obesity, and mortality in US adults with and without chronic kidney disease. Kidney Int Rep 2017; 2: 201-211. DOI: 10.1016/j.ekir.2016.10.008.

7. Arai Y, Kanda E, Kikuchi H, et al. Decreased mobility after starting dialysis is an independent risk factor for short-term mortality after initiation of dialysis. Nephrology (Carlton) 2014; 19: 227-233. DOI: 10.1111/nep.12202.

8. Argyropoulos C, Chang CC, Plantinga L, et al. Considerations in the statistical analysis of hemodialysis patient survival. J Am Soc Nephrol 2009; 20: 2034-2043. DOI: 10.1681/ASN.2008050551.

9. Bancu I, Graterol F, Bonal J, et al. Frail Patient in Hemodialysis: A New Challenge in Nephrology-Incidence in Our Area, Barcelones Nord and Maresme. J Aging Res 2017; 2017: 7624139. DOI: 10.1155/2017/7624139.

10. Bao Y, Dalrymple L, Chertow GM, et al. Frailty, dialysis initiation, and mortality in end-stage renal disease. Arch Intern Med 2012; 172: 1071-1077. DOI: 10.1001/archinternmed.2012.3020.

11. Beddhu S, Baird BC, Zitterkoph J, et al. Physical activity and mortality in chronic kidney disease (NHANES III). Clin J Am Soc Nephrol 2009; 4: 1901-1906. DOI: 10.2215/CJN.01970309.

12. Bordenave K, Tzamaloukas AH, Conneen S, et al. Twenty-one year mortality in a dialysis unit: changing effect of withdrawal from dialysis. ASAIO journal (American Society for

Artificial Internal Organs : 1992) 1998; 44: 194-198. 1998/06/09. DOI: 10.1097/00002480-199805000-00014.

13. Bossola M, Di Stasio E, Antocicco M, et al. Fatigue Is Associated with Increased Risk of Mortality in Patients on Chronic Hemodialysis. Nephron 2015; 130: 113-118. DOI: 10.1159/000430827.

14. Bossola M, Di Stasio E, Antocicco M, et al. Functional impairment is associated with an increased risk of mortality in patients on chronic hemodialysis. BMC Nephrol 2016; 17: 72. DOI: 10.1186/s12882-016-0302-y.

15. Brar R, Whitlock R, Komenda P, et al. The Impact of Frailty on Technique Failure and Mortality in Patients on Home Dialysis. Perit Dial Int 2019; 39: 532-538. DOI: 10.3747/pdi.2018.00195.

16. Brito DCS, Machado EL, Reis IA, et al. Impact of clinical, sociodemographic and quality of life factors on dialysis patient survival: a nine-year follow-up cohort study. Cad Saude Publica 2020; 36: e00007320. DOI: 10.1590/0102-311X00007320.

17. Chan GC, N GJ, Chow KM, et al. Interaction between central obesity and frailty on the clinical outcome of peritoneal dialysis patients. PLoS One 2020; 15: e0241242. DOI: 10.1371/journal.pone.0241242.

18. Chandna SM, Schulz J, Lawrence C, et al. Is there a rationale for rationing chronic dialysis? A hospital based cohort study of factors affecting survival and morbidity. BMJ (Clinical research ed) 1999; 318: 217-223. 1999/01/23. DOI: 10.1136/bmj.318.7178.217.

19. Chang YT, Wu HL, Guo HR, et al. Handgrip strength is an independent predictor of renal outcomes in patients with chronic kidney diseases. Nephrol Dial Transplant 2011; 26: 3588-3595. DOI: 10.1093/ndt/gfr013.

20. Chao CT, Huang JW, Chiang CK, et al. Applicability of laboratory deficit-based frailty index in predominantly older patients with end-stage renal disease under chronic dialysis: A pilot test of its correlation with survival and self-reported instruments. Nephrology (Carlton) 2020; 25: 73-81. DOI: 10.1111/nep.13583.

21. Clarke AL, Zaccardi F, Gould DW, et al. Association of self-reported physical function with survival in patients with chronic kidney disease. Clin Kidney J 2019; 12: 122-128. DOI: 10.1093/ckj/sfy080.

22. Dai L, Mukai H, Lindholm B, et al. Clinical global assessment of nutritional status as predictor of mortality in chronic kidney disease patients. PLoS One 2017; 12: e0186659. DOI: 10.1371/journal.pone.0186659.

23. de Goeij MC, Ocak G, Rotmans JI, et al. Course of symptoms and health-related quality of life during specialized pre-dialysis care. PLoS One 2014; 9: e93069. DOI: 10.1371/journal.pone.0093069.

24. de Oliveira MP, Kusumota L, Haas VJ, et al. Health-related quality of life as a predictor of mortality in patients on peritoneal dialysis. Rev Lat Am Enfermagem 2016; 24: e2687. DOI: 10.1590/1518-8345.0786.2687.

25. Delgado C, Grimes BA, Glidden DV, et al. Association of Frailty based on self-reported physical function with directly measured kidney function and mortality. BMC Nephrol 2015; 16: 203. DOI: 10.1186/s12882-015-0202-6.

26. Delgado C, Shieh S, Grimes B, et al. Association of Self-Reported Frailty with Falls and Fractures among Patients New to Dialysis. Am J Nephrol 2015; 42: 134-140. DOI: 10.1159/000439000.

27. DeOreo PB. Hemodialysis patient-assessed functional health status predicts continued survival, hospitalization, and dialysis-attendance compliance. Am J Kidney Dis 1997; 30: 204-212. 1997/08/01. DOI: 10.1016/s0272-6386(97)90053-6.

28. Ducharlet K, Sundararajan V, Philip J, et al. Patient-reported outcome measures and their utility in the management of patients with advanced chronic kidney disease. Nephrology (Carlton) 2019; 24: 814-818. DOI: 10.1111/nep.13509.

29. Farrokhi F and Jassal SV. Routine use of an abbreviated 4-item scale to assess dependence in essential activities of daily living amongst elderly hemodialysis patients: a validation study. Int Urol Nephrol 2013; 45: 259-264. DOI: 10.1007/s11255-012-0360-4.

30. Freedman BI, Soucie JM, Kenderes B, et al. Family history of end-stage renal disease does not predict dialytic survival. Am J Kidney Dis 2001; 38: 547-552. DOI: 10.1053/ajkd.2001.26851.

31. Fukuma S, Shimizu S, Shintani A, et al. Development and validation of a prediction model for loss of physical function in elderly hemodialysis patients. Nephrol Dial Transplant 2018; 33: 1452-1458. DOI: 10.1093/ndt/gfx260.

32. Giglio J, Kamimura MA, Lamarca F, et al. Association of Sarcopenia With Nutritional Parameters, Quality of Life, Hospitalization, and Mortality Rates of Elderly Patients on Hemodialysis. J Ren Nutr 2018; 28: 197-207. DOI: 10.1053/j.jrn.2017.12.003.

33. Goto NA, van Loon IN, Boereboom FTJ, et al. Association of Initiation of Maintenance Dialysis with Functional Status and Caregiver Burden. Clin J Am Soc Nephrol 2019; 14: 1039-1047. DOI: 10.2215/CJN.13131118.

34. Gregg LP, Jain N, Carmody T, et al. Fatigue in Nondialysis Chronic Kidney Disease: Correlates and Association with Kidney Outcomes. Am J Nephrol 2019; 50: 37-47. DOI: 10.1159/000500668.

35. Hall RK, Luciano A, Pendergast JF, et al. Self-reported Physical Function Decline and Mortality in Older Adults Receiving Hemodialysis. Kidney Med 2019; 1: 288-295. DOI: 10.1016/j.xkme.2019.08.001.

36. Hatakeyama S, Murasawa H, Hamano I, et al. Prognosis of elderly Japanese patients aged >/=80 years undergoing hemodialysis. ScientificWorldJournal 2013; 2013: 693514. DOI: 10.1155/2013/693514.

37. Hellberg M, Wiberg EM, Simonsen O, et al. Small distal muscles and balance predict survival in end-stage renal disease. Nephron Clin Pract 2014; 126: 116-123. DOI: 10.1159/000358431.

38. Ifudu O, Paul HR, Homel P, et al. Predictive value of functional status for mortality in patients on maintenance hemodialysis. Am J Nephrol 1998; 18: 109-116. 1998/05/07. DOI: 10.1159/000013318.

39. Inaguma D, Tanaka A and Shinjo H. Physical function at the time of dialysis initiation is associated with subsequent mortality. Clin Exp Nephrol 2017; 21: 425-435. DOI: 10.1007/s10157-016-1307-3.

40. Isoyama N, Qureshi AR, Avesani CM, et al. Comparative associations of muscle mass and muscle strength with mortality in dialysis patients. Clin J Am Soc Nephrol 2014; 9: 1720-1728. DOI: 10.2215/CJN.10261013.

41. Jafari M, Kour K, Giebel S, et al. The Burden of Frailty on Mood, Cognition, Quality of Life, and Level of Independence in Patients on Hemodialysis: Regina Hemodialysis Frailty Study. Can J Kidney Health Dis 2020; 7: 2054358120917780. DOI: 10.1177/2054358120917780.

42. Jassal SV, Karaboyas A, Comment LA, et al. Functional Dependence and Mortality in the International Dialysis Outcomes and Practice Patterns Study (DOPPS). Am J Kidney Dis 2016; 67: 283-292. DOI: 10.1053/j.ajkd.2015.09.024.

43. Jegatheswaran J, Chan R, Hiremath S, et al. Use of the FRAIL Questionnaire in Patients With End-Stage Kidney Disease. Can J Kidney Health Dis 2020; 7: 2054358120952904. DOI: 10.1177/2054358120952904.

44. Jhamb M, Argyropoulos C, Steel JL, et al. Correlates and outcomes of fatigue among incident dialysis patients. Clin J Am Soc Nephrol 2009; 4: 1779-1786. DOI: 10.2215/CJN.00190109.

45. Jhamb M, Pike F, Ramer S, et al. Impact of fatigue on outcomes in the hemodialysis (HEMO) study. Am J Nephrol 2011; 33: 515-523. DOI: 10.1159/000328004.

46. Jiang X, Li D, Shen W, et al. In-Hospital Outcomes of Patients on Maintenance Dialysis With Frailty: 10-year Results From the US National Inpatient Sample Database. J Ren Nutr 2020; 30: 526-534. DOI: 10.1053/j.jrn.2019.12.007.

47. Jin S, Lu Q, Su C, et al. Shortage of Appendicular Skeletal Muscle Is an Independent Risk Factor for Mortality in Peritoneal Dialysis Patients. Perit Dial Int 2017; 37: 78-84. DOI: 10.3747/pdi.2016.00019.

48. Johansen KL, Chertow GM, Jin C, et al. Significance of frailty among dialysis patients. J Am Soc Nephrol 2007; 18: 2960-2967. DOI: 10.1681/ASN.2007020221.

49. Johansen KL, Dalrymple LS, Glidden D, et al. Association of Performance-Based and Self-Reported Function-Based Definitions of Frailty with Mortality among Patients Receiving Hemodialysis. Clin J Am Soc Nephrol 2016; 11: 626-632. DOI: 10.2215/CJN.03710415.

50. Joly D, Anglicheau D, Alberti C, et al. Octogenarians reaching end-stage renal disease: cohort study of decision-making and clinical outcomes. J Am Soc Nephrol 2003; 14: 1012-1021. DOI: 10.1097/01.asn.0000054493.04151.80.

51. Jones KR. Factors associated with hospitalization in a sample of chronic hemodialysis patients. Health services research 1991; 26: 671-699. 1991/12/01.

52. Kalantar SS, You AS, Norris KC, et al. The Impact of Race and Ethnicity Upon Health-Related Quality of Life and Mortality in Dialysis Patients. Kidney Med 2019; 1: 253-262. DOI: 10.1016/j.xkme.2019.07.005.

53. Kamijo Y, Kanda E, Ishibashi Y, et al. Sarcopenia and Frailty in PD: Impact on Mortality, Malnutrition, and Inflammation. Perit Dial Int 2018; 38: 447-454. DOI: 10.3747/pdi.2017.00271.

54. Kang SH, Do JY, Jeong HY, et al. The Clinical Significance of Physical Activity in Maintenance Dialysis Patients. Kidney Blood Press Res 2017; 42: 575-586. DOI: 10.1159/000480674.

55. Kang SH, Do JY, Lee SY, et al. Effect of dialysis modality on frailty phenotype, disability, and health-related quality of life in maintenance dialysis patients. PLoS One 2017; 12: e0176814. DOI: 10.1371/journal.pone.0176814.

56. Kang SH, Park JW, Yoon KW, et al. Limb/trunk lean mass ratio as a risk factor for mortality in peritoneal dialysis patients. J Ren Nutr 2013; 23: 315-323. DOI: 10.1053/j.jrn.2012.09.004.

57. Kim JK, Kim SG, Oh JE, et al. Impact of sarcopenia on long-term mortality and cardiovascular events in patients undergoing hemodialysis. Korean J Intern Med 2019; 34: 599-607. DOI: 10.3904/kjim.2017.083.

58. Kittiskulnam P, Chertow GM, Carrero JJ, et al. Sarcopenia and its individual criteria are associated, in part, with mortality among patients on hemodialysis. Kidney Int 2017; 92: 238-247. DOI: 10.1016/j.kint.2017.01.024.

59. Knight EL, Ofsthun N, Teng M, et al. The association between mental health, physical function, and hemodialysis mortality. Kidney Int 2003; 63: 1843-1851. 2003/04/05. DOI: 10.1046/j.1523-1755.2003.00931.x.

60. Kohl Lde M, Signori LU, Ribeiro RA, et al. Prognostic value of the six-minute walk test in end-stage renal disease life expectancy: a prospective cohort study. Clinics (Sao Paulo) 2012; 67: 581-586. DOI: 10.6061/clinics/2012(06)06.

61. Koyama H, Fukuda S, Shoji T, et al. Fatigue is a predictor for cardiovascular outcomes in patients undergoing hemodialysis. Clin J Am Soc Nephrol 2010; 5: 659-666. DOI: 10.2215/CJN.08151109.

62. Kruse NT, Buzkova P, Barzilay JI, et al. Association of skeletal muscle mass, kidney disease and mortality in older men and women: the cardiovascular health study. Aging 2020; 12: 21023-21036. 2020/11/04. DOI: 10.18632/aging.202135.

63. Kuki A, Tanaka K, Kushiyama A, et al. Association of gait speed and grip strength with risk of cardiovascular events in patients on haemodialysis: a prospective study. BMC Nephrol 2019; 20: 196. DOI: 10.1186/s12882-019-1370-6.

64. Kurita N, Akizawa T and Fukuhara S. Vitality Measured as Self-reported Energy Level and Clinical Outcomes in Hemodialysis Patients: The Japanese Dialysis Outcomes and Practice Pattern Study (J-DOPPS). Am J Kidney Dis 2019; 73: 486-495. DOI: 10.1053/j.ajkd.2018.10.001.

65. Kutner NG, Brogan D and Fielding B. Physical and psychosocial resource variables related to long-term survival in older dialysis patients. Geriatric nephrology and urology 1997; 7: 23-28. 1997/01/01. DOI: 10.1023/a:1008204311582.

66. Kutner NG, Lin LS, Fielding B, et al. Continued survival of older hemodialysis patients: investigation of psychosocial predictors. Am J Kidney Dis 1994; 24: 42-49. DOI: 10.1016/s0272-6386(12)80158-2.

67. Kutner NG, Zhang R, Huang Y, et al. Gait Speed and Mortality, Hospitalization, and Functional Status Change Among Hemodialysis Patients: A US Renal Data System Special Study. Am J Kidney Dis 2015; 66: 297-304. DOI: 10.1053/j.ajkd.2015.01.024.

68. Lacson E, Jr., Xu J, Lin SF, et al. A comparison of SF-36 and SF-12 composite scores and subsequent hospitalization and mortality risks in long-term dialysis patients. Clin J Am Soc Nephrol 2010; 5: 252-260. DOI: 10.2215/CJN.07231009.

69. Lee SW, Lee A, Yu MY, et al. Is Frailty a Modifiable Risk Factor of Future Adverse Outcomes in Elderly Patients with Incident End-Stage Renal Disease? J Korean Med Sci 2017; 32: 1800-1806. DOI: 10.3346/jkms.2017.32.11.1800.

70. Lee SY, Yang DH, Hwang E, et al. The Prevalence, Association, and Clinical Outcomes of Frailty in Maintenance Dialysis Patients. J Ren Nutr 2017; 27: 106-112. DOI: 10.1053/j.jrn.2016.11.003.

71. Lee YH, Kim JS, Jung SW, et al. Gait speed and handgrip strength as predictors of all-cause mortality and cardiovascular events in hemodialysis patients. BMC Nephrol 2020; 21: 166. DOI: 10.1186/s12882-020-01831-8.

72. Lin YL, Hou JS, Lai YH, et al. Association of SARC-F Questionnaire and Mortality in Prevalent Hemodialysis Patients. Diagnostics (Basel) 2020; 10. DOI: 10.3390/diagnostics10110890.

73. Lin YL, Liou HH, Wang CH, et al. Impact of sarcopenia and its diagnostic criteria on hospitalization and mortality in chronic hemodialysis patients: A 3-year longitudinal study. J Formos Med Assoc 2020; 119: 1219-1229. DOI: 10.1016/j.jfma.2019.10.020.

74. Lopes AA, Lantz B, Morgenstern H, et al. Associations of self-reported physical activity types and levels with quality of life, depression symptoms, and mortality in hemodialysis patients: the DOPPS. Clin J Am Soc Nephrol 2014; 9: 1702-1712. DOI: 10.2215/CJN.12371213.

75. Lopez Revuelta K, Garcia Lopez FJ, de Alvaro Moreno F, et al. Perceived mental health at the start of dialysis as a predictor of morbidity and mortality in patients with end-stage renal disease (CALVIDIA Study). Nephrol Dial Transplant 2004; 19: 2347-2353. DOI: 10.1093/ndt/gfh392.

76. Lopez-Montes A, Martinez-Villaescusa M, Perez-Rodriguez A, et al. Frailty, physical function and affective status in elderly patients on hemodialysis. Arch Gerontol Geriatr 2020; 87: 103976. DOI: 10.1016/j.archger.2019.103976.

77. Lowrie EG, Curtin RB, LePain N, et al. Medical outcomes study short form-36: a consistent and powerful predictor of morbidity and mortality in dialysis patients. Am J Kidney Dis 2003; 41: 1286-1292. DOI: 10.1016/s0272-6386(03)00361-5.

78. Mansur HN, Lovisi JC, Colugnati FA, et al. Association of frailty with endothelial dysfunction and its possible impact on negative outcomes in Brazilian predialysis patients with chronic kidney disease. BMC Nephrol 2015; 16: 157. DOI: 10.1186/s12882-015-0150-1.

79. Mapes DL, Lopes AA, Satayathum S, et al. Health-related quality of life as a predictor of mortality and hospitalization: the Dialysis Outcomes and Practice Patterns Study (DOPPS). Kidney Int 2003; 64: 339-349. DOI: 10.1046/j.1523-1755.2003.00072.x.

80. Matos CM, Silva LF, Santana LD, et al. Handgrip strength at baseline and mortality risk in a cohort of women and men on hemodialysis: a 4-year study. J Ren Nutr 2014; 24: 157-162. DOI: 10.1053/j.jrn.2013.12.005.

81. Matsuzawa R, Kamitani T, Roshanravan B, et al. Decline in the Functional Status and Mortality in Patients on Hemodialysis: Results from the Japan Dialysis Outcome and Practice Patterns Study. J Ren Nutr 2019; 29: 504-510. DOI: 10.1053/j.jrn.2018.10.012.

82. Matsuzawa R, Matsunaga A, Wang G, et al. Relationship between lower extremity muscle strength and all-cause mortality in Japanese patients undergoing dialysis. Physical therapy 2014; 94: 947-956. 2014/03/01. DOI: 10.2522/ptj.20130270.

83. McAdams-DeMarco MA, Law A, Salter ML, et al. Frailty as a novel predictor of mortality and hospitalization in individuals of all ages undergoing hemodialysis. J Am Geriatr Soc 2013; 61: 896-901. DOI: 10.1111/jgs.12266.

84. McAdams-DeMarco MA, Tan J, Salter ML, et al. Frailty and Cognitive Function in Incident Hemodialysis Patients. Clin J Am Soc Nephrol 2015; 10: 2181-2189. DOI: 10.2215/CJN.01960215.

85. McClellan WM, Anson C, Birkeli K, et al. Functional status and quality of life: predictors of early mortality among patients entering treatment for end stage renal disease. Journal of clinical epidemiology 1991; 44: 83-89. 1991/01/01. DOI: 10.1016/0895-4356(91)90204-m.

86. McClellan WM, Flanders WD and Gutman RA. Variable mortality rates among dialysis treatment centers. Annals of internal medicine 1992; 117: 332-336. 1992/08/15. DOI: 10.7326/0003-4819-117-4-332.

87. Meulendijks FG, Hamaker ME, Boereboom FT, et al. Groningen frailty indicator in older patients with end-stage renal disease. Ren Fail 2015; 37: 1419-1424. DOI: 10.3109/0886022X.2015.1077315.

88. Mori K, Nishide K, Okuno S, et al. Impact of diabetes on sarcopenia and mortality in patients undergoing hemodialysis. BMC Nephrol 2019; 20: 105. DOI: 10.1186/s12882-019-1271-8.

89. Navaneethan SD, Kirwan JP, Arrigain S, et al. Adiposity measures, lean body mass, physical activity and mortality: NHANES 1999-2004. BMC Nephrol 2014; 15: 108. 2014/07/10. DOI: 10.1186/1471-2369-15-108.

90. Ng JK, Kwan BC, Chow KM, et al. Frailty in Chinese Peritoneal Dialysis Patients: Prevalence and Prognostic Significance. Kidney Blood Press Res 2016; 41: 736-745. DOI: 10.1159/000450563.

91. Nixon AC, Brown J, Brotherton A, et al. Implementation of a frailty screening programme and Geriatric Assessment Service in a nephrology centre: a quality improvement project. J Nephrol 2021; 34: 1215-1224. DOI: 10.1007/s40620-020-00878-y.

92. Noori N, Kopple JD, Kovesdy CP, et al. Mid-arm muscle circumference and quality of life and survival in maintenance hemodialysis patients. Clin J Am Soc Nephrol 2010; 5: 2258-2268. DOI: 10.2215/CJN.02080310.

93. Peng YS, Chiang CK, Hung KY, et al. Are both psychological and physical dimensions in health-related quality of life associated with mortality in hemodialysis patients: a 7-year Taiwan cohort study. Blood Purif 2010; 30: 98-105. DOI: 10.1159/000319002.

94. Peng YS, Huang JW, Hung KY, et al. Women on hemodialysis have lower self-reported health-related quality of life scores but better survival than men. J Nephrol 2013; 26: 366-374. DOI: 10.5301/jn.5000153.

95. Pereira RA, Cordeiro AC, Avesani CM, et al. Sarcopenia in chronic kidney disease on conservative therapy: prevalence and association with mortality. Nephrol Dial Transplant 2015; 30: 1718-1725. DOI: 10.1093/ndt/gfv133.

96. Plantinga LC, Patzer RE, Franch HA, et al. Serious Fall Injuries Before and After Initiation of Hemodialysis Among Older ESRD Patients in the United States: A Retrospective Cohort Study. Am J Kidney Dis 2017; 70: 76-83. DOI: 10.1053/j.ajkd.2016.11.021.

97. Pugh J, Aggett J, Goodland A, et al. Frailty and comorbidity are independent predictors of outcome in patients referred for pre-dialysis education. Clin Kidney J 2016; 9: 324-329. DOI: 10.1093/ckj/sfv150.

98. Rampersad C, Brar R, Connelly K, et al. Association of Physical Activity and Poor Health Outcomes in Patients With Advanced CKD. Am J Kidney Dis 2021; 78: 391-398. DOI: 10.1053/j.ajkd.2020.12.018.

99. Ren H, Gong D, Jia F, et al. Sarcopenia in patients undergoing maintenance hemodialysis: incidence rate, risk factors and its effect on survival risk. Ren Fail 2016; 38: 364-371. DOI: 10.3109/0886022X.2015.1132173.

100. Ritchie JP, Alderson H, Green D, et al. Functional status and mortality in chronic kidney disease: results from a prospective observational study. Nephron Clin Pract 2014; 128: 22-28. DOI: 10.1159/000362453.

101. Roberts JL. Analysis and outcome of 1063 patients trained for home hemodialysis. Kidney Int 1976; 9: 363-374. DOI: 10.1038/ki.1976.43.

102. Robinson-Cohen C, Littman AJ, Duncan GE, et al. Physical activity and change in estimated GFR among persons with CKD. J Am Soc Nephrol 2014; 25: 399-406. DOI: 10.1681/ASN.2013040392.

103. Roshanravan B, Khatri M, Robinson-Cohen C, et al. A prospective study of frailty in nephrology-referred patients with CKD. Am J Kidney Dis 2012; 60: 912-921. DOI: 10.1053/j.ajkd.2012.05.017.

104. Roshanravan B, Robinson-Cohen C, Patel KV, et al. Association between physical performance and all-cause mortality in CKD. J Am Soc Nephrol 2013; 24: 822-830. DOI: 10.1681/ASN.2012070702.

105. Rymarz A, Gibinska J, Zajbt M, et al. Low lean tissue mass can be a predictor of one-year survival in hemodialysis patients. Ren Fail 2018; 40: 231-237. DOI: 10.1080/0886022X.2018.1456451.

106. Santos PR. Evaluation of objective and subjective indicators of death in a period of one year in a sample of prevalent patients under regular hemodialysis. BMC research notes 2012; 5: 24. 2012/01/13. DOI: 10.1186/1756-0500-5-24.

107. Shah S, Leonard AC and Thakar CV. Functional status, pre-dialysis health and clinical outcomes among elderly dialysis patients. BMC Nephrol 2018; 19: 100. DOI: 10.1186/s12882-018-0898-1.

108. Shavit L, Mikeladze I, Torem C, et al. Mild hyponatremia is associated with functional and cognitive decline in chronic hemodialysis patients. Clin Nephrol 2014; 82: 313-319. DOI: 10.5414/CN108335.

109. Shi Y, Zheng D, Zhang L, et al. Six-minute walk test predicts all-cause mortality and technique failure in ambulatory peritoneal dialysis patients. Nephrology (Carlton) 2017; 22: 118-124. DOI: 10.1111/nep.12726.

110. Shimoda T, Matsuzawa R, Yoneki K, et al. Combined Contribution of Reduced Functional Mobility, Muscle Weakness, and Low Serum Albumin in Prediction of All-Cause Mortality in Hemodialysis Patients: A Retrospective Cohort Study. J Ren Nutr 2018; 28: 302-308. DOI: 10.1053/j.jrn.2017.12.012.

111. Shum CK, Tam KF, Chak WL, et al. Outcomes in older adults with stage 5 chronic kidney disease: comparison of peritoneal dialysis and conservative management. J Gerontol A Biol Sci Med Sci 2014; 69: 308-314. DOI: 10.1093/gerona/glt098.

112. Song YR, Kim JK, Lee HS, et al. Serum levels of protein carbonyl, a marker of oxidative stress, are associated with overhydration, sarcopenia and mortality in hemodialysis patients. BMC Nephrol 2020; 21: 281. DOI: 10.1186/s12882-020-01937-z.

113. Sood MM, Rigatto C, Bueti J, et al. The role of functional status in discharge to assisted care facilities and in-hospital death among dialysis patients. Am J Kidney Dis 2011; 58: 804-812. DOI: 10.1053/j.ajkd.2011.06.017.

114. Souweine JS, Pasquier G, Kuster N, et al. Dynapaenia and sarcopaenia in chronic haemodialysis patients: do muscle weakness and atrophy similarly influence poor outcome? Nephrol Dial Transplant 2021; 36: 1908-1918. DOI: 10.1093/ndt/gfaa353.

115. Stenvinkel P, Barany P, Chung SH, et al. A comparative analysis of nutritional parameters as predictors of outcome in male and female ESRD patients. Nephrol Dial Transplant 2002; 17: 1266-1274. 2002/07/10. DOI: 10.1093/ndt/17.7.1266.

116. Sy J, McCulloch CE and Johansen KL. Depressive symptoms, frailty, and mortality among dialysis patients. Hemodial Int 2019; 23: 239-246. DOI: 10.1111/hdi.12747.

117. Takaki J, Nakao M and Yano E. The relationship of quality of life and depression to mortality in hemodialysis patients. Dialysis & transplantation 2005; 34: 568-575.

118. Tennankore K, Zhao J, Karaboyas A, et al. The Association of Functional Status with Mortality and Dialysis Modality Change: Results from the Peritoneal Dialysis Outcomes and Practice Patterns Study (PDOPPS). Perit Dial Int 2019; 39: 103-111. DOI: 10.3747/pdi.2018.00094.

119. Tentori F, Elder SJ, Thumma J, et al. Physical exercise among participants in the Dialysis Outcomes and Practice Patterns Study (DOPPS): correlates and associated outcomes. Nephrol Dial Transplant 2010; 25: 3050-3062. DOI: 10.1093/ndt/gfq138.

120. Torino C, Manfredini F, Bolignano D, et al. Physical performance and clinical outcomes in dialysis patients: a secondary analysis of the EXCITE trial. Kidney Blood Press Res 2014; 39: 205-211. DOI: 10.1159/000355798.

121. Torino C, Raso FM, van Saase J, et al. Physical functioning and mortality in very old patients on dialysis. Arch Gerontol Geriatr 2019; 85: 103918. DOI: 10.1016/j.archger.2019.103918.

122. Tsai YC, Chen HM, Hsiao SM, et al. Association of physical activity with cardiovascular and renal outcomes and quality of life in chronic kidney disease. PLoS One 2017; 12: e0183642. DOI: 10.1371/journal.pone.0183642.

123. Turkmen K, Guney I, Yazici R, et al. Health-related quality of life, depression and mortality in peritoneal dialysis patients in Turkey: seven-year experience of a center. Ren Fail 2014; 36: 859-864. DOI: 10.3109/0886022X.2014.899874.

124. Utaş C. Patient and technique survival on CAPD in Turkey. Perit Dial Int 2001; 21: 602-606. 2002/01/11.

125. Valenzuela PL, Cobo F, Diez-Vega I, et al. Physical performance, plasma S-klotho, and all-cause mortality in elderly dialysis patients: A prospective cohort study. Exp Gerontol 2019; 122: 123-128. DOI: 10.1016/j.exger.2019.05.003.

126. van Loon I, Hamaker ME, Boereboom FTJ, et al. A closer look at the trajectory of physical functioning in chronic hemodialysis. Age Ageing 2017; 46: 594-599. DOI: 10.1093/ageing/afx006.

127. van Loon IN, Bots ML, Boereboom FTJ, et al. Quality of life as indicator of poor outcome in hemodialysis: relation with mortality in different age groups. BMC Nephrol 2017; 18: 217. DOI: 10.1186/s12882-017-0621-7.

128. van Loon IN, Goto NA, Boereboom FTJ, et al. Geriatric Assessment and the Relation with Mortality and Hospitalizations in Older Patients Starting Dialysis. Nephron 2019; 143: 108-119. DOI: 10.1159/000501277.

129. Vezza C, Vettoretti S, Caldiroli L, et al. Use of the Frailty Index in Older Persons With Chronic Kidney Disease. J Am Med Dir Assoc 2019; 20: 1179-1180. DOI: 10.1016/j.jamda.2019.04.015.

130. Vogt BP, Borges MCC, Goes CR, et al. Handgrip strength is an independent predictor of all-cause mortality in maintenance dialysis patients. Clin Nutr 2016; 35: 1429-1433. DOI: 10.1016/j.clnu.2016.03.020.

131. Wang AY, Sanderson JE, Sea MM, et al. Handgrip strength, but not other nutrition parameters, predicts circulatory congestion in peritoneal dialysis patients. Nephrol Dial Transplant 2010; 25: 3372-3379. DOI: 10.1093/ndt/gfq216.

132. Wang AY, Sea MM, Ho ZS, et al. Evaluation of handgrip strength as a nutritional marker and prognostic indicator in peritoneal dialysis patients. The American journal of clinical nutrition 2005; 81: 79-86. 2005/01/11. DOI: 10.1093/ajcn/81.1.79.

133. Watanabe T, Kutsuna T, Suzuki Y, et al. Perceived difficulty in activities of daily living and survival in patients receiving maintenance hemodialysis. Int Urol Nephrol 2021; 53: 177-184. DOI: 10.1007/s11255-020-02600-0.

134. Watson EL, Major RW, Wilkinson TJ, et al. The association of muscle size, strength and exercise capacity with all-cause mortality in non-dialysis-dependent CKD patients. Clin Physiol Funct Imaging 2020; 40: 399-406. DOI: 10.1111/cpf.12655.

135. Wetmore JB, Roetker NS, Gilbertson DT, et al. Early withdrawal and non-withdrawal death in the months following hemodialysis initiation: A retrospective cohort analysis. Hemodial Int 2019; 23: 261-272. DOI: 10.1111/hdi.12723.

136. Xu X, Yang Z, Ma T, et al. The cut-off values of handgrip strength and lean mass index for sarcopenia among patients on peritoneal dialysis. Nutr Metab (Lond) 2020; 17: 84. DOI: 10.1186/s12986-020-00506-3.

137. Yadla M, John JP and Mummadi M. A study of clinical assessment of frailty in patients on maintenance hemodialysis supported by cashless government scheme. Saudi journal of kidney diseases and transplantation : an official publication of the Saudi Center for Organ Transplantation, Saudi Arabia 2017; 28: 15-22. 2017/01/18. DOI: 10.4103/1319-2442.198102.

138. Yamamoto S, Matsuzawa R, Hoshi K, et al. Modified Creatinine Index and Clinical Outcomes of Hemodialysis Patients: An Indicator of Sarcopenia? J Ren Nutr 2021; 31: 370-379. DOI: 10.1053/j.jrn.2020.08.006.

139. Yazawa M, Kido R, Ohira S, et al. Early Mortality Was Highly and Strongly Associated with Functional Status in Incident Japanese Hemodialysis Patients: A Cohort Study of the Large National Dialysis Registry. PLoS One 2016; 11: e0156951. DOI: 10.1371/journal.pone.0156951.

140. Zhang Q, Zhang J, Zhang W, et al. Risk factors for decreased upper-limb muscle strength and its impact on survival in maintenance hemodialysis patients. Int Urol Nephrol 2020; 52: 1143-1153. DOI: 10.1007/s11255-020-02468-0.

Table S1. Description of included studies, grouped by population studied

Author, year	Country	Data Source	Population description	Tools assessed	Outcomes reported	Follow-Up Duration	N[l]	Age
CKD Non-Dialysis								
Chang, 2011	Taiwan	Prospective cohort	CKD stage 1-5, non-dialysis, aged 18-75, 1 center	HGS	Composite 1	up to 3[◊¥] years	128	60.7 ± 14.8
Roshanravan, 2012	USA	Secondary analysis	CKD stage 1-4, non-dialysis, 2 centers	Fried Frailty Index [modified exhaustion, low activity]; Weight Loss; Gait Speed; HGS; SF-36 Vitality Scale; Physical Activity	Composite 1	967 (1-1752)[§] days	336	58.7 ± 13.0
Roshanravan, 2013	USA	Secondary analysis	CKD stage 2-4, non-dialysis, 4 centers	6MWT; Gait Speed; TUG; HGS	Mortality	3 (2, 3.7)* years	385	62 ± 13
de Goeij, 2014	The Nether-lands	Secondary analysis	CKD patients, incident pre-dialysis, 25 centers	IPQ-R: Weight Loss, Loss of Strength, and Fatigue components; SF-36 PCS	Kidney Function; Composite 1	up to 0.5[◊¥] years	436	69 (56, 76)*
Navaneethan, 2014	USA	Secondary analysis	CKD stage 1-4, non-dialysis, aged >20 years, from a nationally representative survey of the US civilian, non-institutionalized population	LTPA	Mortality	4.5 ± 0.1[†¥] person years	2145	60.7 ± 0.7[†]

Ritchie, 2014	United Kingdom	Secondary analysis	CKD patients, non-dialysis, 1 center	KPS	Mortality; Kidney Function	2.9 (1.5, 4.8)* years	1515	KPS 100: 59.6 ± 15.7; KPS 90: 67.2 ± 12.7; KPS ≤80: 67.9 ± 13.1
Robinson-Cohen, 2014	USA	Secondary analysis	CKD stage 3-4, non-dialysis, 2 centers	Four Week Physical Activity History Questionnaire	Kidney Function	3.7 (-)* years	256	>150 min/wk: 61.7 ± 12.5 60-150 min/wk: 61.7 ± 12 1-60 min/wk: 58.8 ± 12.8 0 min/wk: 61.8 ± 11.3
Delgado, 2015 [25]	USA	Secondary analysis	CKD stage 3-5, non-dialysis, aged 18-70, 15 centers	Frailty, self-report [modified Fried and Woods]	Mortality	17 (11, 18)* years	812	52 (42, 61)*
Mansur, 2015	Brazil	Prospective cohort	CKD stage 3-5, pre-dialysis, 1 center	Johansen Frailty criteria [modified Fried and Woods]	Composite 1	1[◊¥] year	61	60.5 ± 11.5
Meulendijks, 2015	The Nether-lands	Prospective cohort	CKD patients visiting a pre-dialysis clinic, aged >65 years, 1 center	Groningen Frailty Indicator	Mortality; Hospitalization; Dialysis-Related Complications	up to 1[◊] year	63	75 (66, 92)*
Pereira, 2015	Brazil	Secondary analysis	CKD stage 3-5, non-dialysis, 1 center	Sarcopenia Method A (MAMC+HGS); Sarcopenia Method B (SGA+HGS); Sarcopenia Method C (SMI+HGS)	Mortality	up to 3.3[◊¥] years	287	59.9 ± 10.5

Pugh, 2016	United Kingdom	Prospective cohort	CKD patients at risk of ESRD referred to pre-dialysis, 1 center	CFS [adapted]	Mortality	up to 3[◊] years	283	74 (63, 81)*
Androga, 2017	USA	Secondary analysis	CKD stage 2-4, non-dialysis, aged >20 years, from a nationally representative survey of the US civilian, non-institutionalized population	ASMI; LTPA	Mortality	9.4 (7.8, 10.8)*[¥] years	1101	Nonsarcopenic, non-obese: 70.6 ± 1.0[†]; Sarcopenia only: 75.2 ± 1.1[†] Obese only: 70.8 ± 0.8[†] Sarcopenic-obese: 77.2 ± 1.0[†]
Tsai, 2017	Taiwan	Prospective cohort	CKD stage 1-5, non-dialysis, 1 center	HGS; 2-Minute Step; 30-Second Chair Stand	Hospitalization; CVD; Kidney Function	2.4 ± 0.9[¥] years	161	67.2 ± 7.8
Ali, 2018	United Kingdom	Prospective cohort	CKD stage 4-5, non-dialysis, aged >65 years, 1 center	Combined PRISMA/TUG	Mortality; Kidney Function	1.7[◊¥] years	104	Non-frail: 76.7 (65-87)[‡]; Frail: 77.4 (65-92)[‡]
Clarke, 2019	United Kingdom	Prospective cohort	CKD stage 1-5, non-dialysis, aged >18 years, 1 center	Gait Speed [self-report]; Walking; DASI	Mortality	3.6 (3.5, 3.8)*[¥] years	450	62 (48, 75)*
Gregg, 2019	USA	Prospective cohort	CKD stage 2-5, non-dialysis, 1 center	BDI-I - Fatigue; QIDS-SR_{16} - Fatigue; SF-12 Vitality Scale	Composite 2	1[◊¥] year	266	64 ± 12
Vezza, 2019	Italy	Prospective cohort	CKD stage 4-5, aged ≥65 years, 1 center	Frailty Index	Mortality; Hospitalization; Kidney Function	1[◊¥] year	115	80.2 ± 6.3
Kruse, 2020	USA	Secondary analysis	CKD patients, aged ≥65 years, 4 centers	SMI	Mortality; Kidney Function	7 (-)* years	351	(-)

Watson, 2020	United Kingdom	Secondary analysis	Combination of 2 study populations, CKD, non-dialysis, 1 center: Cohort 1, CKD stage 3b-4, aged ≥40 years; Cohort 2, CKD stage 3b-5, aged ≥18 years	Leg Extension Strength	Mortality; Hospitalization; Kidney Function	3.3 ± 1.8 years	89	62.8 ± 11.0
Rampersad, 2021	Canada	Prospective cohort	CKD stage 4-5, non-dialysis, 4 centers	PASE	Mortality; Kidney Function	1193◊ days	579	72 (62, 82)*
Incident Dialysis								
Hemodialysis								
Joly, 2003	France	Hospital records	HD, aged >80 years, 1 center	KPS	Mortality	up to 12◊ years	107	83.2 ± 2.9
Knight, 2003	USA	Hospital records	HD, aged >20 years, 782 centers	SF-36 PCS	Mortality	up to 2◊ years	14815	61.0 ± 15.4
Argyropoulos, 2009	USA	Secondary analysis	HD (<45 days), 81 centers	SF-36 PF Scale	Mortality	up to 9◊ years	491	59.1 ± 14.5
Hatakeyama, 2013	Japan	Hospital records	HD, aged >80 years, 1 center	ECOG-PS	Mortality	up to 10◊¥ years	141	84.2 ± 3.1
Delgado, 2015 [26]	USA	Secondary analysis	HD patients with Medicare, 297 centers	Frailty, self report [modified Fried, Woods, Johansen]; Exhaustion; Adjusted Activity Score; SF-12 PF Scale	Serious Fall Injuries	2.5 (1.0, 3.9)* years	1053	63 (52, 73)*
McAdams-DeMarco, 2015 [84]	USA	Secondary analysis	HD (<6 months), 27 centers	Fried Frailty Index	Mortality	1◊ year	324	54.8 ± 13.3

Yazawa, 2016	Japan	Registry data	HD, from registry data capturing 99% of the HD facilities in Japan	Functional Status – Ability to Perform ADL	Mortality	1[◊] year	7664	69 (59, 77)*
Lee, 2017	South Korea	Prospective cohort	HD, aged >65 years, 1 center	Multidimensional Frailty Score	Composite 3	1.5 (1.0, 1.8)*[¥] years	46	71.5 (67.8, 76.3)*
Plantinga, 2017	USA	Registry data	HD patients with Medicare, aged 67-100 years, from USRDS database	Functional Status – Form CMS-2728	Serious Fall Injuries	1[◊] year	81653	76.8 ± 6.5
Wetmore, 2019	USA	Registry data	HD patients with Medicare, aged ≥18 years, from USRDS database	Functional Status Score	Mortality; Withdrawal from Dialysis	0.5[◊¥] years	80284	71.7 ± 11.4
López-Montes, 2020	Spain	Prospective cohort	HD, aged ≥70 years, 1 center	Fried Frailty Index [modified low activity]	Mortality	1[◊¥] year	117	78.1 ± 4.1
Peritoneal Dialysis								
Utas, 2001	Turkey	Hospital records	CAPD, 12 centers	KPS	Mortality; Hospitalization	2.0 ± 1.5[¥] years	334	42.2 ± 13.8
Shum, 2014	Hong Kong	Hospital records	PD, aged >65 years, 1 center	Basic Activities of Daily Living	Mortality; Hospitalization	up to 8[◊] years	157	73.8 ± 5.4
Xu, 2020	China	Prospective cohort	CAPD (96.7%), 1 center	Sarcopenia (LMI + HGS); HGS	Mortality	3.0 ± (-)[¥] years	327	56.1 ± 15.0
Both HD & PD								
McClellan, 1991	USA	Prospective cohort	HD, CAPD (<6 weeks), 37 centers	KPS	Mortality	479.6 ± 10.4[†] days	294	56.6 ± 15.1
Chandna, 1999	United Kingdom	Hospital records	HD, PD, 1 center	KPS	Mortality	up to 5.3[◊¥] years	292	61.3 ± 15.8
Stenvinkel, 2002	Sweden	Secondary analysis	HD, CAPD, aged <70 years, 1 center	HGS	Mortality	3.1 (0.1-6.9)[‡¥] years	169	Men: 52.0 ± 1.0[†]; Women: 52.0 ± 1.0[†]

Lopez Revuelta, 2004	Spain	Prospective cohort	HD, PD, 34 centers	KPS [modified]; SF-36 PCS	Mortality; Hospitalization	771 (9-1259)[§] days	318	Diabetic: 61.9 ± 13.6; Non-diabetic: 57.0 ± 16.5
Johansen, 2007	USA	Secondary analysis	HD, PD, multiple centers	Johansen Frailty criteria [modified Fried and Woods]; SF-36 Vitality Scale; Physical Activity; SF-36 PF Scale	Mortality; Composite 3	1[◊] year	2275	58.2 ± 15.5
Bao, 2012	USA	Secondary analysis	HD, PD, 295 centers	Frailty, self report [modified Fried, Woods, Johansen]	Mortality; Hospitalization	2.9 (2.25-4)[§] years	1576	59.6 ± 14.2
Arai, 2014	Japan	Hospital records	HD, PD, aged >75 years, 1 center	Mobility – Criteria for Impaired Elderly	Mortality	0.5 ± 0.1[¥] years	202	80.4 ± 4.3
Hellberg, 2014	Sweden	Hospital records	HD, PD (<100 days), 1 center	HGS; Isometric quadriceps strength; Standing heel rise; Toe lift	Mortality	3.5 (-)* years	134	60 ± 16
Alfaadhel, 2015	Canada	Prospective cohort	HD, PD, 1 center	CFS	Mortality	1.7 (0.9, 2.8)* years	390	63 ± 15
Shah, 2018	USA	Registry data	HD, PD patients with Medicare, from USRDS database	Functional Status – Form CMS-2728	Mortality	1.8 ± 0.9[¥] years	49645	72 ± 11

Goto, 2019	The Nether-lands	Prospective cohort	HD, PD, aged ≥65 years, 17 centers	Fried Frailty Index [modified low activity]; Geriatric Assessment; Groningen Frailty Indicator; TUG; Katz' ADL; Lawton and Brody's IADL Scale; Functional Status Score (ADL & IADL)	Composite 4	0.5[◊¥] years	187	75 ± 7
van Loon, 2019	The Nether-lands	Prospective cohort	HD/PD (<2 weeks), aged ≥65 years, 17 centers	Fried Frailty Index [modified low activity]; Geriatric Assessment; Groningen Frailty Indicator; Clinical Impression [physician]; Surprise Question; TUG; Katz' ADL; Lawton and Brody's IADL Scale	Mortality; Hospitalization	up to 1[◊¥] year	192	75 ± 7
Unspecified								
Isoyama, 2014	Sweden	Secondary analysis	Dialysis modality unspecified, aged 18-75 years, 1 center	Sarcopenia; HGS	Mortality	up to 5[◊] years	330	54 ± 13

Inaguma, 2016	Japan	Secondary analysis	Dialysis modality unspecified, aged >20 years, 17 centers	BI	Mortality; CVD	up to 1200[◊] days	1496	67.4 ± 13.0
Chronic Dialysis								
Hemodialysis								
Roberts, 1976	USA	Prospective cohort	HHD, 12 centers	State of health	Mortality	up to 6[◊] years	981	39.7 ± 12.8
Jones, 1991	USA	Prospective cohort	HD (>1 month), 7 centers	KPS	Hospitalization	0.5[◊¥] years	527	>65 years: 31.8%
McClellan, 1992	USA	Registry data	HD, aged >20 years, 31 centers	KPS	Mortality	up to 1[◊] year	3612	55.1 ± 14.8
Kutner, 1994	USA	Secondary analysis	HD, aged >60 years, from a random sample drawn from the ESRD Network 20 census	Functional Limitations Score	Mortality	up to 2[◊] years	287	68.7 ± 5.9
DeOreo, 1997	USA	Prospective cohort	HD, 3 centers	SF-36 PCS	Mortality; Hospitalization	531 ± 231 days	1000	58.2 ± 15.4
Ifudu, 1998	USA	Prospective cohort	HD (>6 months), 8 centers	KPS [modified]	Mortality	up to 3[◊] years	522	60 ± 15
Lowrie, 2003	USA	Hospital records	HD, multiple centers	SF-36 PCS	Mortality; Hospitalization	0.5[◊¥] years	13592	59.0 ± 15.4
Mapes, 2003	USA	Secondary analysis	HD patients, 314 international centers	SF-36 Vitality Scale; SF-36 PCS; SF-36 PF Scale	Mortality; Hospitalization	(-)	10030	58.9 ± 14.9
Takaki, 2005	Japan	Prospective cohort	HD (>3 months), 4 centers	SF-36 Vitality Scale; SF-36 PCS; SF-36 PF Scale	Mortality	986 ± 264 days	490	60.3 ± 11.5
Koyama, 2010	Japan	Prospective cohort	HD, 3 centers	Fukuda Fatigue Scale	Mortality; CVD	2.2 (0.1-2.2)[§ ¥] years	788	61.8 ± 10.7

Noori, 2010	USA	Secondary analysis	HD (>8 weeks), 8 centers	MAMC	Mortality	730 (-)* days	792	54 ± 15
Peng, 2010	Taiwan	Prospective cohort	HD (>3 months), 14 centers	SF-36 PCS	Mortality	up to 7◊ years	888	57.9 ± 13.1†
Tentori, 2010	USA	Secondary analysis	HD, 626 international centers	Exercise Frequency	Mortality; Hospitalization	1.75 (-)* years	20920	60.7 ± 14.8
Jhamb, 2011	USA	Secondary analysis	HD (>3 months), aged 18-80, 15 centers	SF-36 Vitality Scale	Mortality; CVD	2.84 ± 1.84 years	1798	57.5 ± 14.0
Kohl, 2012	Brazil	Prospective cohort	HD (>6 months), 1 center	6MWT	Mortality	up to 12◊ years	52	37 ± 11
Santos, 2012	Brazil	Prospective cohort	HD (>3 months), 1 center	SF-36 PF Scale	Mortality	1◊ year	161	44.5 ± 15.6
Farrokhi, 2013	Canada	Secondary analysis	HD, aged >65 years, 1 center	4-Item Essential ADL Score	Mortality	up to 5◊ years	167	74.8 ± 5.9
McAdams-DeMarco, 2013 [83]	USA	Prospective cohort	HD, 1 center	Fried Frailty Index	Mortality; Hospitalization	3.0 (2.4, 3.1)* years	146	60.6 ± 13.6
Peng, 2013	Taiwan	Prospective cohort	HD (>3 months), 14 centers	SF-36 PCS	Mortality	up to 7◊ years	816	57.8 ± 13.1
Lopes, 2014	Brazil	Secondary analysis	HD, multiple international centers	RAPA	Mortality	1.6 (0.9, 2.5)* years	5763	63.4 ± 14.5
Matos, 2014	Brazil	Secondary analysis	HD, 4 centers	HGS	Mortality	2.8 (2.0, 3.8)* ¥ years	443	46.61 ± 14.09
Matsuzawa, 2014	Japan	Prospective cohort	HD, 1 center	Lower extremity muscle strength	Mortality	3.0 (0.2-7.0)‡ ¥ years	190	64 (57, 72)*
Shavit, 2014	Israel	Prospective cohort	HD, 1 center	Katz' ADL	Mortality	1◊ year	56	65.0 ± 17.8

Bossola, 2015	Italy	Prospective cohort	HD (>6 months), 1 center	SF-36 Vitality Scale	Mortality	3.6 ± 2.6[¥] years	126	Dead: 70.1 ± 11.1; Alive: 60.5 ± 15.2
Kutner, 2015	USA	Secondary analysis	HD (>3 months), 14 centers	Gait Speed	Mortality; Hospitalization	up to 3.3[◊¥] years	752	≥1.0 m/s: 50 ± 12.7 0.8 to <1.0 m/s: 56.8 ± 13.5 0.6 to <0.8 m/s: 60.1 ± 13.4 <0.6 m/s: 65 ± 12.9 Unable to walk: 64.7 ± 12.9
Bossola, 2016	Italy	Prospective cohort	HD (>6 months), 1 center	Katz' ADL; Lawton and Brody's IADL scale	Mortality	up to 7.5[◊¥] years	132	62 ± 15
Jassal, 2016	Canada	Secondary analysis	HD, multiple international centers	Functional Status Score (ADL & IADL)	Mortality; Hospitalization; Withdrawal from Dialysis	1.4 (0.7, 2.4)*[¥] years	7226	63.6 ± 14.4
Johansen, 2016	USA	Secondary analysis	HD (>3 months), 14 centers	Fried Frailty Index; Fried Frailty Index [modified slowness, weakness, exhaustion]	Mortality	1.7 (1.4, 2.4)* years	762	57.1 ± 14.2
Ren, 2016	China	Prospective cohort	HD (>6 months), 1 center	Sarcopenia Method C (SMI+HGS)	Mortality	1[◊] year	131	49.4 ± 11.7
Bancu, 2017	Spain	Prospective cohort	HD, 3 centers	Fried Frailty Index + Dialysis Time/Week	Mortality; Hospitalization	1[◊] year	320	70.26 ± 13.85

Fukuma, 2017	Japan	Secondary analysis	HD (>6 months), aged >65 years, single country data from an international cohort study	SF-12 PF Scale	Mortality	1◊ year	1376	Derivation cohort: 71.6 ± 5.1 Validation cohort: 71.9 ± 5.6
Kim, 2017	South Korea	Prospective cohort	HD (>3 months), 3 centers	Sarcopenia Status; HGS	Mortality; CVD	4.3 ± 0.8 years	142	59.8 ± 13.1
Kittiskulnam, 2017	USA	Secondary analysis	HD (>3 months), 14 centers	Sarcopenia (Muscle Mass/Height², BW, BSA, or BMI + Weakness); Sarcopenia (Muscle Mass/Height², BW, BSA, or BMI + Slowness); Gait Speed; HGS	Mortality	1.9 (0.1-3.2)‡ years	645	56.7 ± 14.5
Shi, 2017	China	Prospective cohort	HD (>3 months), 1 center	6MWT	Mortality; Peritonitis	2.0 (1.4, 2.3)* ¥ years	145	55.0 ± 13.0
van Loon, 2017 [126]	The Nether-lands	Secondary analysis	HD (>2 months), 29 centers	SF-36 PF Scale	Mortality; Transplantation	2◊ years	679	64.1 ± 13.7
van Loon, 2017 [127]	The Nether-lands	Secondary analysis	HD (>2 months), 29 centers	SF-36 Vitality Scale; SF-36 PF Scale	Mortality	2◊ years	714	64 ± 14
Yadla, 2017	India	Prospective cohort	HD (>6 months), 1 center	Fried Frailty Index	Mortality; Hospitalization	1◊ year	205	44.95 ± 13.27

Giglio, 2018	Brazil	Prospective cohort	HD (>3 months), aged >60 years, 6 centers	Sarcopenia [modified]; HGS	Mortality; Hospitalization	1.5 (1.0, 2.6)* ¥ years	170	70.6 ± 7.2
Rymarz, 2018	Poland	Prospective cohort	HD (>3 months), 1 center	LTI	Mortality	2.5 ± 1.7¥ years	48	59.83 ± 15.54
Shimoda, 2018	Japan	Hospital records	HD, 1 center	Combined Score	Mortality	up to 6.5◊ years	314	66.4 ± 11.2
Hall, 2019	USA	Registry data	HD (≥ 6 months), aged ≥65 years, from a nationally representative sample assembled by a large dialysis organization	SF-12 PCS	Mortality	151 (-)* days	1371	79.9 ± 4.5
Kalantar, 2019	USA	Secondary analysis	HD (>4 weeks), aged ≥18 years, 18 centers	SF-36 Vitality Scale; SF-36 PCS; SF-36 PF Scale	Mortality	up to 6◊ years	753	55 ± 14
Kuki, 2019	Japan	Prospective cohort	HD (>3 months), aged ≥20 years, 4 centers	Gait Speed; HGS	CVD	2 (-)* years	173	69.0 (62.5, 76.0)*
Kurita, 2019	Japan	Secondary analysis	HD, single country data from an international cohort study, up to 120 centers	SF-12 Vitality Scale	Mortality; Composite 5	2.7 (-)* years	3667	62.9 ± 12.1
Matsuzawa, 2019	Japan	Secondary analysis	HD, aged ≥18 years, single country data from an international cohort study, multiple centers	Functional Status Score (ADL & IADL)	Mortality	704 (642, 722)* days	817	62.3 ± 11.9

Mori, 2019	Japan	Prospective cohort	HD (>1 year), 1 center	Sarcopenia	Mortality	6.3 ± 2.9[¥] years	308	Without sarcopenia: 54.4 ± 11.0 With sarcopenia: 63.5 ± 11.0
Sy, 2019	USA	Secondary analysis	HD, aged ≥18 years, 14 centers	Fried Frailty Index	Mortality	2[◊] years	746	57.2 ± 14.2
Torino, 2019	Italy	Prospective cohort	HD, aged ≥75 years, 35 centers	SF-36 Vitality Scale; SF-36 PF Scale	Mortality	2.2 (1.3, 3.3)* years	245	81 ± 4
Valenzuela, 2019	Spain	Prospective cohort	HD, male only, 3 centers	6MWT; HGS; 30-Second Chair Stand	Mortality	1.5[◊¥] years	30	71 ± 9
Chao, 2020	Taiwan	Prospective cohort	HD, aged ≥20 years, 1 center	Laboratory Deficit-Based Frailty Index – 1; Laboratory Deficit-Based Frailty Index – 2	Mortality	2.7 ± 0.5[¥] years	33	69.5 ± 9.4
Jafari, 2020	Canada	Prospective cohort	HD (>6 months), aged >18 years, 2 centers	Fried Frailty Index [modified low activity]	Mortality	1[◊] year	97	62.9 ± 15.4
Lee, 2020	South Korea	Secondary analysis	HD (>3 months), aged >18 years, 6 centers	Physical Performance	Composite 5	2.1 ± (-)[¥] years	277	Normal gait speed and HGS: 58.6 ± 14.3 Normal gait speed and Low HGS: 61.5 ± 11.1 Low gait speed and Normal HGS: 63.7 ± 10.3 Low gait speed and HGS: 68.6 ± 12.0

Lin, 2020 [72]	Taiwan	Prospective cohort	HD (>3 months), aged >20 years, 1 center	SARC-F	Mortality	2◊ years	271	64.4 ± 14.3
Lin, 2020 [73]	Taiwan	Prospective cohort	HD (>3 months), aged >20 years, 1 center	Sarcopenia (SMI + HGS/Gait Speed); Gait Speed; HGS	Mortality; Hospitalization; Composite 3	3◊ years	126	63.2 ± 13.0
Souweine, 2020	France	Prospective cohort	HD (>3 months), multiple centers	Sarcopenia (CrI + MVF); Dynapenia; Voorrips Score	Mortality	2.0 (1.4-2.9)‡ ¥ years	187	65.3 ± 16.7
Song, 2020	South Korea	Prospective cohort	HD (>3 months), 1 center	Sarcopenia Status	Mortality; CVD	5.2 ± (-) years	88	60.6 ± 13.5
Zhang, 2020	China	Prospective cohort	HD (>3 months), aged ≥18 years, 1 center	Biceps Muscle Strength	Mortality; CVD	1◊¥ year	174	63.1 ± 12.3
Watanabe, 2021	Japan	Prospective cohort	HD, 1 center	ADL Difficulty	Mortality	4.8 (2.6, 7.7)* years	300	65.0 (57.3, 72.0)*
Yamamoto, 2021	Japan	Hospital records	HD (>3 months), 2 centers	Sarcopenia (CrI + HGS); Sarcopenia (CrI + Gait Speed); Gait Speed; HGS	Mortality; Composite 5	3.0 (1.5, 5.7)* years	542	65.3 ± 12.1
Peritoneal Dialysis								
Anderson, 1990	USA	Hospital records	CAPD (>2 weeks), 1 center	Activity of Daily Living Score	Mortality	1◊¥ year	44	64.5 ± 11
Anderson, 1997	USA	Hospital records	CAPD, 1 center	Activity of Daily Living Score	Mortality; Peritonitis; Discharge from Assisted Care Facility	1.1 ± 1.4¥ years	109	62.7 ± 12.8
Wang, 2005	Hong Kong	Prospective cohort	CAPD (>3 months), 1 center	HGS	Mortality; CVD	2.5 ± 1.2¥ years	233	55 ± 12

Wang, 2010	Hong Kong	Prospective cohort	PD (>3 months), 1 center	HGS	CVD	4[◊] years	218	56 ± 12
Kang, 2013	South Korea	Prospective cohort	CAPD, 1 center	LTLM; ASMI	Mortality	3.7 ± 3.1[¥] years	534	53.2 ± 14.1
Turkmen, 2014	Turkey	Prospective cohort	PD, aged 17-84, 3 centers	SF-36 PCS	Mortality	up to 7[◊] years	63	Survived: 43.6 ± 14.6; Died: 56.6 ± 15
de Oliveira, 2016	Brazil	Prospective cohort	PD (>3 months), 2 centers	SF-36 PF Scale	Mortality	2[◊] years	76	>60 years: 57.9% <59 years: 42.1%
Ng, 2016	Hong Kong	Prospective cohort	PD, 1 center	FQ	Mortality; Hospitalization; CVD; Peritonitis	1.9 ± 0.6[¥] years	193	60.6 ± 12.1
Jin, 2017	China	Prospective cohort	CAPD (>1 month), 1 center	RASM	Mortality	5.0 ± 2.0[¥] years	117	60.75 ± 12.24
Kamijo, 2018	Japan	Prospective cohort	PD (>2 months), aged >20 years, 1 center	CFS [adapted]; Sarcopenia (RASM + HGS/Gait Speed); Gait Speed; HGS	Mortality	589.2 ± (-) days	119	66.8 ± 13.2
Tennankore, 2019	Canada	Secondary analysis	PD, aged ≥18 years, multiple international centers	Functional Status Score (ADL & IADL)	Mortality	1.2 (0.7, 2.0)*[¥] years	2593	60.7 ± 14.2
Chan, 2020	Hong Kong	Prospective cohort	PD, 1 center	FQ	Mortality; Hospitalization; CVD	2[◊] years	267	Not Frail: 61.1 ± 11.8; Frail: 64.2 ± 12.2
Both HD & PD								
Anderson, 1993	USA	Prospective cohort	HD, PD, 73 centers	Activity of Daily Living Score	Mortality	up to 2.2[◊¥] years	228	65.5 ± 14.2

Kutner, 1997	USA	Secondary analysis	HD, PD, aged >60 years, 58 centers	Exercise Activity Score; Functional Limitations Score	Mortality	7◊ years	349	Survivors: 66.5 ± 5.6; Non-survivors: 69.1 ± 6.0
Bordenave, 1998	USA	Hospital records	HD, PD, 1 center	ADL	Withdrawal from Dialysis	up to 21◊ years	304	Age at time of death – Withdrawal deaths: 67 ± 11 Other deaths: 61 ± 11
Freedman, 2001	USA	Secondary analysis	HD, PD, patients with Medicare, multiple centers	KPS [modified]	Mortality	up to 5◊ years	3442	18-49.4 years: 25.5%; 49.5-61.7 years: 24.7%; 61.8-70.9 years: 25.3%; 71+ years: 24.5%
Jhamb, 2009	USA	Secondary analysis	HD, PD, 81 centers	SF-36 Vitality Scale	Mortality	1065 (-)* days	917	57.9 ± 14.8
Lacson, 2010	USA	Hospital records	HD, PD, multiple centers	SF-36 PCS; SF-12 PCS	Mortality; Hospitalization	up to 1◊ year	44395	61.2 ± 15.1
Sood, 2011	Canada	Hospital records	HD, PD, hospitalized patients, 11 centers	Katz' ADL	Mortality; Discharge to Assisted Care Facility; Composite 6; Discharge Home	7.5 (3.9, 17.2)* days	1286	<65 years: 62.4% 66-80 years: 29.2% >80 years: 8.3%
Torino, 2014	Italy	Secondary analysis	HD, PD (>6 months), multiple centers	6MWT	Mortality; Hospitalization; CVD; Composite 3	3.3 (2.7, 3.5)* years	296	65 ± 13
Vogt, 2016	Brazil	Hospital records	HD, PD (>3 months), 1 center	HGS	Mortality	up to 3◊¥ years	265	59 ± 15.2

Kang, 2017 [55]	South Korea	Secondary analysis	HD, PD (>6 months), aged >20 years, 27 centers	Johansen Frailty Criteria [modified weight loss]; Disability; SF-36 PCS	Mortality; Hospitalization	HD: 489 ± 116 days; PD: 467 ± 104 days	1616	HD: 56.4 ± 13.2; PD: 54.1 ± 11.9
Kang, 2017[54]	South Korea	Secondary analysis	HD, PD (>6 months), aged >20 years, 27 centers	Physical Activity – WHO Recommendations	Mortality; CVD	500[◊] days	1611	Active: 57.3 ± 11.6; Intermediate: 56.1 ± 12.2; Inactive: 56.1 ± 12.2
Lee, 2017	South Korea	Prospective cohort	HD, PD (>6 months), aged >20 years, 27 centers	Johansen Frailty Criteria [modified weight loss]; Disability	Mortality; Hospitalization	1.4 (-)*[¥] years	1658	55.9 ± 12.9
Brar, 2019	Canada	Prospective cohort	HHD, PD, 1 center	Fried Frailty Index [modified low activity]; Fried Frailty Index [modified low activity] + Clinical Impression [physician]; Clinical Impression [nurse]; Clinical Impression [physician]; SPPB; Weight Loss; Gait Speed; HGS; CES-D - Exhaustion; PASE	Mortality	3.3 (2.5, 4.1)* years	109	Not Frail: 51 (43, 64)*; Frail: 64 (51, 73)*
Ducharlet, 2019	Australia	Prospective cohort	HD, PD (>3 months), 5 centers	POS-S Renal - Weakness; POS-S Renal - Mobility	Mortality	254 ± (-) days	102	70 (-)*

Jegatheswaran, 2020	Canada	Prospective cohort	HD, PD (>3 months), aged >18 years, 1 center	FRAIL Questionnaire	Mortality; Hospitalization; Transplantation	1.5[◊¥] years	261	63.3 ± 15.6
Jiang, 2020	China	Registry data	HD, PD, aged >18 years, from a national inpatient care database	Frailty (Johns Hopkins ACG)	Mortality; Hospitalization; Discharge to Assisted Care Facility	(-)	1424026	(-)
Unspecified								
Brito, 2020	Brazil	Prospective cohort	Dialysis modality unspecified (>3 months), aged ≥18 years, 12 centers	SF-36 PCS; SF-36 PF Scale	Mortality	9[◊] years	670	53.9 ± 15.2
Other								
Beddhu, 2009	USA	Secondary analysis	CKD stage 2-5, aged >20 years, from a nationally representative survey of the US civilian, non-institutionalized population	LTPA	Mortality	7[◊] years	907	Recommended activity: 68 ± 1.1; Insufficient activity: 66 ± 1.1; Inactive: 73 ± 0.9
Dai, 2017	Sweden	Secondary analysis	CKD stage 1-5 non-dialysis (including LD transplant recipients) and CKD stage 5 dialysis (HD and PD) patients, derived from multiple prospective cohort studies	HGS	Mortality	5[◊¥] years	985	% HGS ≥75: 55 (32-70)[¶]; % HGS <75: 64 (44-79)[¶]

Nixon, 2020	United Kingdom	Prospective cohort	CKD (non-dialysis), HD, 1 center	CFS [adapted]	Mortality; Hospitalization	210 (203, 217)* days	450	Not Frail: 74 (63, 85)*; Frail: 81 (67, 95)*

Values are mean ± standard deviation unless otherwise specified

* Median (interquartile range); ◊ Number; † Mean (standard error); ‡ Mean (range); § Median (range); ¶ Median (10^{th}-90^{th} percentile); ¥ converted to years

(-) denotes missing values

‖ Some sample sizes represent our target population and therefore may be a subcategory of the total reported study population in studies.

Abbreviations: 6MWT, 6-Minute Walk Test; ADL, Activities of Daily Living; ASMI, Appendicular Skeletal Mass Index; BDI-I, Beck Depression Inventory-I; BI, Barthel Index; BMI, body mass index; BSA, body surface area; BW, body weight; CAPD, continuous ambulatory peritoneal dialysis; CES-D, Center for Epidemiologic Studies Depression Scale; CFS, Clinical Frailty Scale; CMS, Centers for Medicare & Medicaid Services; Composite 1, Mortality/Need for RRT; Composite 2, Mortality/Hospitalization/Need for RRT; Composite 3, Mortality/Hospitalization; Composite 4, Mortality/Functional Status Decline; Composite 5, Mortality/CVD; Composite 6, In-Hospital Mortality/Discharge to Assisted Care Facility; CrI, Creatinine Index; CKD, chronic kidney disease; CVD, cardiovascular disease; DASI, Duke Activity Status Index; ECOG, Eastern Cooperative Oncology Group Performance Status; ESRD, end-stage renal disease; FQ, Frailty Score; HD, hemodialysis; HGS, handgrip strength; HHD, home hemodialysis; IADL, Instrumental Activities of Daily Living; IPQ-R, Revised Illness Perception Questionnaire; KPS, Karnofsky Performance Status; LD, living donor; LMI, Lean Mass Index; LTI, Lean Tissue Index; LTLM, limb/trunk lean mass ratio; LTPA, Leisure Time Physical Activity; MAMC, midarm muscle circumference; MVF, Maximal Voluntary Force; PASE, Physical Activity Scale for the Elderly; PCS, Physical Component Summary; PD, peritoneal dialysis; PF, physical function; POS-S, Palliative Care Outcome Scale Symptoms; PRISMA, Program on Research for Integrating Services for the Maintenance of Autonomy; QIDS-SR_{16}, Quick Inventory of Depressive Symptomology-Self Report; RAPA, Rapid Assessment of Physical Activity; RASM, relative appendicular skeletal muscle; RRT, renal replacement therapy; SGA, Subjective Global Assessment; SMI, Skeletal Muscle Index; SPPB, Short Physical Performance Battery; SF-12, 12-Item Short Form Survey; SF-36, 36-Item Short Form Survey; TUG, Timed Up-and-Go Test; USRDS, United States Renal Data System; WHO, World Health Organization.

Table S2. Description of frailty and functional status instruments

2A. Frailty Tools

Tool	Measurement method	Criteria for Frailty
Overall Frailty		
Fried Frailty Index[49,83, 84, 116, 137]	Frailty score with 5 domains; a score of 0 or 1 is given to each domain based on the following criteria: Shrinking = self-report unintentional weight loss >10 pounds in the last year Slowness = time to walk 15 feet, below an established cut-off by sex and height Weakness = grip strength below an established cut-off based on sex and BMI Exhaustion = self-report (questions about endurance and energy from CES-D scale) Low activity = Minnesota Leisure Time Physical Activity questionnaire (kcal/week below an established cut-off)	Frail = 3 or higher Not Frail = 0-2 [Alternatively: Not Frail (0-1), Intermediately Frail (2), and Frail (3-5)]
Fried Frailty Index [modified low activity][15, 33, 41, 76, 128]	Frailty score with 5 domains; a score of 0 or 1 is given to each domain based on the following criteria: Shrinking = self-report unintentional weight loss >10 pounds in the last year Slowness = time to walk 13.1 feet, below an established cut-off by sex and height Weakness = grip strength below an established cut-off based on sex and BMI Exhaustion = self-report (questions about endurance and energy from CES-D scale) Low activity[†;] various instruments including: • Calcumed Instrument; • Paffenbarger Physical Activity Index Questionnaire; low activity = <383kcal/week (male), <270 kcal/week (female); • PASE questionnaire; low activity = <383 kcal/week (male); <270 kcal/week (female) • Self-report; low activity = last 3 months ≥ 4 hours sedentary lifestyle, no activities like cycling or running	Frail = 3 or higher Not Frail = 0-2 [Alternatively: Not Frail (0), Pre-Frail (1-2), and Frail (3-5)]

Fried Frailty Index [modified exhaustion, low activity] [103]	Frailty score with 5 domains; a score of 0 or 1 is given to each domain based on the following: Shrinking = self-report unintentional weight loss >10 pounds in the last 6 months Slowness = gait speed below 20th percentile for sex and height Weakness = grip strength below an established cut-off based on sex and BMI Exhaustion[†]= SF-36 Vitality Scale <37.5 Low activity[†]= self-report; physically inactive = exercising "never" or <1 time/week	Frail = 3 or higher Not Frail = 0-2
Fried Frailty Index [modified slowness, weakness, exhaustion][49]	Frailty score with 4 domains (with the 5 standard components); 2 points for slowness/weakness and 1 point for each of the other criteria based on the following: Shrinking = self-report unintentional weight loss >10 pounds in the last year Slowness/weakness[†]= SF-36 PF Scale <75 Exhaustion[†]= SF-36 Vitality Scale <55 Low activity = Minnesota Leisure Time Physical Activity questionnaire (kcal/week below an established cut-off)	Frail = 3 or higher Not Frail = 0-2
Johansen Frailty Criteria [modified Fried and Woods][48,78]	Frailty score with 4 domains (with the 5 standard components); 2 points for slowness/weakness and 1 point for each of the other criteria based on the following: Shrinking[†]= classification as "undernourished" or "malnourished" by dialysis staff Slowness/weakness[†]= SF-36 PF Scale <75 Exhaustion[†]= SF-36 Vitality Scale <55 Low activity[†]= self-report; inactive = exercising "almost never" or "never"	Frail = 3 or higher Not Frail = 0-2
Johansen Frailty Criteria [modified weight loss][55,70]	Frailty score with 4 domains (with the 5 standard components); 2 points for slowness/weakness and 1 point for each of the other criteria based on the following: Shrinking = self report unintentional weight loss >10 pounds in the last year Slowness/weakness[†]= SF-36 PF Scale <75 Exhaustion[†]= SF-36 Vitality Scale <55 Low activity[†]= self-report; inactive = "almost never" or "never"	Frailty = 3 or higher Pre-Frail = 1-2 Not Frail = 0

Frailty, self-report [modified Fried and Woods][25]	Frailty score with 4 domains (with the 5 standard components); 2 points for slowness/weakness and 1 point for each of the other criteria based on the following: Shrinking†= >5% of standard body weight loss at 1 year, to a weight of 75-95% of standard body weight Slowness/weakness†= study specific questionnaire; ability to perform ADLs = lowest quartile Exhaustion†= study specific questionnaire; lack of pep/energy; tiring easily = moderate or severe Low activity = study specific Leisure Time Physical Activity questionnaire (kcal/week x kg in the lowest quartile)	Frail = 3 or higher Intermediately Frail = 1-2 Not Frail = 0
Frailty, self report [modified Fried, Woods, Johansen][10,26]	Frailty score with 3 domains; 1 point is allocated to each of the following criteria: slowness/weakness†= SF-12 PF Scale <75 exhaustion†= participants answered "a little of the time" or "none of the time" when asked how often they felt they had a lot of energy during the past 4 weeks low activity†= Adjusted Activity Score of the Human Activity Profile; lowest quintile for age and sex	Frail = 2-3 Not Frail = 0-1
Fried Frailty Index + Dialysis Time/Week[9]	Frailty score with the Fried Frailty Index, scored as normal. An additional component, dialysis time (hours/week), is applied afterwards and modifies the frailty designation.	Frail = 3 or higher AND greater than 12 hours of dialysis per week Not Frail = 0-2 OR 3 or higher but less than 12 hours of dialysis per week
Fried Frailty Index [modified low activity] + Clinical Impression [physician] [15]	Combined Fried Frailty Index (low activity measured using PASE) and physician impression of frailty.	Frail = score 3 or higher on both tools

Clinical Frailty Scale (CFS) [1]	Clinical judgement based on 7 categories, with each level increasing in degree of frailty: 1. Very fit - robust, active, energetic, well motivated, and fit; fittest in their age group 2. Well - without active disease but not as fit as those in Category 1 3. Well- with treated comorbid disease 4. Apparently vulnerable - not dependent, but has symptoms from comorbid disease (such as being slowed up) 5. Mildly frail - limited dependence on others for IADLs 6. Moderately frail - help is needed for IADLs and ADLs 7. Severely frail - completely dependent on others for IADLs and ADLs, or terminally ill	Per one-category increase
Clinical Frailty Scale (CFS) [adapted] [53,91,97]	A modification of the CFS. Categories 1 through 6 are the same. Category 7 is divided into the following: 7. Severely frail - Completely dependent for personal care, but seems stable and not at high risk of dying (within 6 months) 8. Very severely frail – Completely dependent, approaching end of life; typically, could not recover even from a minor illness 9. Terminally ill – Approaching the end of life; people with a life expectancy of <6 months who are not otherwise evidently frail	Managing well = 1–3 Vulnerable to mildly frail = 4–5 Moderate to severe frailty= 6–8 [Alternatively: Not Frail (1-4), Frail (5-8); or per one-category increase]
Clinical Impression [nurse] [15]	Nurse asked to indicate how frail the patient was on a 5-point Likert scale ranging from 0 (very fit) to 5 (very frail).	Frail = 3 or higher Not Frail = 1-2
Clinical Impression [physician] [15,128]	Treating physician/nephrologist asked to indicate how frail the patient was on a 5-point Likert scale ranging from 0 (very fit) to 5 (very frail).	Frail = 3 or higher Not Frail = 1-2 [Alternatively: a 10-point scale was used with Frailty = 5 or higher]

Combined PRISMA / Timed Up-and-Go (TUG) [2]	Combination of PRISMA, a 7-item frailty questionnaire, and the TUG test (time needed to stand up and walk 3m). Components of PRISMA (1 point scored for each affirmative answer): Q1. Are you more than 85 years old? Q2. Male? Q3. Do you have any health problems that require you to limit your activity? Q4. Do you need someone to help you on a regular basis? Q5. Do you have any health problems that require you to stay at home? Q6. In case of need, can you count on someone close to you? Q7. Do you regularly use stick, walker, or wheelchair to get around?	Frail = PRISMA score ≥ 3 AND a TUG time ≥ 8 seconds
Combined Score[110]	Frailty tool with 4 domains; malnutrition, slowness, and weakness assigned a score of 0-3 based on quartiles; inactivity is scored as either 0 (ADL independence) or 3 (any ADL dependence). Total score ranges from 0 (least frail) to 12 (most frail). Malnutrition = serum albumin Slowness = walking time over a 10m course Weakness = grip strength, stratified by sex Inactivity = dependence in any of the following: transfer to bed, chair, wheelchair, toilet, tub, shower; walking; stair climbing	Low score < 5 [Alternatively: Per 1-point increase]
Frailty Index[129]	A 38-item tool considering deficits in the following areas: cardiovascular, ADL, physical performance, mood, cognition, anthropometric measures, nutritional status, and biochemical parameters. Each item scored 0 (deficit absent) or 1 (deficit present). The Frailty Index was the ratio between the number of deficits presented and the total number of deficits considered.	Frail = ≥ 0.25
Frailty (Johns Hopkins ACG)[46]	Johns Hopkins adjusted clinical groups (ACG) frailty-defining diagnosis indicator is a binary variable based on ICD-9 codes and 12 clusters of frailty-defining diagnoses. In brief, the included ICD-9 codes were for nutritional marasmus, senile dementia, impairment (eyes), decubitus ulcer, incontinence (urine, feces), abnormal weight loss, lack of housing, difficulty walking, and falls.	Frail = meeting the criteria for any of the 12 clusters of frailty-defining diagnoses
Frailty Score (FQ)[17,90]	Frailty assessed by 30 dichotomous questions about personal health, psychological and physical state, body weight, ADLs, and mobility. Total score of 0-30.	Not Frail = ≤ 5 Mild = 6 to 8 Moderate = 9 to 11 Severely Frail = 12 or above

FRAIL Questionnaire [43]	5 components, each scored 1 point: Fatigue: are you too tired to exercise? Resistance: can you climb one flight of stairs without assistance? Aerobic: can you walk one block without assistance? Illnesses: 5 or more illnesses (confirmed with medical records) Loss of weight: >5% weight loss over the past year (obtained from medical records)	Frail = ≥ 3 Pre-frail = 1-2 Not Frail = 0
Geriatric Assessment [33, 128]	Measure of impairment in 7 domains using validated questionnaires/structured assessments. One point is given for each impaired domain (for a total out of 7) as follows: (a) ADL (Katz): ≥ 1 dependency (b) IADL (Lawton and Brody): ≥ 1 dependency (c) Mobility (TUG): > 20s (d) Cognitive: Mini-Mental State Examination: < 25; Clock Drawing Test: ≥ 10; Enhanced Cued Recall: < 14; Fluency: < 5th percentile (e) Depression (Geriatric Depression Scale): ≥ 5 (f) Malnutrition (Mini Nutritional Assessment): ≤ 17 (g) Comorbidity (Cumulative Illness Rating Scale - Geriatrics): ≥ 2 x Score 3 or ≥ 1 x Score 4 (renal comorbidity excluded)	Frail = ≥ 2 impairments Fit = < 2 impairments [Alternatively: Frail (≥ 3 impairments)]
Groningen Frailty Indicator [33,87, 128]	This is a 15-item tool, subdivided into four geriatric domains: physical functioning (mobility, ADLs, vision, hearing, and weight loss), cognitive functioning, social functioning (loneliness), and psychological functioning (anxiety, depression).	Frail = ≥ 4 Not Frail = < 4
Laboratory Deficit-Based Frailty Index – 1[20]	23 laboratory items collected from routine hematology, biochemistry, and vital signs. Each item beyond the normal range is assigned one point. The scores for each item were summed and divided by the total number of items.	Frail/Not Frail groups determined by the mean score of the study cohort
Laboratory Deficit-Based Frailty Index - 2[20]	32 laboratory items collected from routine hematology, biochemistry, urinalysis, and vital signs. Each item beyond the normal range is assigned one point. The scores for each item were summed and divided by the total number of items.	Frail/Not Frail groups determined by the mean score of the study cohort

Multidimensional Frailty Score[69]	Frailty tool based on the Comprehensive Geriatric Assessment consisting of 9 items: (1) malignant disease, (2) Charlson Comorbidity Index, (3) serum albumin, (4) ADL (modified BI), (5) IADL (Lawton and Brody Index), (6) dementia (Mini-Mental State Examination), (7) risk of delirium (Nursing Delirium Screening), (8) malnutrition (Mini Nutritional Assessment), and (9) MAMC. Each item is scored 0-2 based on predetermined cut-offs.	Frail = 10 or higher Not Frail = 0-9
Short Physical Performance Battery (SPPB) [15]	A composite of balance, gait speed, and chair stand testing. Total score between 0-12, with higher scores indicating better function.	Frail = 10 or less Not Frail = 10-12
Surprise Question[128]	Clinicians were asked whether they would be surprised if the patients would die within 6 months after dialysis initiation.	Frail = answer NO to surprise question ("Not Surprised") Not Frail = answer YES ("Surprised")
Sarcopenia		
Appendicular Skeletal Muscle Index (ASMI) [6, 56]	Sum of both upper and lower extremities' lean mass by the square of the height (kg/m^2) [measured by DXA].	Gender-based cut-offs established by young, healthy, reference population Sarcopenia: ASMI = $<7.26 kg/m^2$ (male)/$5.5 kg/m^2$ (female) [Alternatively: Categorized by tertiles; Lowest tertile = $<6.54 kg/m^2$ (male) and $<5.69 kg/m^2$ (female)]
Lean Tissue Index (LTI)[105]	Total lean tissue mass by the square of the height (kg/m^2) [measured by BIS]. The difference between the patient's LTI and the 10^{th} percentile (by age and gender) of a reference population is calculated (ΔLTI).	Sarcopenia = $\Delta LTI \leq -1$ Not sarcopenic = $\Delta LTI \geq 0$

Limb/Trunk Lean Mass Ratio (LTLM) [56]	Sum of 4 limbs divided by trunk lean mass [measured by DXA].	Low LTLM tertile: <0.7943 (male), <0.7100 (female) Middle LTLM tertile: 0.7943-0.8745 (male) and 0.7100-0.8116 (female) High LTLM tertile: >0.8745 (male), >0.8116 (female)
Midarm Muscle Circumference (MAMC)[92]	MAMC (cm) = midarm circumference (cm) – 3.142 x triceps skinfold thickness (TSF) (cm) MAMC measured with plastic tape; TSF measured with calipers.	Quartiles of MAMC
Relative Appendicular Skeletal Muscle (RASM)[47]	Sum of both upper and lower extremities' muscle mass by the square of the height (kg/m^2) [measured by BIA].	Sarcopenia = Men: RASM <7.0 kg/m^2; Women: RASM <5.7 kg/m^2 No Sarcopenia = Men: RASM ≥7.0 kg/m^2; Women: RASM ≥5.7 kg/m^2
Skeletal Muscle Mass Index (SMI)[62]	Skeletal muscle mass calculated by the following equation: SMI (kg) = (($height^2$/BIA–resistance x 0.401) + (sex x 3.825) + (age x -0.071)) + 5.102	Normal: ≥10.76 kg/m^2 (male); ≥6.76 kg/m^2 (female) Class I Sarcopenia: 8.51-10.75 kg/m^2 (male); 5.76-6.75 kg/m^2 (female) Class II Sarcopenia: ≤8.50 kg/m^2 (male); ≤5.75 kg/m^2 (female)
SARC-F[72]	5-item self-report questionnaire: (a) How much difficulty do you have in lifting and carrying 10 lbs? (b) How much difficulty do you have with walking? (c) How much difficulty do you have transferring from a chair or bed? (d) How much difficulty do you have climbing a flight of 10 stairs? (e) How many times have you fallen in the past year? Each component was scored from 0 (no difficulty or no fall) to 2 (great difficulty or more than 4 falls). Total score between 0 and 10.	Sarcopenia: ≥ 1 [Alternatively, sarcopenia: ≥ 4]

Sarcopenia [40,88]	Sarcopenia = low muscle mass and low muscle strength (below sex specific cut-offs) Muscle mass: ASMI = the sum of lean soft tissue of the arms and legs by the square of the height (kg/m²) [measured by DXA] Muscle strength: HGS (i.e., the maximum value measured by a dynamometer using the dominant hand)	Gender-based cut-offs established by young, healthy, reference population. Cut-offs vary by geographic location.
Sarcopenia [modified][32]	Sarcopenia = low muscle mass and low muscle strength (below sex specific cut-offs) Muscle mass: ASMI = the sum of lean soft tissue of the arms and legs by the square of the height (kg/m²) [estimated by equation] Muscle strength: HGS	Gender-based cut-offs established by young, healthy, reference population Sarcopenia: ASMI = <7.26kg/m² (male)/5.45kg/m² (female) AND HGS = <30kg (male)/<20kg (female)
Sarcopenia (CrI + Gait Speed)[138]	Sarcopenia = low muscle mass and slowness Muscle mass: Creatinine Index (CrI) was calculated using the following formula: CrI (mg/kg/d) = 16.21 + 1.12 X [1 if male; 0 if female] – 0.06 X age (years) – 0.08 X single-pool Kt/Vurea + 0.009 X serum creatinine before dialysis (μmol/L). Slowness: gait speed	Cut-offs determined by median of study cohort. Sarcopenia: CrI = <20.8mg/kg/d AND gait speed = <1.0m/s
Sarcopenia (CrI + HGS) [138]	Sarcopenia = low muscle mass and weakness Muscle mass: CrI was calculated using the following formula: CrI (mg/kg/d) = 16.21 + 1.12 X [1 if male; 0 if female] – 0.06 X age (years) – 0.08 X single-pool Kt/Vurea + 0.009 X serum creatinine before dialysis (μmol/L). Weakness: HGS	Cut-offs determined by median of study cohort. Sarcopenia: CrI = <20.8mg/kg/d AND HGS = <28kg (male)/18kg (female)
Sarcopenia (CrI + MVF)[114]	Sarcopenia = low muscle mass and low muscle strength. Muscle Mass: CrI, a type of creatinine kinetic modelling Muscle Strength: Maximal voluntary force (MVF) of the quadriceps, measured with a dynamometer	Cut-offs determined by median of study cohort. Sarcopenia: CrI < median AND MVF < median
Sarcopenia (LMI + HGS)[136]	Sarcopenia = low muscle mass and weakness Muscle mass = Lean mass index (LMI) = lean body mass/height^2; lean body mass (kg) = (1 if male; 0 if female) x 4.72 + height (cm) x 0.28 + weight (kg) x 0.27 + HGS (N) x 0.02 – dialysis duration (months) x 0.04 – 26.84 Weakness = HGS	Sarcopenia: Low LMI: < 16.7 kg/m^2 (male)/13.8 kg/m^2 (female) Low HGS: < 24.5 kg (male)/14.0 kg (female)

Sarcopenia (Muscle Mass/Height² + Slowness)[58]	Sarcopenia = low muscle mass and slowness Muscle mass: total body muscle mass by the square of the height (kg/m²) [measured by BIS] Slowness: gait speed (i.e., usual walk speed measured over a 15-foot course)	Gender-based cut-offs established by young, healthy, reference population Sarcopenia: muscle mass/height² = <7.89kg/m² (male)/6.05kg/m² (female) AND gait speed = ≤0.8m/s
Sarcopenia (Muscle Mass/BW + Slowness) [58]	Sarcopenia = low muscle mass and slowness Muscle mass: total body muscle mass by BW (%) [measured by BIS] Slowness: gait speed	Gender-based cut-offs established by young, healthy, reference population Sarcopenia: muscle mass/BW = <32.68% (male)/27.65% (female) AND gait speed = ≤0.8m/s
Sarcopenia (Muscle Mass/BSA + Slowness) [58]	Sarcopenia = low muscle mass and slowness Muscle mass: total body muscle mass by BSA (kg/m²) [measured by BIS] Slowness: gait speed	Gender-based cut-offs established by young, healthy, reference population Sarcopenia: muscle mass/BSA = <14.31kg/m² (male)/11.64kg/m² (female) AND gait speed = ≤0.8m/s
Sarcopenia (Muscle Mass/BMI + Slowness) [58]	Sarcopenia = low muscle mass and slowness Muscle mass: total body muscle mass by BMI (m²) [measured by BIS] Slowness: gait speed	Gender-based cut-offs established by young, healthy, reference population Sarcopenia: muscle mass/BMI = <0.97/m² (male)/0.72kg/m² (female) AND gait speed = ≤0.8m/s

Sarcopenia (Muscle Mass/Height² + Weakness) [58]	Sarcopenia = low muscle mass and weakness Muscle mass: total body muscle mass by the square of the height (kg/m²) [measured by BIS] Weakness: HGS	Gender-based cut-offs established by young, healthy, reference population Sarcopenia: muscle mass/height² = <7.89kg/m² (male)/6.05kg/m² (female) AND HGS = <26kg (male)/<16kg (female)
Sarcopenia (Muscle Mass/Body Weight (BW) + Weakness) [58]	Sarcopenia = low muscle mass and weakness Muscle mass: total body muscle mass by BW (%) [measured by BIS] Weakness: HGS	Gender-based cut-offs established by young, healthy, reference population Sarcopenia: muscle mass/BW = <32.68% (male)/27.65% (female) AND HGS = <26kg (male)/<16kg (female)
Sarcopenia (Muscle Mass/Body Surface Area (BSA) + Weakness) [58]	Sarcopenia = low muscle mass and weakness Muscle mass: total body muscle mass by BSA (kg/m²) [measured by BIS] Weakness: HGS	Gender-based cut-offs established by young, healthy, reference population Sarcopenia: muscle mass/BSA = <14.31kg/m² (male)/11.64kg/m² (female) AND HGS = <26kg (male)/<16kg (female)
Sarcopenia (Muscle Mass/Body Mass Index (BMI) + Weakness) [58]	Sarcopenia = low muscle mass and weakness Muscle mass: total body muscle mass by BMI (m²) [measured by BIS] Weakness: HGS	Gender-based cut-offs established by young, healthy, reference population Sarcopenia: muscle mass/BMI = <0.97/m² (male)/0.72kg/m² (female) AND HGS = <26kg (male)/<16kg (female)

Sarcopenia (RASM + HGS/Gait Speed) [53]	Sarcopenia = low muscle mass + weakness and/or poor physical function (below sex specific cut-offs) Muscle mass: Relative Appendicular Skeletal Muscle (RASM) = appendicular skeletal muscle mass divided by the square of the height (kg/m²) [measured by BIA] Weakness: HGS Physical function: gait speed	Gender-based cut-offs established by young, healthy, reference population Sarcopenia: RASM = <7.0 g/m^2 (male)/5.7kg/m^2 (female) AND HGS = <26kg (male)/<18kg (female) AND/OR gait speed = <0.8m/s
Sarcopenia (SMI + HGS/Gait Speed)[73]	Sarcopenia = low muscle mass + weakness and/or slowness (below sex specific cut-offs) Muscle mass: Skeletal Muscle Mass Index (SMI) = skeletal muscle mass/height squared (kg/m²) [measured by BIA] Weakness: HGS Slowness: gait speed	Gender-based cut-offs established by young, healthy, reference population Sarcopenia: SMI = <10.76kg/m² (male)/6.76kg/m² (female)] AND HGS = <30kg (male)/<20kg (female) AND/OR gait speed = <0.8m/s [Alternatively: SMI = <8.87kg/m^2 (male)/6.42kg/m^2 (female) AND HGS = <26kg (male)/<18kg (female) AND/OR gait speed = <0.8m/s]
Sarcopenia Method A (MAMC + Handgrip Strength (HGS))[95]	Sarcopenia = low muscle mass and low muscle strength (below sex specific cut-offs) Muscle mass = MAMC (cm) = midarm circumference (cm) – 3.142 x TSF (cm) Muscle strength = HGS	Gender-based cut-offs established by young, healthy, reference population Sarcopenia: MAMC = below the 50th percentile of a reference population AND HGS = below the 30th percentile of a reference population

Sarcopenia Method B (SGA + HGS) [95]	Sarcopenia = low muscle mass and low muscle strength (below sex specific cut-offs) Muscle mass = muscle wasting as determined by the physical examination component of the Subjective Global Assessment (SGA) Muscle strength = HGS	Gender-based cut-offs established by young, healthy, reference population Sarcopenia: SGA = + for muscle wasting AND HGS = below the 30th percentile of a reference population
Sarcopenia Method C (SMI + HGS) [95,99]	Sarcopenia = low muscle mass and low muscle strength (below sex specific cut-offs) Muscle mass: Skeletal Muscle Mass Index (SMI) = skeletal muscle mass/height squared (kg/m²) [measured by BIA] Muscle strength = HGS	Gender-based cut-offs established by young, healthy, reference population Sarcopenia: SMI = <10.76kg/m² (male)/6.76kg/m² (female) AND HGS = below the 30th percentile of a reference population [Alternatively: <30kg (male)/<20kg (female)]
Sarcopenia Status [57,112]	Sarcopenia = low muscle mass and low muscle strength (below sex specific cut-offs) Muscle mass: LTI = total lean tissue mass by BSA (kg/m²) [measured by BIS] Muscle strength: HGS	Gender-based cut-offs established by young, healthy, reference population Sarcopenia: LTI = 2 SDs below the mean of a reference population AND HGS = <30kg (male)/<20kg (female) [Alternatively: LTI <10th percentile of a reference population]

Revised Illness Perception Questionnaire (IPQ-R) – Weight Loss[23]	Questionnaire about the onset of symptoms: weight loss component.*	Presence or absence of weight loss
Weight Loss[15, 103]	Self-reported amount of unintentional weight loss using questionnaire.	Weight loss = loss of ≥ 10lbs in 6 months [Alternatively: loss of ≥ 10lbs in 12 months]
Gait		
Gait Speed [15, 53, 58, 63, 67, 73, 103,104, 138	Usual walk speed measured over a 13.1-foot, 15-foot, or 32-foot course.	Assessed as a continuous measure or categorically using various cut-off values
Gait Speed [self-report][21]	Self-report of walking pace, extracted from the General Practice Physical Activity Questionnaire.	Fast (> 4mph) Brisk Steady Slow (< 3mph)
6-Minute Walk Test (6MWT) [60, 104,109, 120,125	The goal of this test is to walk as far as possible in six minutes.	By various increments (in meters)
Timed Up-and-Go (TUG) [33, 104, 128	Time to get up from a fully seated position, walk around a cone placed 4m away, and then return to a seated position.	Fast (< 12s) Slow (≥ 12s) [Alternatively: Mildly Impaired (10-20s), Impaired (> 20s); or per 1s slower]
2-Minute Step[122]	Patient alternately raises each knee for 2 minutes. Score based on the number of repetitions.	Good endurance: > 105 repetitions Poor endurance: ≤ 105 repetitions

Strength Measurement		
Handgrip Strength (HGS) [15,19,22, 32,37, 40, 53, 57, 58, 63, 73, 80, 103, 104, 115, 122, 125,130-132, 136, 138	Patients hold a dynamometer (posture varies by study) and are encouraged to squeeze the instrument as hard as possible for 3 seconds. HGS repeated 2-4 times for dominant and non-dominant hands. The maximum value is used.	Weak/Low Strength = below a sex (and/or BMI) based cut-off (varies by study) [Alternatively: Per unit decrease]
Biceps Muscle Strength[140]	Measured with a digital handheld dynamometer in the non-fistula hand or dominant hand. Each measurement was repeated 3 times and the mean value (in kg) was used.	Low/High muscle strength groups determined by the mean score of the study cohort
Dynapenia[114]	Dynapenia is defined as normal muscle mass and low muscle strength. Muscle Mass: CI, a type of creatinine kinetic modelling Muscle Strength: MVF of the quadriceps, measured with a dynamometer	Cut-offs determined by median of study cohort. Dynapenia: CI > median AND MVF < median
Isometric quadriceps strength[37]	Measurement of proximal strength knee stretch against resistance (kg multiplied by cm).	Normative reference values: 25th percentile= 1134 kg x cm 50th percentile= 1412 kg x cm 75th percentile= 1658 kg x cm [Alternatively: Per unit change]
Leg Extension Strength[134]	5- or 10-repetition maximum tests using leg extension equipment. Maximal leg extension strength (the weight that participants were unable to lift more than 5 or 10 times with good form) was estimated using a prediction equation.	Greater score (measured in kg) indicates greater strength
Lower extremity muscle strength[82]	Knee extensor strength = Participants were seated on a bed with knees flexed to 90 degrees and told to push against the dynamometer pad by attempting to straighten their knees for a period of 5 seconds. Each side measured 3 times; average calculated by taking the highest value for the right and left legs. To adjust for physical constitution differences, this value was divided by dry weight and expressed as a percentage.	Low strength = < 40%

Standing heel rise[37]	Measurement of distal strength. Patient stands against a wall and repeatedly gets up on tiptoe and down again until fatigue.	Normative reference value: 25 repetitions [Alternatively: Per unit change]
30-Second Chair Stand[122, 125]	The number of repetitions in 30 seconds to stand fully from a seated position.	Good endurance: > 11 repetitions Poor endurance: ≤ 11 repetitions [Alternatively: Based on population median]
Toe lift[37]	Measurement of distal strength. Patient stands against a wall with the heels on the floor and repeatedly moves the forefoot up and down until fatigue.	Normative reference value: 20 repetitions [Alternatively: Per unit change]
Revised Illness Perception Questionnaire (IPQ-R) – Loss of Strength[23]	Questionnaire about the onset of symptoms: loss of strength component.*	Presence or absence of loss of strength
Beck Depression Inventory-I (BDI-I) – Fatigue[34]	Fatigue component of the BDI-I, self reported on a Likert scale of 0 (no fatigue) to 3 (severe fatigue): 0: I don't get any more tired than usual 1: I get tired more easily than I used to 2: I get tired from doing anything 3: I get too tired to do anything	Fatigue = 1-3 No Fatigue = 0
CES-D – Exhaustion[15]	2 exhaustion related questions from the CES-D scale.	Exhaustion: answer "occasionally" or "most or all of the time" to either question

Exhaustion[26]	Exhaustion determined by the response to the following question on the KDQOL-36 questionnaire: (1) How much of the time during the last 4 weeks did you have a lot of energy?	Exhaustion defined as answering either: (1) a little of the time OR (2) none of the time
Fukuda Fatigue Scale [61]	Subjects used a Likert scale (0-4) to rate how often in a recent week they experienced the following symptoms: Feeling so tired that I want to lie down at times; Feeling tired and without energy; Becoming very tired with just a small amount of exercise or work; Feeling sluggish lately; A recent lack of physical energy; Thinking that the way I get tired recently is abnormal; General fatigue lately; Even after a night's sleep do not feel refreshed.	High fatigue: scores exceeding twice the SD of the mean of healthy subjects
Palliative Care Outcome Scale Symptoms (POS-S) Renal – Weakness[28]	POS-S Renal is a survey of 18 specific symptoms that affect renal patients. Weakness/low energy over the past week was scored on the following scale: 0=not at all (no effect) 1=slightly (but not bother to be rid of it) 2=moderately (limits some activity of concentration) 3=severely (activities or concentration markedly affected) 4=overwhelming (unable to think of anything else)	Weakness/Low Energy = 3-4
Quick Inventory of Depressive Symptomatology-Self Report (QIDS-SR$_{16}$) – Fatigue[34]	Fatigue component of the QIDS-SR16, self reported on a Likert scale of 0 (no fatigue) to 3 (severe fatigue): Which item best describes you for the past 7 days? 0: There is no change in my usual level of energy 1: I get tired more easily than usual 2: I have to make a big effort to start or finish my usual daily activities 3: I really cannot carry out most of my usual daily activities because I just don't have enough energy	Fatigue = 1-3 No Fatigue = 0
Revised Illness Perception Questionnaire (IPQ-R) – Fatigue[23]	Questionnaire about the onset of symptoms: fatigue component. *	Presence or absence of fatigue

SF-36 Vitality Scale[13,44,45, 48, 52, 79, 103,117, 121,127]	A four-item measure of vitality (energy level and fatigue) over the previous 4 weeks, scores range from 0 to 100, with lower score indicating more fatigue. Questions asked include: Did you feel full of pep? Did you have a lot of energy? Did you feel worn out? Did you feel tired?	Low vitality = below a cut-off (varies by study) [Alternatively: By category (varies by study, e.g. by quartile), or per unit change]
SF-12 Vitality Scale[34, 64]	Vitality component of the SF-12: "How much time during the past 4 weeks did you have a lot of energy?" Fatigue is measured with a Likert score range of 1 ("all of the time") to 5 or 6 ("none of the time").	Higher scores represent more fatigue
Exercise Activity Score[65]	Three questions, each receiving a score of 1 (often) to 4 (never). How frequently do you do: (1) work in the garden? (2) take walks? (3) engage in active sports or exercises?	Most active = 3 points Least active = 12 points (change in exercise activity = 3-point shift towards least active)
Exercise Frequency [119]	Physical exercise measured by asking: 'How often do you exercise [do physical activity] during your leisure time?' Answer options: 1. Daily or almost daily 2. 4-5 times/week 3. 2-3 times/week 4. About once/week 5. Less than once/week 6. Almost never or never	Exercise frequency categories: 1. 6-7 times/week 2. 4-5 times/week 3. 2-3 times/week 4. Once/week 5. < once/week or never [Alternatively: per decrease in exercise frequency category]
Four Week Physical Activity History Questionnaire [102]	Frequency and duration of the following activities in the previous month: walking for exercise, jogging, biking, aerobics, golf, tennis, swimming, weight training, running on a treadmill, or using an aerobic machine. Number of minutes per week averaged for each activity.	Exercise per week: None 1-60 min/week 60-150 min/week >150 min/week

Human Activity Profile - Adjusted Activity Score[26]	94-item questionnaire assessing ability to perform activities of increasing metabolic equivalents (MET), ranging from getting in or out of a chair/bed (score = 1) to running 3 miles in ≤30 minutes (score = 94). Each activity is answered as (1) still doing the activity; (2) stopped doing the activity; or (3) never did the activity. The Adjusted Activity Score is the highest-level activity the respondent can still perform minus the number of activities they have stopped.	Inactivity = Lowest quintile, stratified by age and gender
Leisure Time Physical Activity (LTPA) [6,11, 89]	Questionnaire assessing frequency of various leisure time activities in the past 30 days: walking a mile without stopping, running, jogging, cycling, swimming, aerobics, dancing, calisthenics, garden/yard work, lifting weights, etc. Physical activity converted to METs based on the Compendium of Physical Activities. Activity level presented as METs, METs/wk, or MET-min/wk.	Low physical activity = < 450 MET/wk [Alternatively: By category (cut-offs/units vary by study), or per unit change]
Physical Activity[48,103]	How often do you exercise (do physical activity during your leisure time)?	Inactive = almost never or never [Alternatively: <1 time per week or never]
Physical Activity Scale for the Elderly (PASE) [15, 98]	A self-report tool that includes questions about activities (occupational, household, leisure) performed during the previous 7 days. A total score was calculated by multiplying the total time spent per week or participation (yes/no) by a weighted score assigned to each activity and summed across all activity items.	Low physical activity: 0-40 Light physical activity: 41-90 Moderate to high physical activity: >90 [Alternatively: Low physical activity = <383kcal/week (male), <270kcal/week (female)]
Physical Activity – WHO Recommendations[54]	The amount of moderate or vigorous intensity activity in a 3-month period. Scoring based on 2010 WHO Global Recommendations for Physical Activity for Health.	Active = moderate activity for >30min/day for 5 days a week OR high intensity for >20min/day for 3 days a week Intermediate Inactive = physical activity <1 time per week

Rapid Assessment of Physical Activity (RAPA)[74]	Questionnaire with binary (yes or no) questions for light, moderate, and vigorous physical activities with increasing intensity. Score chosen by selecting the question with highest score with an affirmative response.	Sedentary = 1 Infrequently active = 2 Sometimes active = 3 Often active = 4-5 Very active = 6-7
Voorrips Score[114]	An assessment of physical activity/muscle function in the past 3 months.	Not specified
Walking[21]	Self-report number of hours spent walking each week (including walking to work, shopping, and walking for pleasure), extracted from the General Practice Physical Activity Questionnaire.	None Some, but < 1 hour 1-3 hours ≥ 3 hours

* For this study, only a portion of the questionnaire was relevant; these components include weight loss, loss of strength and fatigue component

† Indicates differences from Fried

Abbreviations: 6MWT, 6-Minute Walk Test; ADL, Activities of Daily Living; ASMI, Appendicular Skeletal Mass Index; BDI-I, Beck Depression Inventory-I; BI, Barthel Index; BIA, bioelectrical impedance analysis; BIS, bioelectrical impedance spectroscopy; BMI, body mass index; BSA, body surface area; BW, body weight; CES-D, Center for Epidemiologic Studies-Depression; CFS, Clinical Frailty Scale; CrI, Creatinine Index; DXA, duel-energy x-ray absorbtiometry; FQ, Frailty Score; HD, hemodialysis; HGS, handgrip strength; IADL, Instrumental Activities of Daily Living; IPQ-R, Revised Illness Perception Questionnaire; LMI, Lean Mass Index; LTI, Lean Tissue Index; LTLM, limb/trunk lean mass ratio; LTPA, Leisure Time Physical Activity; MAMC, midarm muscle circumference; MET, metabolic equivalent; MVF, maximal voluntary force; PASE, Physical Activity Scale for the Elderly; PF, physical function; POS-S, Palliative Care Outcome Scale – Symptoms; QIDS-SR_{16}, Quick Inventory of Depressive Symptomatology – Self Report; RAPA, Rapid Assessment of Physical Activity; RASM, relative appendicular skeletal muscle; SGA, Subjective Global Assessment; SMI, Skeletal Muscle Index; SPPB, Short Physical Performance Battery; TSF, triceps skinfold thickness; TUG, Timed Up-and-Go Test; WHO, World Health Organization.

2B. Functional Status Tools

Tool	Measurement method	Criteria for Poor Functional Status
Activity of Daily Living Score[3-5]	ADL scores determined by geriatricians based on ability to eat, dress, bathe, groom, ambulate, communicate, transfer, and use the toilet. Each activity was scored (maximum score of 16): 2 points (total independence), 1 point (assistance required), 0 (total dependency). Maintaining urinary continence was sometimes included (maximum score of 18).	Reduced ADL = below mean value (varies by study) [Alternatively: Per 1-point change]
ADL[12]	Degree of restriction of daily living activities.	No restriction Moderate restriction Severe restriction
ADL Difficulty[133]	Lower limb function evaluated by a 12-item questionnaire developed for HD patients: rising from chair (1), floor (2); sitting down on floor (3); walking 100m (4), 300m (5), 600m (6), 1km (7), 20m quickly (8); walking up/down 1 or 2 flights of stairs (9-12). Each item scored 1-5 points based on perceived difficulty: 1, not possible; 2, severe difficulty; 3, moderate difficulty; 4, mild difficulty; 5, ease. A lower score (out of a maximum of 60) indicates greater ADL difficulty.	ADL difficulty = < 45 (median)
Barthel Index (BI)[39]	10 items: eating, transferring between the bed and wheelchair, grooming, using the toilet, bathing, walking on a flat surface, climbing and descending stairs, dressing, controlling bowel movements, and controlling urination. Each item is evaluated on a two-point (0 and 5) or four-point (0, 5, 10, and 15) scale, with a total score 0-100 (in increments of 5).	High = 100 Middle = 75-95 Low = ≤ 70
Basic Activities of Daily Living[111]	Categorizes patients as either independent or impaired.	Independent Impaired
Disability[55,70]	4-item ADL score assessing the patient's ability to eat, dress, get out of bed, and bathe. Each activity was scored according to assistance required: no help (0 points); some help (1 point); full help (2 points).	No Disability = 0 Disability = 1-8

Duke Activity Status Index (DASI)[21]	A 12-item ADL questionnaire. Each activity is assigned a metabolic equivalent of tasks (METs) value, the sum of which provides a score out of 58.2. A higher DASI score is associated with better physical functioning.	Better physical function: > 19.2 METS
Functional Limitations Score[65,66,]	Five questions, answer to each determines whether the next question is posed, or final score is determined from that question. (1) Does patient spend most or all day in bed or chair? Patient's reported difficulty doing specific activities: (2) Bathing independently, (3) Climbing a few flights of stairs, (4) Walking several blocks, (5) Performing heavy work around the house.	Most severe = 1 Moderately severe = 2 Least severe = 3 No impairment = 4
Functional Status – Ability to Perform ADL[139]	Inability to perform ADL evaluated by nephrologist, and categorized as: severe (bedridden), moderate (overt difficulties in exerting basic ADL), or mild/none (none or some functional disabilities that are not moderate or severe).	Severe Moderate Mild/none
Functional Status – Form CMS-2728 [96, 107]	Question(s) on Medicare ESRD eligibility Form CMS-2728 relating to functional status: 1. inability to ambulate 2. inability to transfer 3. needs assistance with daily activities	An affirmative answer to any of the three questions implies poor functional status
Functional Status Score[135]	Based on a previously developed algorithm. Data obtained from Medicare billings claims data, including claims for use of durable medical equipment.	≤ 0 (High functional status) 1-2 3-4 5-6 ≥ 7 (Low functional status)
Katz' ADL§ [14,33, 108, 113,128]	Evaluates eating, dressing, bathing, toileting, transferring, and continence. 1 point is given for independence in each area, up to a maximum of 6.	Impairment: < 6 [Alternatively: Per unit change, OR Severe functional impairment: ≤ 2 Moderate impairment = 4 Full function = 6]

4-Item Essential ADL Score [29]	4-item ADL score with a dichotomous scale assessing the patient's ability to walk 50 yards, transfer from a chair, dress, and bathe independently. Score = total number of items for which the patient required help (0 = needs no assistance on any of the 4 items)	Score 0 (no disability) Score 1 Score 2 Score 3 Score 4 (severe disability) [Alternatively: Per unit change]
Lawton and Brody's IADL Scale[14, 33, 128]	Assesses independence in: using the telephone, shopping, food preparation, housekeeping, laundering, traveling, taking medications, and handling finances. 1 point is given for independence in each area, with a total score of 8.	Impairment = <8 Not impaired = 8
Functional Status Score (ADL & IADL) [33, 42, 81, 118]	Combined ADL and IADL scale to assess overall functional status score; ability to perform 5 ADLs (Katz) and 8 IADLs (Lawton-Brody); total score out of 13. ADLs (ability to perform task without assistance – yes/no): eating, getting dressed, bathing, using the toilet, transferring from bed to chair IADLs (ability to perform the task – no help/some help/unable to do at all): using the telephone, getting places beyond walking distance, grocery shopping, preparing meals, doing housework or handyman work, doing laundry, taking medications, managing money	Categorized into increasingly smaller groups Functionally independent: 13 11 to < 13 8 to < 11 Most dependent: < 8
Eastern Cooperative Oncology Group Performance Status (ECOG-PS)[36]	Categories assigned by doctors: 0. Fully active, able to carry on all pre-disease performance without restriction 1. Restricted in physically strenuous activity but ambulatory and able to carry out work of a light or sedentary nature 2. Ambulatory and capable of all selfcare but unable to carry out any work activities. Up and about more than 50% of waking hours 3. Capable of only limited selfcare, confined to bed or chair more than 50% of waking hours 4. Completely disabled. Cannot carry on any selfcare. Totally confined to bed or chair 5. Dead	Low performance status: >1

Karnofsky Performance Scale (KPS)[18,50,51,85, 86, 100, 124]	Patient's ability to carry on normal activities, categorized as one of the following: 100: Normal (no complaints, no sign of disease) 90: Capable of normal activity (few symptoms or signs of disease) 80: Normal activity with some difficulty (some symptoms or signs) 70: Caring for self (not capable of normal activity or work) 60: Requiring some help (can take care of most personal requirements) 50: Requires help often (needs frequent medical care) 40: Disabled (requires special care and help) 30: Severely disabled (hospital admission indicated but no risk of death) 20: Very ill (urgently requiring admission, requires supportive measures or treatment) 10: Moribund (rapidly progressive fatal disease processes) 0: Death	Normal activity: ≥ 80 Requiring assistance = 50-70 Dependent: ≤ 40 (minor variations in categories/cut-offs between studies) [Alternatively: Low functional status = < 70, or per unit change]
Karnofsky Performance Scale (KPS) [modified] [30,38,75]	Modified KPS comprising 14 different levels of activity, with narrower ranges at each level: 96-100: Normal function, no disability 91-95: Minor signs and symptoms, full activity 81-90: Usual activities with effort 76-80: Independent, most out of home activities 70-75: Independent, limited to home 65-69: Needs assistance with errands 60-64: Needs assistance with meal preparation 55-59: Needs assistance with bathing/dressing 50-54: Home attendant, not totally disabled 45-49: Disabled, living at home 40-44: Nursing home for long term care 35-39: Hospitalized, fair condition 30-34: Hospitalized, poor condition < 30: Hospitalized, progressive fatal process	Low functional status: < 70 [Alternatively: By quartile, or per unit change]

Mobility – Criteria for Impaired Elderly[7]	Mobility was divided into 8 categories: i. able to walk without any limitation ii. Able to walk without assistance only in the neighbourhood iii. Able to walk without assistance only indoors iv. Need assistance to walk v. able to stand without assistance, but not walk vi. Need assistance to stand vii. Able to roll over without assistance in bed, but not stand viii. Need assistance to roll over in bed	Independent mobility = i Moderately impaired mobility = ii, iii Impaired mobility = iv – viii
Palliative Care Outcome Scale Symptoms (POS-S) Renal – Mobility[28]	POS-S Renal is a survey of 18 specific symptoms that affect renal patients. Low mobility over the past week was scored on the following scale: 0=not at all (no effect) 1=slightly (but not bother to be rid of it) 2=moderately (limits some activity of concentration) 3=severely (activities or concentration markedly affected) 4=overwhelming (unable to think of anything else)	Low mobility = 3-4
Physical Performance[71]	Physical performance assessed by gait speed and handgrip strength (HGS). Gait speed: usual walk speed measured over a 13.1-foot course. The average of 3 tests was used. HGS: measured on the dominant hand. The highest value of 3 tests was used. Low gait speed and HGS were defined by suggestions made by the Asian Working Group for Sarcopenia.	Low physical performance: gait speed = <0.8m/s AND HGS = <26kg (male)/18kg (female)
State of Health [101]	Health status assigned by doctor: Health status 1: able to carry on essentially normal activity having only inconsequential signs or symptoms Health status 2: able to carry on limited activity, having some signs or symptoms Health status 3: carried on minimal activity, but cared for personal needs Health status 4: unable to care for themselves, requiring hospital or equivalent care at home Health status 5: moribund-preterminal	Health status 1 to 5

SF-36 Physical Component Summary (PCS)[16, 23,27,52, 55, 59,68, 75, 77, 79,93, 94, 117,123]	SF-36 PCS, includes up to 26 questions on physical functioning (10 questions), role-physical (4), bodily pain (2), and general health (4). Some studies included the domains of vitality (4) and social functioning (2) in the summary score. Scale of 0 to 100; higher scores represent better physical function outcomes.	Low physical function = below a cut-off (varies by study) [Alternatively: By category (varies by study, e.g. by quartile), or per unit change]
SF-12 PCS[35,68]	Shortened version of the SF-36 PCS. Only includes 7 questions on physical functioning (2), role-physical (2), bodily pain (1), general health (1), and vitality (1) (vs. 26 questions in the SF-36 PCS). Scale of 0 to 100; higher scores represent better physical function outcomes.	Categories: <25; 25-29; 30-34; 35-39; 40-44; >44 [Alternatively: Per unit change]
SF-36 Physical Function (PF) Scale[8,16,24, 48, 52, 79, 106, 117, 121, 126,127]	SF-36 PF domain; includes 10 questions that assess patients' self reported challenges completing common physical activities requiring varying levels of effort, such as bending and kneeling or walking a mile. Scale from 0 (lowest functioning) to 100 (highest functioning).	By 10-point change or by various cut-offs
SF-12 PF Scale[26,31]	Shortened version of the SF-36 PF domain. Two questions (vs. 10 questions in the SF-36 PF domain) assess level of difficulty in performing moderate activities and climbing several flights of stairs. Scale from 0 (lowest functioning) to 100 (highest functioning).	Low Function: <75 [Alternatively: Categorized as 0; 25; 50; 75; 100]

[§]Sood, 2018(ref) deviates from scoring scheme: 12 points total: No/mild impairment = 0-1; Moderate impairment = 2-5; Marked impairment = >5.

Abbreviations: ADL, Activities of Daily Living; BI, Barthel Index; DASI, Duke Activity Status Index; ECOG-PS, Eastern Cooperative Oncology Group Performance Status; ESRD, end stage renal disease; HGS, handgrip strength; IADL, Instrumental Activities of Daily Living; KPS, Karnofsky Performance Status; MET, metabolic equivalent of tasks; NYHA, New York Heart Association; PCS, Physical Component Summary; PF, physical function; SPPB, Short Physical Performance Battery; UNOS, United Network for Organ Sharing

Table S3. Overview of the association between frailty and functional status instruments and clinical adverse outcomes, classified by patient population

Author, Year	N	Tool	Follow-up	Analysis[§]	Main Findings
Cardiovascular Disease					
CKD Non-Dialysis Patients					
Frailty Tools, overall frailty or individual domains					
Tsai, 2017[122]	161	2-Minute Step	2.4 years[◊¶]	High 2-Minute Step (ref) vs. Low 2-Minute Step: aHR 25.0[¥]; p-value: 0.33	2-Minute Step was not associated with major adverse cardiovascular events.
Tsai, 2017[122]	161	Handgrip Strength (HGS)	2.4 years[◊¶]	High HGS (ref) vs. Low HGS: aHR 1.01 (0.88 - 1.15)[¥]	HGS was not associated with major adverse cardiovascular events.
Tsai, 2017[122]	161	30-Second Chair Stand	2.4 years[◊¶]	Per one decrease of the time of 30-Second Chair Stand: aHR 1.54 (1.12 - 2.13)[¥]	Chair stand performance was associated with ↑ risk for major adverse cardiovascular events.
Incident Dialysis Patients					
Functional Status Tools					
Inaguma, 2016	1496	Barthel Index (BI)	3.3 years[¶]	High BI (score = 100; ref) vs. Middle BI (75≤BI<100) vs. Low BI (<75): Log rank p-value <0.001[d]	Lower functional status was associated with higher cardiovascular disease-related mortality.
Chronic Dialysis Patients					
Frailty Tools, overall frailty or individual domains					
Ng, 2016[90]	193	Frailty Score	1.9 years[◊¶]	Number of hospitalizations related to cardiovascular events: β=0.37, p-value <0.0001[a‖]	Frailty Score was associated with number of hospitalizations related to cardiovascular events.

Chan, 2020	267	Frailty Score	2 years	Cardiovascular mortality Not Frail (ref) vs. Frail: aHR 2.65 (1.13 - 6.20)[a] Cardiovascular event-related hospitalization Not Frail (ref) vs. Frail: aβ Not reported; p-value >0.05[a]	Frailty was associated with ↑ risk of cardiovascular mortality. Frailty was not associated with cardiovascular event-related hospitalization.
Kim, 2017[57]	142	Sarcopenia Status	4.3 years[◊]	No Sarcopenia (ref) vs. Sarcopenia: aHR 4.33 (1.51 - 12.43)	Sarcopenia was associated with ↑ risk of cardiovascular events.
Song, 2020	88	Sarcopenia Status	5.2 years[◊]	No Sarcopenia (ref) vs. Sarcopenia: aHR 7.71 (1.83 - 32.57)	Sarcopenia was associated with ↑ risk of cardiovascular mortality.
Kuki, 2019[63]	173	Gait Speed	2 years	High (ref) vs. Low: aHR 2.29 (1.20 - 4.33)	Low gait speed was associated with ↑ risk of cardiovascular events.
Torino, 2014[120]	296	6-Minute Walk Test (6MWT)	3.3 years[‡]	Per 100m decrease: aHR 1.22 (0.95 - 1.61)[†¥€]	Shorter walk distance was not associated with fatal and non-fatal cardiovascular events.
Wang, 2005	180	HGS	2.5 years[◊¶]	Per 1kg decrease: aHR 1.06 (1.02 – 1.11)[†¥]	Decreasing HGS was associated with ↑ risk of cardiovascular mortality.
Wang, 2010	218	HGS	4 years	Per 1kg decrease: aHR 1.04 (1.01 – 1.06)[b¥]	Decreasing HGS was associated with ↑ risk for developing circulatory congestion.
Kim, 2017[57]	142	HGS	4.3 years[◊]	Appropriate Strength (ref) vs. Low Strength: aHR 4.09 (1.26 - 13.29)	Lower HGS was associated with ↑ risk for cardiovascular events.
Kuki, 2019[63]	173	HGS	2 years	High (ref) vs. Low: aHR 2.15 (1.00 - 5.04)	Low HGS was associated with ↑ risk of cardiovascular events.

Zhang, 2020	174	Biceps Muscle Strength	1 year[¶]	High (ref) vs. Low: aHR 2.50 (1.01 - 6.25)[†¥] Per 1kg decrease: aHR 1.15 (1.01 - 1.33)[†¥]	Low biceps muscle strength was associated with ↑ risk of non-mortal cardiovascular events.
Koyama, 2010	788	Fukuda Fatigue Scale	2.2 years[‡¶]	Normal (ref) vs. Highly fatigued: aHR 1.89 (1.06 - 3.36)[a†]	High fatigue was associated with ↑ risk for cardiovascular events.
Jhamb, 2011	1798	SF-36 Vitality Scale	2.8 years[◊]	High vitality (Q4; ref) vs.: Q3: aHR 0.93 (0.78 - 1.19)[†] Q2: aHR 1.09 (0.90 - 1.33)[†] Low vitality (Q1): aHR 1.27 (1.04 - 1.56)[†]	Increasing fatigue was associated with ↑ risk of first cardiac hospitalization or cardiac death.
Kang, 2017	1611	Physical Activity – WHO Recommendations	500 days	Active (ref) vs.: Intermediate: RR 1.57 (0.48 – 5.06)* Inactive: RR 2.99 (1.05 – 8.56)*	Physical inactivity was associated with ↑ risk of cardiovascular death.
Kidney Function					
CKD Non-Dialysis Patients					
Frailty Tools, overall frailty or individual domains					
Ali, 2018	104	Combined PRISMA / Timed Up-and-Go	1.7 years[¶]	Not Frail vs. Frail: log rank p-value Not reported [d]	Frailty was not associated with time to initiation of dialysis.
Vezza, 2019	115	Frailty Index	1 year[¶]	Not Frail (ref) vs. Frail: aOR 5.42 (1.06 - 27.64)[†] Per unit decrease: aOR 1.05 (0.98 - 1.11)[†]	Frailty was associated with ↑ odds of renal replacement therapy initiation.

Kruse, 2020	351	Skeletal Muscle Mass Index (SMI)	7 years	Normal (ref) vs. Low SMI: Men: aRR not reported; p-value Not reported Women: aRR not reported; p-value Not reported	Lower SMI was not associated with rapid kidney function decline in either men or women.
de Goeij, 2014[23]	436	Revised Illness Perception Questionnaire (IPQ-R) - Weight Loss	0.5 years[¶]	No Weight Loss (ref) vs. Weight Loss: aHR 1.33 (0.99 – 1.77)	Weight loss was not associated with starting dialysis.
Tsai, 2017[122]	161	2-Minute Step	2.4 years[◊¶]	High 2-Minute Step (ref) vs. Low 2-Minute Step: aHR 25.0 (1.05 – 100.0)[¥]	Lower 2-Minute Step was associated with ↑ risk for commencing dialysis.
Tsai, 2017[122]	161	HGS	2.4 years[◊¶]	High HGS (ref) vs Low HGS: aHR 1.12 (1.04 - 1.19)[†¥]	Lower HGS was associated with ↑ risk for commencing dialysis.
Watson, 2020	89	Leg Extension Strength	3.3 years[◊]	Per 1kg decrease: aHR 1.02 (0.98 - 1.05)[¥]	Muscle strength was not associated with the development of ESRD.
Tsai, 2017[122]	161	30-Second Chair Stand	2.4 years[◊¶]	Per one decrease of the time of 30-Second Chair Stand: aHR 0.98 (0.85 - 1.14)[¥]	Chair stand performance was not associated with commencing dialysis.
de Goeij, 2014 [23]	436	IPQ-R - Loss of Strength	0.5 years[¶]	No Loss of Strength (ref) vs. Loss of Strength: aHR 1.20 (0.89 – 1.64)	Loss of strength was not associated with starting dialysis.
de Goeij, 2014[23]	436	IPQ-R - Fatigue	0.5 years[¶]	No Fatigue (ref) vs. Fatigue: aHR 1.48 (0.94 – 2.31)	Fatigue was not associated with starting dialysis.
Robinson-Cohen, 2014	256	Four Week Physical Activity History Questionnaire	3.0 years[‡]	Any Physical Activity (ref) vs. No Physical Activity: aHR 0.98 (0.43 - 2.22)[†¥] Per 60 min/week decrease: aHR 1.02 (0.88 – 1.18)[†¥]	Physical activity was not associated with ESRD events (i.e., initiation of chronic dialysis or kidney transplantation).

Rampersad, 2021	569	Physical Activity Scale for the Elderly	903 days‡	Light Activity (ref) vs. Low Activity: aHR 0.71 (0.48 - 1.06)†¥ Moderate-High Activity (ref) vs. Low Activity: aHR 0.83 (0.55 - 1.27)†¥	Physical activity was not associated with risk of progression to kidney failure.
Functional Status					
Ritchie, 2014	1515	Karnofsky Performance Scale (KPS)	2.9 years‡	KPS 100 (ref) vs KPS ≤ 80: aHR 1.50 (0.94 - 2.48)[a]	Lower KPS was not associated with progression to renal replacement therapy.
de Goeij, 2014 [23]	436	SF-36 Physical Component Summary (PCS)	0.5 years¶	Per 10-point decrease: aHR 1.14 (1.07 – 1.21)€	Decreasing PCS was associated with ↑ risk of starting dialysis.
Composite: Death or Dialysis Initiation/Transplantation/Reaching ESRD					
CKD Non-Dialysis Patients					
Frailty Tools, overall frailty or individual domains					
Roshanravan, 2012[103]	336	Fried Frailty Index [modified exhaustion, low activity]	967 days‡	Not Frail (ref) vs. Frail: aHR 2.50 (1.40 - 4.40)†	Frailty was associated with ↑ risk of death or dialysis therapy.
Mansur, 2015	57	Johansen Frailty Criteria [modified Fried and Woods]	1 year¶	Not Frail (ref) vs Frail: aHR 2.50 (1.04 - 6.10)	Frailty was associated with ↑ risk of negative health outcomes (i.e., death or start of renal replacement therapy).
de Goeij, 2014[23]	436	IPQ-R - Weight Loss	0.5 years¶	No Weight Loss (ref) vs. Weight Loss: aHR 1.20 (0.93 - 1.55)	Weight loss was not associated with combined poor health outcome (i.e., dialysis, transplantation, and death).
Roshanravan, 2012[103]	336	Weight Loss	967 days‡	No Weight Loss (ref) vs. Weight Loss: aHR 3.20 (1.60 - 6.30)†	Weight loss was associated with ↑ risk of death or dialysis therapy.

Roshanravan, 2012 [103]	336	Gait Speed	967 days[‡]	Normal Walk Speed (ref) vs. Slow Walk Speed: aHR 1.80 (1.10 - 3.20)[†]	Slow walk speed was associated with ↑ risk of death or dialysis therapy.
Chang, 2011	128	HGS	2.8 years[◊¶]	Men HGS > 24.65kgw (ref) vs. HGS < 24.65kgw: aHR 4.57 (1.13 – 17.08)[a†] Women HGS > 10.15kgw (ref) vs. HGS < 10.15kgw: aHR 5.94 (1.10 – 32.19)[a†] Per 1kg decrease: aHR 1.11 (1.03 - 1.19)[†¥]	Decreasing HGS was associated with ↑ risk of composite renal end point (i.e., pre-dialysis mortality or reaching ESRD).
Roshanravan, 2012[103]	336	HGS	967 days[‡]	Strong Grip (ref) vs. Weak Grip: aHR 1.70 (0.90 - 3.10)[†]	Weak grip was not associated with death or dialysis therapy.
de Goeij, 2014 [23]	436	IPQ-R - Loss of Strength	0.5 years[¶]	No Loss of Strength (ref) vs. Loss of Strength: aHR 1.25 (0.95 - 1.65)	Loss of strength was not associated with combined poor health outcome (i.e., dialysis, transplantation, and death).
de Goeij, 2014 [23]	436	IPQ-R - Fatigue	0.5 years[¶]	No Fatigue (ref) vs. Fatigue: aHR 1.33 (0.90 - 1.97)	Fatigue was not associated with combined poor health outcome (i.e., dialysis, transplantation, and death).
Roshanravan, 2012[103]	336	SF-36 Vitality Scale	967 days[‡]	No Fatigue (ref) vs. Fatigue: aHR 1.20 (0.70 - 1.90)[†]	Fatigue was not associated with death or dialysis therapy.

Roshanravan, 2012 [103]	336	Physical Activity	967 days‡	High Physical Activity (ref) vs. Low Physical Activity: aHR 2.10 (1.30 - 3.30)†	Low physical activity was associated with ↑ risk of death or dialysis therapy.
Functional Status Tools					
de Goeij, 2014[23]	436	SF-36 PCS	0.5 years¶	Per 10-point decrease: aHR 1.14 (1.07 – 1.21)€	Decreasing PCS was associated with ↑ risk of combined poor health outcome (i.e., dialysis, transplantation, and death).
Composite: Death or Hospitalization (all-cause or cardiovascular only)					
Incident Dialysis Patients					
Frailty Tools, overall frailty or individual domains					
Johansen, 2007[48]	2275	Johansen Frailty criteria [modified Fried and Woods]	1 year	Not Frail (ref) vs. Frail: aHR 1.56 (1.36 – 1.79)†	Frailty was associated with ↑ risk of mortality or hospitalization.
Lee, 2017	46	Multidimensional Frailty Score	1.5 years‡¶	Not Frail (ref) vs Frail: aHR 23.58 (1.61 - 346.03) Per 1-point increase: aHR 1.63 (1.01 – 2.65)	Frailty was associated with ↑ risk of all-cause death or cardiovascular hospitalization.
Johansen, 2007[48]	2275	SF-36 Vitality Scale	1 year	Score ≥55 (ref) vs. <55: aHR 1.26 (1.10 – 1.45)†	Fatigue was associated with ↑ risk of mortality or hospitalization.
Johansen, 2007[48]	2275	Physical Activity	1 year	Active (ref) vs. Inactive: aHR 1.20 (1.07 – 1.35)†	Inactivity was associated with ↑ risk of mortality or hospitalization.
Functional Status Tools					
Johansen, 2007[48]	2275	SF-36 Physical Function (PF) Scale	1 year	Score ≥75 (ref) vs. <75: aHR 1.41 (1.19 – 1.66)†	Lower PF is associated with ↑ risk of mortality or hospitalization.

Chronic Dialysis Patients					
Frailty Tools, overall frailty or individual domains					
Lin, 2020[73]	126	Gait Speed	3 years	Per 0.1 m/s decrease: aHR 1.05 (0.98 - 1.12)¥€	Gait speed was not associated with risk of all-cause mortality/hospitalization.
Torino, 2014[120]	296	6MWT	3.3 years‡	Per 100m decrease: aHR 1.34 (1.10 - 1.61)†¥€	Shorter walk distance was associated with ↑ risk of mortality, fatal and non-fatal cardiovascular events, and hospitalizations.
Lin, 2020[73]	126	HGS	3 years	Per 1kg decrease: aHR 1.01 (0.98 - 1.03)¥	HGS was not associated with risk of all-cause mortality/hospitalization.
Composite: Mortality or Cardiovascular Outcomes					
Chronic Dialysis Patients					
Frailty Tools, overall frailty or individual domains					
Yamamoto, 2021[138]	542	Sarcopenia (Creatinine Index + Gait Speed)	3.0 years‡	No Sarcopenia (ref) vs. Sarcopenia: aIRR 2.08 (1.31 - 3.33)	Sarcopenia was associated with ↑ risk of mortality and/or cardiovascular hospitalizations.
Yamamoto, 2021[138]	542	Sarcopenia (Creatinine Index + HGS)	3.0 years‡	No Sarcopenia (ref) vs. Sarcopenia: aIRR 1.83 (1.40 - 2.39)	Sarcopenia was associated with ↑ risk of mortality and/or cardiovascular hospitalizations.
Yamamoto, 2021[138]	542	Gait Speed	3.0 years‡	Per 0.1m/s decrease: aIRR 1.1 (1.04 – 1.16)¥€	Lower gait speed was associated with ↑ risk of mortality and/or cardiovascular hospitalizations.
Yamamoto, 2021[138]	542	HGS	3.0 years‡	Per 1kg decrease: aIRR 1.04 (1.03 – 1.05)¥€	Decrease in HGS was associated with ↑ risk of mortality and/or cardiovascular hospitalizations.
Kurita, 2019	3667	SF-12 Vitality Scale	2.7 years‡	Per 1-energy level lowerer: aIRR 1.18 (1.09 – 1.27)†¥	Lower energy was associated with ↑ risk of all-cause mortality/cardiovascular hospitalizations.

Functional Status Tools					
Lee, 2020	277	Physical Performance	2.1 years[◊¶]	Normal gait speed/Normal HGS (ref) vs. Normal gait speed/Low HGS: aHR 1.08 (0.49 – 2.39)[†] Low gait speed/Normal HGS: aHR 2.38 (0.86 – 6.53)[†] Low gait speed/Low HGS: aHR 2.72 (1.14 – 6.46)[†]	Low physical performance (combined low gait speed and HGS) was associated with ↑ risk of mortality/cardiovascular events.
Composite: Mortality or Hospitalization or Progression to ESRD					
CKD Non-Dialysis Patients					
Frailty Tools, overall frailty or individual domains					
Gregg, 2019[34]	262	Beck Depression Inventory-I – Fatigue	1 year[¶]	No Fatigue (ref) vs. Fatigue: aHR 0.88 (0.52 - 1.50)[a†]	Fatigue was not associated with risk of mortality/hospitalization/progression to ESRD.
Gregg, 2019[34]	262	Quick Inventory of Depressive Symptomatology-Self Report – Fatigue	1 year[¶]	No Fatigue (ref) vs. Fatigue: aHR 1.35 (0.84 - 2.19)[a†]	Fatigue was not associated with risk of mortality/hospitalization/progression to ESRD.
Gregg, 2019[34]	262	SF-12 Vitality Scale	1 year[¶]	Per 1-point increase: aHR 1.06 (0.92 - 1.23)[a†]	Fatigue was not associated with risk of mortality/hospitalization/progression to ESRD.
Composite: Mortality or Functional Status Decline					
Incident Dialysis Patients					
Frailty Tools, overall frailty or individual domains					
Goto, 2019[33]	187	Fried Frailty Index	0.5 years[¶]	Not Frail (ref) vs. Frail: aOR 1.46 (0.80 - 2.68)	Frailty was not associated with odds of mortality/functional decline.
Goto, 2019[33]	187	Geriatric Assessment	0.5 years[¶]	Not Frail (ref) vs. Frail: aOR 1.65 (0.81 - 3.35)	Frailty was not associated with odds of mortality/functional decline.

Goto, 2019[33]	187	Groningen Frailty Indicator	0.5 years[¶]	Not Frail (ref) vs. Frail: aOR 1.97 (1.05 - 3.68)	Frailty was associated with ↑ odds of mortality/functional decline.
Goto, 2019[33]	177	Timed Up-and-Go	0.5 years[¶]	Not Impaired (ref) vs. Impaired: aOR 1.53 (0.67 - 3.47)	Impairment was not associated with odds of mortality/functional decline.
Functional Status Tools					
Goto, 2019[33]	187	Katz' Activities of Daily Living (ADL)	0.5 years[¶]	Independent (ref) vs. Dependent: OR 1.27 (0.68 - 2.38)[d]	Dependence was not associated with odds of mortality/functional decline.
Goto, 2019[33]	187	Lawton and Brody's Instrumental Activities of Daily Living (IADL) Scale	0.5 years[¶]	Independent (ref) vs. Dependent: OR 1.21 (0.60 - 2.43)[d]	Dependence was not associated with odds of mortality/functional decline.
Goto, 2019[33]	187	Functional Status Score (ADL & IADL)	0.5 years[¶]	Independent (ref) vs.: Mild/Moderate Dependence: RR 1.17 (0.77-1.77)* Severe Dependence: RR 1.11 (0.69-1.76)*	Functional Status Score was not associated with mortality/functional decline.
Peritonitis					
Chronic Dialysis Patients					
Frailty Tools, overall frailty or individual domains					
Ng, 2016[90]	193	Frailty Score	1.9 years[◊¶]	Not Frail (ref) vs.: Mild: RR 1.04 (0.64 – 1.68)* Moderate: RR 0.85 (0.46 – 1.58)* Severe: RR 0.89 (0.51 – 1.55)*	Frailty was not associated with developing peritonitis.
Shi, 2017	145	6MWT	1.9 years[‡¶]	Long (ref) vs. Short 6MWT: Log rank p-value= 0.37[d]	Walk distance was not associated with peritonitis-free survival.

Functional Status Tools					
Anderson, 1997[3]	109	ADL Score	1.1 year[◊¶]	ADL score: aHR Not reported; p-value Not reported[‖]	ADL score was not associated with time to development of first peritonitis.
Withdrawal from Dialysis					
Incident Dialysis Patients					
Functional Status Tools					
Wetmore, 2019	80284	Functional Status Score	0.5 years[¶]	Score ≤ 0 (high functional status) (ref): Score 1-2: aOR 1.41 (1.25 - 1.58) Score 3-4: aOR 1.60 (1.40 - 1.82) Score 5-6: aOR 1.79 (1.46 - 2.19) Score ≥ 7 (low functional status): aOR 1.83 (1.35 - 2.48)	Lower functional status was associated with ↑ odds of dialysis withdrawal.
Chronic Dialysis Patients					
Functional Status Tools					
Bordenave, 1998	304	ADL	21 years	No Restriction/Moderate Restriction (ref) vs. Severe Restriction: aOR 3.36 (CI not reported); p-value =0.0003[c]	Severe restriction of ADL was associated with ↑ odds of withdrawal from dialysis.
Jassal, 2016	3583	Functional Status Score (ADL & IADL)	1.4 years[‡¶]	Functionally Independent (Score=13; ref) vs. Most Dependent (Score<8): aHR 2.02 (1.45 - 2.80)	Lower functional status was associated with ↑ risk of dialysis withdrawal.

Serious Fall Injuries					
Incident Dialysis Patients					
Frailty Tools, overall frailty or individual domains					
Delgado, 2015[26]	1053	Frailty, self-report [modified Fried, Woods, Johansen]	2.5 years‡	Not Frail (ref) vs. Frail: aHR 1.60 (1.16 - 2.20)	Frailty was associated with ↑ risk of fall or fracture.
Delgado, 2015[26]	1053	Exhaustion	2.5 years‡	No Exhaustion (ref) vs. Exhaustion: aHR 1.40 (1.10 – 1.76)	Exhaustion was associated with ↑ risk of fall or fracture.
Delgado, 2015[26]	1053	Human Activity Profile – Adjusted Activity Score	2.5 years‡	Quintiles 2-5 (ref) vs. Quintile 1 (lowest): aHR 1.36 (0.78 – 2.37)	Physical activity was not associated with falls or fractures.
Functional Status Tools					
Plantinga, 2017	81653	Functional Status – Form CMS-2728	1 year	Does not need assistance with ADL's: 1.75 (1.68-1.82)[d] Needs assistance with ADL's: 1.27 (1.18-1.36)[d]	The risk of serious fall injuries in the post- versus pre-dialysis therapy were ↑ among patients who did not need assistance with ADL's
Delgado, 2015[26]	1053	SF-12 PF Scale	2.5 years‡	Score ≥ 75 (ref) vs. Score < 75: aHR 1.33 (1.01 – 1.75)	Poor physical function was associated with ↑ risk of fall or fracture.
Discharged					
Chronic Dialysis Patients					
Functional Status Tools					
Anderson, 1997[3]	109	Activity of Daily Living Score	1.1 year◊¶	Score<8 (ref) vs. Score ≥8: OR 0.24 (0.08 – 0.73)[d¥]	Lower functional status was associated with ↓ odds of being discharged from assisted care.

Sood, 2011[113]	1286	Katz' ADL	7.5 days‡	Normal or Mild Impairment (ref) vs.: Moderate Impairment: aHR 0.67 (0.58 - 0.79) Marked Impairment: aHR 0.47 (0.39 - 0.56)	Moderate or marked impairment was associated with ↓ risk of being discharged home.
Discharge to Assisted Care					
Chronic Dialysis Patients					
Frailty Tools, overall frailty or individual domains					
Jiang, 2020	1424026	Frailty (Johns Hopkins Adjusted Clinical Groups)	Not reported	Not Frail (ref) vs. Frail: aOR 3.55 (3.49 - 3.61)	Frailty was associated with ↑ odds of being discharged from hospital to an assisted care facility.
Functional Status Tools					
Sood, 2011[113]	1036	Katz' ADL	7.5 days‡	Per 1-point change towards more impaired: aOR 1.25 (1.15 - 1.37)[a]	Increased impairment in functional status was associated with ↑ odds of discharge to an assisted care facility.
Transplant					
Chronic Dialysis Patients					
Frailty Tools, overall frailty or individual domains					
Jegatheswaran, 2020	261	FRAIL Questionnaire	1.5 years¶	Not Frail/Pre-Frail (ref) vs. Frail: aHR 0.15 (0.02 - 1.15)[a]	Frailty was not associated with a decreased likelihood of kidney transplant.
Functional Status Tools					
van Loon, 2017	679	SF-36 PF Scale	2 years	Good physical function vs.: Intermediate: RR 1.04 (0.94 – 1.16)* Poor: RR 1.24 (1.13 – 1.35)*	Poor physical function was associated with ↑ risk of not receiving a kidney transplant.

Single Study Outcomes					
CKD Non-Dialysis Patients					
Frailty Tools, overall frailty or individual domains					
Meulendijks, 2015	63	Groningen Frailty Indicator	1 year	Dialysis-Related Complications Not Frail (ref) vs. Frail: RR 1.45 (0.77 – 2.74)*	Frailty was not associated with dialysis-related complications.
Chronic Dialysis Patients					
Functional Status Tools					
Sood, 2011[113]	1286	Katz' ADL	7.5 days[‡]	Composite: In-Hospital Mortality/Discharge to an Assisted Care Facility Normal or Mild Impairment (ref) vs.: Moderate Impairment: aHR 1.77 (1.05 - 2.98) Marked Impairment: aHR 1.84 (1.10 - 3.10)	Moderate or marked impairment was associated with ↑ risk of in-hospital mortality OR discharge to an assisted care facility.

[§]all models adjusted for a minimum of age and sex, unless otherwise noted. Where a choice of models exists, the most fully adjusted model is presented; [a]model not adjusted for sex; [b]model not adjusted for age; [c]model not adjusted for age or sex; [d]unadjusted model; [†]multiple adjusted models available; [‡]median; [◊]mean; [¶]converted to years; *RR calculated from event data, or cumulative survival event data; [¥]scale inverted; [€]scale change; [ǁ]reference group and comparator not reported; unit of measure not clearly reported

Abbreviations: 6MWT, 6-Minute Walk Test; aβ, adjusted beta; ADL, Activities of Daily Living; aHR, adjusted hazard ratio; aIRR, adjusted incidence rate ratio; aOR, adjusted odds ratio; aRR, adjusted relative risk; BI, Barthel Index; CKD, chronic kidney disease; ESRD, end-stage renal disease; HGS, handgrip strength; IADL, Instrumental Activities of Daily Living; IPQ-R, Revised Illness Perception Questionnaire; IRR, incidence rate ratio; kgw, kilogram weight; KPS, Karnofsky Performance Scale; OR, odds ratio; PCS, Physical Component Summary; PF, Physical Function; Ref, reference value, RR, relative risk; SD, standard deviation; SMI, Skeletal Muscle Mass Index; WHO, World Health Organization

Table S4. Quality assessment of included studies based on the modified version of the QUIPS tool

Author, year	1. Study Participation	2. Study Attrition	3. Prognostic Factor Measurement	4. Outcome Measurement	5. Study Confounding	6. Statistical Analysis and Reporting
Alfaadhel, 2015	+	+	/	+	+	+
Anderson, 1997	/	+	/	+	/	/
Anderson, 1993	/	/	/	/	-	/
Anderson, 1990	+	+	-	-	+	-
Arai, 2014	+	+	+	+	+	/
Argyropoulos, 2009	+	+	/	+	+	+
Bordenave, 1998	/	+	-	/	/	/
Bossola, 2015	/	/	/	+	/	/
Bossola, 2016	+	+	/	-	/	/
Chandna, 1999	+	+	-	+	+	+
Chang, 2011	+	+	/	/	+	/
Delgado, 2015[25]	/	+	-	+	+	+
Delgado, 2015[26]	/	+	/	+	+	/
DeOreo, 1997	-	-	+	/	+	-
Farrokhi, 2013	-	/	+	/	+	/
Freedman, 2001	/	/	-	+	+	/
Lopez Revuelta, 2004	/	+	+	+	+	-
Hellberg, 2014	+	/	+	+	+	+
Ifudu, 1998	+	+	+	+	+	-
Inaguma, 2016	+	+	+	+	+	/
Isoyama, 2014	/	/	+	/	+	/
Jassal, 2016	/	/	/	/	+	/
Jhamb, 2009	/	/	+	/	+	-
Jhamb, 2011	/	-	+	+	+	-
Johansen, 2007	/	+	/	+	+	+

Johansen, 2016	/	+	+	+	+	+
Joly, 2003	+	+	-	+	+	+
Jones, 1991	/	+	+	/	+	-
Kang, 2013	+	/	/	-	/	/
Knight, 2003	/	/	/	/	+	-
Kohl, 2012	/	-	-	-	/	-
Koyama, 2010	/	+	/	+	+	-
Kutner, 1994	+	/	/	+	+	-
Kutner, 2015	/	/	/	+	+	-
Lacson, 2010	/	+	/	/	+	+
Lowrie, 2003	/	+	+	/	+	+
Mapes, 2003	/	+	/	-	+	/
McAdams-DeMarco, 2013	+	+	+	+	+	-
McAdams-DeMarco, 2015	/	-	+	+	/	/
McClellan, 1991	-	-	/	-	/	-
McClellan, 1992	+	+	/	+	/	/
Meulendijks, 2015	/	+	-	/	-	+
Noori, 2010	/	+	+	-	+	/
de Oliveira, 2016	/	+	/	/	/	-
Peng, 2010	+	+	+	+	+	+
Peng, 2013	/	/	+	/	+	/
Pereira, 2015	+	+	-	-	+	/
Pugh, 2016	+	+	+	/	+	/
Ren, 2016	+	+	-	-	-	-
Ritchie, 2014	+	+	/	+	+	+
Robinson-Cohen, 2014	-	+	+	+	+	+
Roshanravan, 2012	/	+	/	/	+	/
Roshanravan, 2013	-	/	/	/	+	+

Santos, 2012	+	+	+	+	+	/
Shavit, 2014	/	/	/	-	/	-
Shum, 2014	+	+	-	+	/	-
Sood, 2011	+	+	/	+	/	-
Takaki, 2005	/	/	/	-	+	/
Tentori, 2010	+	/	/	/	+	/
Torino, 2014	-	/	/	+	+	/
Turkmen, 2014	/	-	-	-	/	-
Utas, 2001	-	/	-	-	/	-
Yazawa, 2016	+	+	-	+	+	+
Bao, 2012	+	+	/	+	+	+
de Goeij, 2014	/	-	-	+	+	-
Hatakeyama, 2013	+	+	/	+	/	-
Kutner, 1997	-	+	-	-	-	-
Lopes, 2014	-	/	/	/	+	-
Mansur, 2015	/	+	-	-	/	-
Matos, 2014	/	+	/	+	+	/
Matsuzawa, 2014	+	/	+	/	+	+
Roberts, 1976	-	/	-	/	/	-
Stenvinkel, 2002	-	/	/	+	/	/
Vogt, 2016	/	/	+	+	+	/
Wang, 2010	-	/	+	+	+	-
Wang, 2005	+	/	/	/	/	-
Ali, 2018	-	/	-	-	/	/
Androga, 2017	/	/	+	/	+	/
Bancu, 2017	/	/	-	-	/	-
Dai, 2017	-	/	/	-	+	+
Fukuma, 2017	/	/	+	/	/	/
Giglio, 2018	/	/	/	/	/	/
Jin, 2017	/	+	/	+	/	-
Kang, 2017[54]	+	/	/	/	/	/

Kang, 2017[55]	+	/	/	/	+	+
Kim, 2017	+	/	/	/	+	/
Kittiskulnam, 2017	+	+	/	/	/	+
Lee, 2017[69]	+	/	/	/	-	/
Lee, 2017[70]	+	/	/	/	/	/
Ng, 2016	/	/	-	/	+	+
Plantinga, 2017	-	+	-	+	/	+
Rymarz, 2018	/	/	-	/	-	/
Shah, 2018	-	+	-	+	+	-
Shi, 2017	-	/	+	-	/	+
Shimoda, 2018	-	+	-	+	+	/
Tsai, 2017	/	/	/	/	+	/
van Loon, 2017[126]	/	-	+	+	-	+
van Loon, 2017[127]	/	+	+	+	+	/
Yadla, 2017	+	/	+	-	/	/
Beddhu, 2009	+	+	+	+	+	/
Navaneethan, 2014	+	+	+	+	+	+
Brar, 2019	/	-	/	+	+	+
Brito, 2020	-	+	+	+	/	+
Chan, 2020	/	-	-	+	+	/
Chao, 2020	-	-	-	+	/	-
Clarke, 2019	+	+	+	+	+	+
Ducharlet, 2019	-	-	/	+	/	-
Goto, 2019	-	+	+	/	/	/
Gregg, 2019	-	+	-	/	+	-
Hall, 2019	/	+	/	+	+	+
Jafari, 2020	+	/	/	/	-	-
Jegatheswaran, 2020	/	+	/	/	/	/
Jiang, 2020	+	+	/	+	/	+
Kalantar, 2019	-	/	+	+	+	+

Kamijo, 2018	/	+	/	+	/	-
Kruse, 2020	-	-	/	+	/	/
Kuki, 2019	/	+	+	+	/	-
Kurita, 2019	/	+	+	+	+	+
Lee, 2020	-	-	/	+	/	-
Lin, 2020[72]	+	+	+	+	+	+
Lin, 2020[73]	/	+	+	/	+	/
López-Montes, 2020	+	/	+	+	+	+
Matsuzawa, 2019	/	+	+	+	+	+
Mori, 2019	/	/	+	+	/	+
Nixon, 2020	/	-	/	/	/	+
Souweine, 2020	+	+	+	+	+	+
Rampersad, 2021	-	+	+	+	+	+
Song, 2020	/	-	+	/	+	+
Sy, 2019	+	+	+	+	+	+
Tennankore, 2019	/	+	+	+	+	+
Torino, 2019	+	/	+	+	+	/
Valenzuela, 2019	-	-	-	/	-	-
van Loon, 2019	+	+	+	/	+	/
Vezza, 2019	-	-	-	/	-	/
Watanabe, 2021	+	/	/	+	+	+
Watson, 2020	-	+	+	+	+	+
Wetmore, 2019	+	+	-	/	+	+
Xu, 2020	/	+	+	+	+	+
Yamamoto, 2021	/	-	/	+	+	+
Zhang, 2020	/	-	/	/	/	/

+: Low risk of bias
/: Moderate risk of bias
-: High risk of bias