

**Table 1. Search syntax**

Domain	("Kidney Failure, Chronic"[Mesh] OR "Renal Dialysis"[Mesh] OR dialysis[tiab] OR "hemodialysis"[tiab] OR "renal replacement therapy"[ tiab] OR "renal failure"[tiab] OR "kidney failure"[tiab] OR "chronic kidney disease"[tiab] OR "chronic renal disease"[tiab] OR "end stage renal disease"[tiab] OR "end stage kidney disease"[tiab])
	AND
Determinant	("Geriatric Assessment*" [tiab] OR frailty[tiab] OR "activities of daily living"[tiab] OR "activities of daily life"[tiab] OR "assistance with daily living"[tiab] OR "functional status"[tiab] OR "functional decline"[tiab] OR "functional dependency"[tiab] OR "functional dependencies"[tiab] OR "dependency for transfers"[tiab] OR "functional impairment*" [tiab] OR ((cognitive[tiab]AND (impairment* OR decline OR dysfunction OR status OR function)) OR dementia[tiab] OR mood[tiab] OR depression[tiab] OR depressive[tiab] OR nutrition*[tiab] OR malnutrition[tiab] OR mobility[tiab] OR "gait speed"[tiab] OR "physical function*" [tiab] OR "physical performance"[tiab] OR comorbid*[tiab] OR "screening tool*" [tiab] OR (social[tiab] AND (network OR environment OR issues)))
	AND
Outcome	(prognosis[tiab] OR survival[tiab] OR prognostication[tiab] OR mortality[tiab] OR complication*[tiab] OR "quality of life"[tiab] OR "life expectancy"[tiab])

**Table 2. Quality Assessment of studies according to the Newcastle-Ottawa Quality Assessment Scale for Cohort Studies<sup>1</sup>**

<b>Selection</b>	<b>Score</b>
1) Representativeness of the exposed cohort	
a) truly representative of the average incident dialysis population <i>incident dialysis defined as &lt; 7 days before start of dialysis</i>	+
b) somewhat representative of the average incident dialysis population <i>also included children excluding a racial group "incident" defined as between start and 3 months after start dialysis</i>	+/-
c) selected group of dialysis population <i>only diabetics excluding mortality &lt; 3 months excluding patients with poor health previous other mode of dialysis excluding elderly patients</i>	-
d) no description of the derivation of the cohort	-
2) Selection of the non-exposed cohort: not applicable	
3) Ascertainment of exposure	
a) systematic assessment of at least one domain	+
b) non-systematic assessment	+/-
c) diagnosis based on ICD code only	-
4) Demonstration that outcome of interest was not present at start of study	
a) yes	+
b) no	-
<b>Comparability</b> Not applicable	
<b>Outcome</b>	
1) Assessment of outcome	
a) independent blind assessment	+
b) record linkage	+
c) self-report	-
d) no description	-
2) Was follow-up long enough for outcomes to occur	
a) yes (6 months or more)	+
b) no	-
3) Adequacy of follow up of cohorts	
a) complete follow up - all subjects accounted for	+
b) small number lost to follow up (< 10%)	+
c) large number lost to follow up (> 10%)	-
d) no statement	-

Legend: + Good, +/- Moderate, - Poor

**Table 3. Quality Assessment of studies according to the Newcastle-Ottawa Quality Assessment Scale for Cohort Studies**

Author	Publication Year	Quality assessment: selection			Quality assessment: outcome		
		Representativeness of exposed cohort	Ascertainment of exposure	Outcome not present at start of study	Assessment of outcome	Sufficient duration of follow-up	Adequacy of follow-up
Aflaadhel <sup>2</sup>	2015	+	+	+	+	+	+
Arai <sup>3</sup>	2014	+	-	+	+	+	+
Bao <sup>4</sup>	2012	+/-	-	+	+	+	+
Boulware <sup>5</sup>	2006	+/-	-	+	+	+	-
Chan <sup>6</sup>	2012	+/-	-	+	+	+	+
Chandna <sup>7</sup>	1999	+	+	+	+	+	+
Chilcot <sup>8</sup>	2011	+/-	+	+	+	+	+
Chung <sup>9</sup>	2009	-	+	+	+	+	-
Churchill <sup>10</sup>	1996	-	+	+	+	+	+
Couchoud <sup>11</sup>	2009	+	-	+	+/-	+	+
Couchoud <sup>12</sup>	2015	+	-	+	+/-	+	+
Diefenthaeler <sup>13</sup>	2008	+/-	+	+	+	+	+
Doi <sup>14</sup>	2015	+	-	+	+	+	-
Genestier <sup>15</sup>	2009	+	-	+	+	+	+
Honda <sup>16</sup>	2007	-	+	+	+	+	+
Jassal <sup>17</sup>	1996	+	+	+	+	+	-
Johansen <sup>18</sup>	2007	+/-	-	+	+	+	+
Joly <sup>19</sup>	2003	+	+	+	+	+	+
Kim <sup>20</sup>	2014	+	-	+	+	+	-
Lacson <sup>21</sup>	2012	+/-	-	+	+/-	+	+
Lacson <sup>22</sup>	2013	+/-	-	+	+/-	+	+
Lopez Revuelta <sup>23</sup>	2004	+/-	+	+	+	+	-
Mauri <sup>24</sup>	2008	+	-	+	+	+	+
McClellan <sup>25</sup>	1991	+/-	+	+	+	+	-
Rakowski <sup>26</sup>	2006	+	-	+	-	+	-
Soucie <sup>27</sup>	1996	+/-	-	+	-	+	-
Thamer <sup>28</sup>	2015	-	-	+	-	+	-

Legend: + Good, +/- Moderate, - Poor

**Table 4. Critical appraisal of assessment tools as used in the studies included in the review**

Frailty	(* <b>) Frailty Index by Fried<sup>29</sup></b>	<b>Modified Fried Frailty Index by Woods<sup>30</sup> (18)</b>	<b>Modified Fried Frailty Index (4)</b>	<b>Clinical Frailty Scale (CFS)<sup>31</sup> (2)</b>
<b>Content</b>	1. Unintentional Weight loss 2. Weakness 3. Poor endurance 4. Slowness 5. Low activity	1. Undernourished or cachectic as assessed by data abstractor 2. Rand-36 physical function < 75 3. Rand-36 vitality < 55 4. "Almost never" or never active 5. Kcal/week by self-report	1. SF-12 physical function scale; score < 75='slow' or 'weak' 2. Two questions addressing energy and "feeling washed out and drained" 3. Lowest quintile of Adjusted Activity Score 4. Activities based on Human Activity Profile	1. Very fit 2. Well, without active disease 3. Well, with treated comorbid disease 4. Apparently vulnerable: "slowed up" 5. Mildly frail: limited dependence for iADL 6. Moderately frail, limited dependence for ADL 7. Severely frail: completely dependent for ADL
<b>Score</b>	1 point for each item; total 5 points	1 point for each item; total 5 points	1 point for SF-12 PF < 75, 1 point for other 2 items; total 3 points	Ordinal scale
<b>Cut-off</b>	frail ≥ 3 points, pre-frail 2 points	frail ≥ 3 points	frail ≥ 2 points	none
<b>Strengths</b>	Widely used Objective: all points have standard measurements and cut-off values	Can be used when performance measures are missing, Easy to obtain from database	Idem as Woods index	Easy to obtain Captures incremental severity of frailty Includes impression of ADL/iADL
<b>Weaknesses</b>	Collecting grip strength and walking speed is time consuming	Subjective: self-reported Frailty may be over-identified when compared to Fried frailty index	Idem as Woods Index Does not include information on wasting, which may reduce its sensitivity (no data available on this)	Subjective: impression of physician Definitions not indisputable, standardization difficult Not compared with Fried Index in dialysis
<b>Conclusion</b>	The Fried Frailty Index, which includes items of physical performance, is most objective and considered the "gold standard" in nephrology. <sup>32</sup> The Fried derived frailty scores focus on physical activity rather than performance, and are useful in retrospectively obtaining data on frailty from databases. However, they are likely to overestimate frailty compared to Fried. CFS focuses on the influence on daily life by capturing aspects of ADL and iADL. The different definitions of frailty of the Fried (derived) scores and the CFS make it difficult to compare the scores. Frailty is a multidimensional construct and the exact definition is subject of an on-going debate. <sup>33</sup> Different frailty screening tools exist that additionally include psychosocial and cognitive domains. <sup>34,35</sup> Which frailty-screening instrument is appropriate depends on the setting and indication. The CFS may be useful for longitudinal measurements due to the ability to detect incremental severity of frailty.			

  

Performance	<b>Karnofsky Performance (7,8,17,19,36)</b>	<b>Modified Karnofsky Performance index (23-25, 27)</b>	<b>WHO score (14)</b>	<b>AGGIR<sup>(15)</sup></b>
<b>Content</b>	100. Normal no complaints 90. Able to carry on normal activity 80. Normal activity with effort 70. Cares for self; unable to carry on normal activity 60. Requires occasional assistance 50. Requires considerable assistance 40. Disabled 30. Severely disabled 20. Very sick 10. Moribund	90-100 (≥ 9) No complaints: almost normal physical activity 80-89 (8-<9) Able to carry out normal physical activity at least part of the time 70-79 (7-<8) Only able to carry out physical activities involving self-care 40-69 (4-<7) Requires at least some assistance for care of bodily needs; may require special care; often debilitated 1-39 (< 4) Requires institutionalization or hospitalization; may be moribund	0. Able to carry out all normal activity without restrictions. 1. Restricted in physically strenuous activity but ambulatory and able to carry out light work. 2. Ambulatory and capable of all self-care but unable to carry out any work; up and more than 50% of waking hours. 3. Capable of only limited self-care; confined to bed or chair more than 50% of waking hours. 4. Completely disabled	1. bedridden, cognitive impaired, ADL-dependent 2. bedridden, cognitive mildly impaired, mostly ADL-dependent 3. total assistance with physical performance 4. limited assistance with ADL and physical performance 5. occasional assistance with ADL 6. non ADL dependent
<b>Score</b>	Ordinal 10-point scale 100-0 (moribund)	Ordinal 5-point scale	Ordinal 5-point scale 0-4	Ordinal 6-point scale 1-6
<b>Cut-off</b>	≤ 70 / ≤ 60 disabled <sup>2</sup> ≤ 40 severely impaired*	< 70 / < 7 dependent < 4 severely impaired*	2-4 limited; 0-1 non-limited	1-4 limited; 5-6 non-limited
<b>Strengths</b>	Widely used in ESKD, easy to obtain, clear definition of performance status	Easy to obtain, clear definition of performance status	Easy to obtain, clear definition of performance status	Easy to obtain, fairly clear definition performance status
<b>Weaknesses</b>	Developed for the oncology population. *Different cut-off values for (severe) disability, which may impede comparison of results	Idem to original score, although simplification may cause loss of information. The numbering may be confusing. *Different cut-off values.	Developed for the oncology population. Discriminates only 3 categories of self-care, which makes it less suited for elderly patients	National score system, not frequently used in ESKD, overlap with ADL-scores but not as comprehensive
<b>Conclusion</b>	All tests score both physical performance and ADL and are fairly comparable. The Karnofsky score is most extended and has been widely used in ESKD. There is no comparison between the original and			

	modified Karnofsky in ESKD. Use of different cut-off values impedes with comparison of the results. A score of $\leq 70$ for disablement is most common. NB. It is noteworthy that retrospectively collected data regarding performance status may be compromised by missing data or assumptions, since the amount of assistance needed is often not (well) documented.
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ADL	Barthel Index <sup>37</sup> (17)	Scale of Basic Activities of Daily Living (15)
<b>Content</b>	10-items: feeding, bathing, grooming, dressing, bowels, bladder, toilet use, transfers, mobility, stairs	6-items: hygiene, dressing, toileting, locomotion, continence, meals
<b>Score</b>	Items are divided in 2-4 categories, given 0,5,10, or 15 points Subsequently categorized into multiple categories	Each item ranked from 0. autonomous 1. partial assistance 2. total assistance
<b>Cut-off</b>	Different cut-off values for categories	ADL Dependent > 6
<b>Strengths</b>	Easy to obtain, clear definition of subcategories, comprehensive scale for ADL, weighted score for the different items	Easy to obtain, clear definition of subcategories
<b>Weaknesses</b>	Different cut-off values for categories, not specifically developed or adjusted for ESKD	Not specifically developed or adjusted for ESKD
<b>Conclusion</b>	The Barthel Index has been most frequently applied in ESKD. The scale of basic ADL resembles the widely used Katz's ADL score, an other frequently used scale, but ranks each item on a 3-point scale instead of a 2-point score. The Barthel index is slightly more comprehensive, but the tests are equally likely to detect problems in ADL. NB. These is considerable overlap with the items captured in the tests for performance status. For intervention purposes, the more comprehensive tests for ADL (Barthel, Katz) may be superior, because deficits in specific items can be found.	

Depression	Beck's Depression Inventory (13)& Beck's Depression Inventory II (8)	Geriatric Depression Scale-30 <sup>38</sup> (17)	(*) Geriatric Depression Scale-15 <sup>39</sup>	Mental Health Index – 5 item (6) (subscale of the SF-36)	Mental Health Index – 2 item (21,22) (subscale of the SF-36)
<b>Content</b>	21 items about affective, cognitive and somatic symptoms that are indicative for depression. BDI II is the revised version (1996)	30 items on how participant felt over the last week	15 items on how participant felt over the last week	Frequency of feelings over last 4 wks: #1. Being nervous #2. Feeling down in the dumps #3. Feeling calm and peaceful #4. Feeling downhearted and blue #5. Being happy	Frequency of feelings over last 4 wks: #2. Feeling down in the dumps #4. Feeling downhearted and blue
<b>Score</b>	Each item ranked 0-3, range 0-63	Yes/no.	Yes/no. In the short form 5 items are scored positive when the answer is "no".	Frequency of each item scored 1-6. Answers to each question are summed to produce raw scores and then transformed to a 0 –100 scale.	Frequency of each item scored 1-6. Depression score = $(7-#2 + 7-#4) / 2$ <sup>21</sup>
<b>Cut-off</b>	$\geq 14$ <sup>13</sup> / $\geq 16$ <sup>8</sup>	10-19 mild depressive 20-30 severe depressive	5-8 mild, 9-11 moderate, 12-15 severe depression*	$\leq 52$ depressive symptoms	>2-4 possibly depressed $\geq 5-6$ likely depressed
<b>Strengths</b>	Validated in ESKD <sup>40</sup> High sensitivity (91%) and specificity (86%) <sup>40</sup> Most frequently used in dialysis	High sensitivity (92%) and specificity (89%) in general elderly population. <sup>41</sup> Comprehensive	Validated in ESKD <sup>40</sup> Good specificity 82% (Sensitivity 63%) <sup>40</sup> Most widely used in the general elderly population	Convenient tool to obtain data on depressive symptoms from registries/databases that use the SF-36	Convenient tool to obtain data on depressive symptoms from registries/databases that use the SF-36
<b>Weaknesses</b>	Different cut-off values, which impedes comparison of results	Time consuming (30 minutes) No other studies in ESKD	*Different cut-off values, which impedes comparison of results	Sensitivity (79%) and specificity (72%) in general population. <sup>42</sup> Not validated in ESKD	Compared to BDI in ESKD: Sensitivity 65%, 82% and specificity 67% and 69% (for #2 and #4 resp.) <sup>42</sup>
<b>Conclusion</b>	BDI is the most frequently used test for depression in ESKD and has a good validity. The GDS-30 is rather time-consuming to function as a screening test. The shorter GDS(-15), which was specifically developed for elderly patients as well, might be a good option in elderly dialysis patients. The correlation between the GDS-15 and the BDI in elderly dialysis patients was not optimal ( $r = 0.692$ ; $p < 0.001$ ). <sup>40</sup> However, in two studies assessing both tests sensitivity and specificity were comparable. <sup>40,43</sup> The MHI-5 and MHI-2 can retrospectively obtain data on depressive symptoms from registries that incorporate the SF-36. However, they are inferior to the other screening tests and will not be suffice for a geriatric assessment. Studies that only include the ICD diagnosis of depression are likely to miss a considerable amount of depressed patients. <sup>44</sup>				

<b>Mobility</b>	<b>Criteria for impaired elderly Ministry of Health and Welfare in Japan (3)</b>	<b>Criteria as applied by Couchoud (11,12)</b>
<b>Content</b>	8 categories based on increasing disability 1. able to walk without any limitation 2. able to walk without assistance only in the neighbourhood 3. able to walk without assistance only indoors 4. need assistance to walk 5. able to stand without assistance, but not walk 6. need assistance to stand 7. able to roll over without assistance in bed, but not stand 8. need assistance to roll over in bed	3 categories based on increasing disability 1. Walks without help 2. Need assistance for transfer 3. Totally dependent for transfer
<b>Score</b>	Ordinal	Ordinal
<b>Cut-off</b>	3-8 impaired; 1-2 not impaired	n/a
<b>Strengths</b>	Structured clinical measurement Discriminates between different levels of more severe impairment	Easy to obtain from database
<b>Weaknesses</b>	Does not include information on walking aids and balance disorders Specially suited for the very elderly or disabled population	Does not include information on walking aids and balance disorders Likely to miss a considerable amount of data
<b>Conclusion</b>	The Japanese mobility test obtains more detailed information on mobility in a structured and prospective way. Such an approach is likely to be more reliable, since in retrospective obtained data information on mobility may be missing if not adequately filed. However, it is an assessment specifically for elderly patients. Multiple other assessments for mobility are available, some of which are significantly related to poor outcome in community-dwelling elderly, such as walking speed, stair climbing and Timed-Up-and-Go test. <sup>45</sup>	

<b>Cognition</b>	<b>Mental score<sup>46</sup> (17)</b>
<b>Content</b>	10-items, mainly on orientation: 1. age; 2. Time; 3. address "42 West Street" (To be recalled at the end of the test); 4. Year; 5. name of hospital; 6. recognition of two persons (nurse, doctor etc.); 7. date of birth; 8. date of First World War I; 9. name of present Monarch; 10. count backward 20-0
<b>Score</b>	Good score of each items scores 1 point
<b>Cut-off</b>	< 7
<b>Strengths</b>	Easy to apply Clear definition
<b>Weaknesses</b>	Captures only a limited number of potentially impaired cognitive domains Not developed or validated in kidney disease
<b>Conclusion</b>	The Mental score has not frequently be used in ESKD. A cognition-screening test in CKD and dialysis should be able to adequately detect vascular cognitive impairment. The Montreal Cognitive Assessment showed good sensitivity (77%) and specificity (79%) for cognitive impairment in prevalent dialysis patients and performed better than the better-known Mini Mental State Examination (MMSE). <sup>47</sup> Database studies will most likely underestimate the prevalence of cognitive impairment, because it is often under-diagnosed in dialysis and ESKD patients. <sup>8</sup>

<b>Nutritional status</b>	<b>Subjective Global Assessment<sup>48</sup> (6,9,16,20,36)</b>
<b>Content</b>	5 items on medical history (weight change, dietary intake, gastrointestinal symptoms, functional impairment (nutritionally related), disease and its relation to nutritional requirements) 3 items on physical examination (signs of fat and muscle wasting, edema)
<b>Score</b>	1-7
<b>Cut-off</b>	Very mild risk to well-nourished= 6 or 7 Mild-moderate = 3-5 Severely malnourished = 1 or 2
<b>Strengths</b>	Reliable assessment, rapid performance, widely used in CKD, strong predictive value for mortality in multiple large studies, recommended clinical test by K/DOQI. <sup>49</sup>
<b>Weaknesses</b>	May not be a reliable predictor of degree of protein malnutrition. Reproducibility over time has not been well assessed.
<b>Conclusion</b>	Reliable screening instrument for malnutrition. K/DOQI advises additional assessment of BMI, handgrip strength, waist circumference, serum albumin, and serum creatinine. <sup>49</sup>

## Legend

AGGIR Autonomie Gérontologique Groupes Iso-Ressources, (i)ADL (instrumental) activities of daily living iADL BDI Beck's Depression Inventory, GDS Geriatric Depression Scale, ESKD end stage kidney disease, MHI Mental Health Inventory, PF physical functioning, RAND-36/ SF-36 Short Form (36) Health Survey, SF-12 short version of the SF-36.

References of the studies included in the review are indicated by (...). Tests marked with (\*) are not included in the review, but are reference tests mentioned in the conclusion section

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