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1 **Title Page:**

2 **Title:** Multi-component frailty assessment tools for older people with psychiatric disorders:
3 A systematic review

4 **Short running title:** Frailty assessment and psychiatric disorder

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22 **Impact statement:** We certify that this work is novel. To the authors best knowledge this is
23 the first systematic review to consider frailty assessment in the context of psychiatric
24 disorder in older adults. This review highlights that no existing multi-component frailty
25 assessment has been developed for or validated in older adult populations with psychiatric
26 disorders. It also highlights that significant construct overlap and potential confounding
27 exists between the indicators of frailty as conceptualised in existing frailty assessment tools
28 and DSM-5 diagnostic criteria for common psychiatric disorders, including Major Depressive
29 Episode and Generalised Anxiety Disorder. It determines that further research is necessary
30 to establish a reliable and valid tool to assess frailty in this population.

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42 **ABSTRACT:**

43 **Objective:** To review evidence evaluating the use of multi-component frailty assessment
44 tools in assessing frailty in older adults with psychiatric disorders. **Methods:** A systematic
45 literature review was conducted to identify all multi-component frailty assessment tools (i.e.
46 a tool that assesses ≥ 2 indicators of frailty). The items of each frailty assessment tool were
47 compared to DSM-5 diagnostic criteria for psychiatric disorders to assess construct overlap.
48 Studies conducted in community, inpatient and outpatient clinical settings were considered
49 for inclusion. **Participants:** Adults aged ≥ 60 years old. **Results:** 5,639 studies in total were
50 identified following the removal of duplicates; 97 of which were included for review. Of the
51 48 multi-component frailty assessment tools identified, no tool had been developed for, or
52 validated in, older adult populations with psychiatric disorder. 24/48 frailty assessment tools
53 contained a psychological assessment domain, with 18/48 tools using presence of depressed
54 mood and/or anxiety as a frailty indicator. Common areas of construct overlap in frailty
55 assessment tools and DSM-5 diagnostic criteria included weight loss (29/48) and fatigue
56 (21/48). **Conclusions:** Significant construct overlap exists between the indicators of frailty as
57 conceptualised in existing frailty assessment tools and DSM-5 diagnostic criteria for
58 common psychiatric disorders, including Major Depressive Episode and Generalised Anxiety
59 Disorder, which has the potential to confound frailty assessment results. Further research is
60 necessary to establish a reliable and valid tool to assess frailty in this population.

61 **Keywords:** frailty assessment, psychiatric disorder.

62 INTRODUCTION:

63 Frailty is a prevalent issue in later life, with evidenced links to adverse outcomes including
64 functional decline, falls, institutionalisation and mortality.¹⁻⁵ Frailty is a multifactorial clinical
65 state or syndrome; it represents decline in multiple physiological systems resulting in poor
66 maintenance of homeostasis and decreased reserves and resilience to stressors^{6,7}. There are
67 number of models to conceptualise frailty, the two most widely accepted being the
68 Canadian Study of Health and Ageing Cumulative Deficit Model⁸ and the Cardiovascular
69 Health Study Phenotype Model⁹. The Cumulative Deficit Model assesses frailty through an
70 index of deficits associated with aging including disabilities and diseases; a higher index
71 score indicates a higher level of frailty, with no cut point to distinguish between frail and
72 robust⁸. The Phenotype Model establishes a frailty phenotype consisting of the following
73 frailty indicators; involuntary weight loss, self-reported exhaustion, self-reported sedentary
74 behaviour, slow gait speed and weak grip strength⁹. The presence of zero frailty indicators
75 suggests an individual is robust, 1-2 frailty indicators is suggestive of pre-frail (the
76 intermediate stage between robust and frail) and ≥ 3 indicators confirms frailty¹⁰.

77 Frailty and psychiatric disorders, such as Major Depressive Disorder and Generalised Anxiety
78 Disorder, are thought to be distinct but highly related clinical entities.^{11,12} Evidence suggests
79 that frailty and psychiatric disorders are highly co-morbid^{12,13}. A recent systematic review of
80 evidence exploring comorbidity of frailty and depression found that 4-16% of frail adults
81 aged ≥ 60 years had major depression, with this rising to 35% in frail older adults aged ≥ 75
82 years and in male populations.¹³ The rate of co-morbid frailty in depressed older adult
83 populations reached 46-57%.¹³

84 In addition to comorbidity there is good evidence to support a bidirectional association
85 between depression/anxiety and frailty in later life.^{12,14-16} Evidence suggests that older
86 adults with a psychiatric disorder are at an increased risk of becoming frail and often
87 experience the highest levels of frailty.^{17,18} For example, a cross sectional observational
88 study by Collard and colleagues¹⁹ found that the overall prevalence of physical frailty in a
89 depressed older adult population was 27.0%, three times higher than the prevalence in the
90 study's non-depressed sample (9.1%). Conversely, evidence suggests that frailty is
91 associated with an increased chance of developing clinically meaningful depression and
92 anxiety symptoms.^{12,14-16} Further to this, physical frailty has been shown to adversely affect
93 the course of late-life depression, with increased odds of non-remission associated with
94 increased physical frailty²⁰. Brown and colleagues²¹ have recently proposed a depressed
95 frail phenotype as a high-risk profile for late life frailty. Given that psychiatric disorders are
96 also pervasive late life issues with increased risks for many of the same adverse outcomes as
97 frailty including dementia and mortality,^{22,23} frailty in the context of psychiatric disorder
98 warrants specialist clinical detection and intervention.

99 Frailty is widely considered to be a dynamic process with potential for restorative and
100 preventative clinical interventions.^{6,24} The need to develop new treatment modalities to
101 address frailty in the context of psychiatric disorders has been recently highlighted^{13,25}. The
102 accurate assessment of frailty is key in the development and provision of such interventions.
103 A recent systematic review of the psychometric properties of existing multi-component
104 frailty assessment tools found the extent and quality of psychometric testing of these tools
105 to be limited²⁶. Only two of the thirty-eight tools included for review evidenced reliability
106 and validity data within statistically significant parameters and were of fair-to-excellent
107 quality according to the COnsensus-based Standards for the selection of health

108 Measurement INstruments (COSMIN) checklist²⁷; the Frailty Index-Comprehensive Geriatric
109 Assessment (FI-CGA)²⁸ and the Tilburg Frailty Indicator (TFI)²⁹. To date, there is no frailty
110 assessment tool that is widely accepted as a gold standard.²⁶

111 Given the high co-morbidity of frailty and psychiatric disorders in late life, associations
112 between the two, the increased risk for adverse outcomes and potential for restorative and
113 preventative interventions, the accurate assessment of frailty in older adult psychiatric
114 populations should be a priority. Of the 10 systematic reviews concerning frailty
115 assessment published to date,^{7,26,30-37} none have considered frailty assessment in the
116 context of mental illness. Therefore, the aims of this review were to: (1) Establish if any
117 existing multi-component frailty assessment tools have been developed for or validated in
118 older adult populations with a diagnosis of psychiatric disorder, and (2) establish any
119 construct overlap between the assessment domains of existing multicomponent frailty
120 assessment tools and the Diagnostic and Statistical Manual of Mental Disorders (DSM–5)
121 diagnostic criteria for psychiatric disorders in older adults, exploring the potential impact of
122 this on valid and reliable frailty assessment in this population.

123

124 **METHODS:**

125 Search strategy

126 The following databases were searched on 15th February 2017: Medline (1946–present),
127 PsychINFO (1806–present), Embase (1947– present) and the Cochrane Central Register of
128 Controlled Trials. The search strategy used was: frailty AND (older OR elder* OR geriatr*)
129 AND (measure* OR assess*). The reference lists of 10 systematic reviews^{7,26,30-37} concerning

130 frailty assessment identified through the above search strategy were also searched
131 manually.

132 Selection criteria

133 Studies were selected for inclusion for review if they met the following criteria:

- 134 • All study participants were aged ≥ 60 years old.
- 135 • The study described a multi-component tool, which was defined as a tool that
136 assesses ≥ 2 indicators of frailty, such as a frailty index.
- 137 • The study described a tool that was specifically developed to assess frailty.
- 138 • The main purpose of the study was the development and/or evaluation of the
139 reliability and validity of a multi-component tool to assess frailty.
- 140 • The study applied the original version of a multi-component tool to assess frailty.
- 141 • The full content of the multi-component tool was available (including all indicators of
142 frailty, units of measurement and scoring systems).
- 143 • The study reported quantitative data.
- 144 • The full peer-reviewed study text was available.
- 145 • Studies were available in English or were translated wherever possible.

146 See supplementary file 1 for an expanded explanation of study selection criteria. The title
147 and abstracts were screened, and potentially eligible studies were selected for inclusion by
148 JLS. Studies were considered for inclusion regardless of their methodological quality.

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150

151 Data extraction and analysis

152 Data were extracted regarding: i) study characteristics; ii) the population each tool was
153 developed for and validated in; iii) the content of each frailty assessment tool. Data for
154 items i) and ii) were extracted by two independent raters, while data for items iii) were
155 extracted by JLS.

156 Following data extraction, the assessment items of each frailty assessment tool were
157 compared to the DSM–5 diagnostic criteria for the seven common psychiatric disorders in
158 older adults; Major Depressive Disorder (MDD), Bipolar Affective Disorder (BAD),
159 Schizophrenia, Generalised Anxiety Disorder (GAD), Social Anxiety Disorder (SAD), Specific
160 phobia (SP) and Panic Disorder (PD).^{22,38} An assessment of definite construct overlap
161 between the items of the frailty assessment tools and the DSM-5 diagnostic criteria was
162 then completed. Definite construct overlap was defined as instances where the frailty
163 assessment tool item and DSM-5 diagnostic criteria were conceptually the same (for
164 example, ‘troubles with sleeping’ and ‘Insomnia or hypersomnia’). The exact units and
165 process of measurement did not need to be the same, but they must have assessed the
166 same theoretical construct. The potential for an individual to be assessed as frail or pre-frail
167 based on mental health symptoms alone was also reviewed. Assessment of definite
168 construct overlap was completed by two independent blind raters (JLS, RG, MC, EW, AB,
169 MLS, MS, AR). Any disagreements were resolved through discussion.

170 Assessment of methodological quality of studies included for review

171 The COSMIN checklist is a standardized tool for evaluating the methodological quality of
172 studies examining measurement properties of health-related instruments.^{27,39,40} It assesses
173 measurement properties across the following domains, awarding ratings of ‘excellent’,

174 'good', 'fair', or 'poor' quality; internal consistency, reliability, measurement error, content
175 validity, structural validity, hypotheses testing, cross-cultural validity, criterion validity and
176 responsiveness.^{27,39,40} A rating of 'excellent' indicates that the evidence provided for that
177 measurement property is adequate. A rating of 'good' indicates that the evidence provided
178 can be assumed to be adequate. A rating of 'fair' indicates that the evidence is questionable,
179 and 'poor' indicates that the evidence provided is inadequate. The COSMIN checklist was
180 applied to each study and data were extracted by two independent, blind raters (JLS, RLG,
181 MCC, AMB, EVW, MLS, GL). Any disagreements were resolved through discussion.

182 Reporting

183 This review followed the PRISMA standards⁴¹ for reporting of systematic reviews.

184

185 **RESULTS:**

186 Literature search and inclusion for review:

187 The literature search identified 5,639 records in total following the removal of duplicates;
188 from which 95 studies were included for review following assessment against selection
189 criteria (see Fig. 1).^{3,9,28,29,42-132}

190 Study characteristics

191 A full outline of study characteristics is provided in supplementary table 1. Forty-eight multi-
192 component frailty assessment tools were examined across 95 studies.^{3,9,28,29,42-132} The most
193 frequently observed study design was prospective cohort (32/95 studies).<sup>3,42-46,9,48-51,70-
194 72,74,75,80,82,86,89,91,94,97,99,103,107,109,116,118,131,132</sup> Of the 62 studies with follow-up data available,

195 follow-up periods ranged from 1 month^{53,64,73} to 348 months.¹¹⁹ The total number of
196 participants per study ranged from 14¹²¹ to 931,541.⁶⁷ The overall total percentage of
197 female participants, calculated by pooling the percentage female population from the 84/95
198 studies with data available, was 65.9%. The overall mean age of participants, calculated by
199 pooling the mean ages from the 73/95 studies with data available, was 74.9 years.
200 Participants were most commonly sampled from The Netherlands (29/95 studies).^{29,60-}
201 ^{62,68,76,77,84,86-92,95,96,98,101,102,107,111,113-115,125-128} The cohorts were predominantly community
202 based, general older adult populations (51/95).^{3,9,29,42,46,48,50,56-58,60-62,67,69,70,74,76,77,79,81,82,84-}
203 ^{88,90,95-99,103,105,106,108,109,111,118,119,123-132} Only one of the 95 cohorts consisted of
204 'psychogeriatric patients' (80.8% diagnosed with dementia, 5% depression, 11% unspecified,
205 3% no mental disorder).¹⁰⁷ Data regarding participant mental health diagnoses were not
206 available in the remaining 94 studies.

207 Methodological quality of studies included for review

208 The COSMIN checklist results are detailed in supplementary table 2. In total, 7/95 studies
209 had one aspect of methodological quality rated as excellent.^{48,56,59,84,99,111,132} All ratings of
210 excellent were in relation to content validity. A further 7/95 studies had at least one aspect
211 of methodological quality rated as good; hypothesis testing being the measurement
212 property with the highest number of good ratings (4/7).^{67,73,88,101,103,122,123} 70/95 studies had
213 at least one aspect of methodological quality rated as fair.^{3,9,28,29,42,44,45,47,48,51-60,62,64,66,69-72,74-}
214 ^{77,81-87,89-99,101-103,106,107,109-118,120,124,125,127-129} Hypothesis testing had the greatest number of
215 fair ratings (65/70). 42/95 studies had at least one aspect of methodological quality rated as
216 poor.^{43,46,50,52,53,57,58,60,61,63,65,68-70,76,78-80,82,84,86-88,91,98-100,104,105,108,111,112,115,118,119,121,126,129,130}

217 Criterion validity had the greatest number of poor ratings (30/42). Five studies cited low
218 response rates as a study limitation.^{29,76,125,126,128}

219 Construct overlap between multi-component frailty assessment tool items and psychiatric
220 disorder

221 Figure 2 summarizes key findings in relation to the review aims. Table 1 provides an
222 overview of construct overlap observed in relation to frailty assessment domains and
223 supplementary table 3 provides an overview of all construct overlap observed. Of the tools
224 reviewed, only 7/48 had no definite construct overlap between frailty assessment tool items
225 and DSM-5 diagnostic criteria for MDD, BAD, Schizophrenia, GAD, SAD, SP or PD; Brief
226 Clinical Instrument to Classify Frailty,⁴²⁻⁴⁴ Clinical Frailty Scale (CFS),⁴⁸⁻⁵¹ Frailty predicts
227 death One year after CARDiac Surgery Test (FORECAST),^{54,55,73} Frailty Index Based on
228 Common Laboratory Tests (FI-LAB),⁷⁵ Korean Longitudinal Study of Health and Aging
229 (KLoSHA) Frailty Index,⁹⁹ Palumbo Frailty Index,¹⁰² and the 9-Item Frailty Measure.¹³² In
230 29/48 tools, definite construct overlap was established between the nutritive domains of
231 the frailty assessment tool (weight loss/reduced appetite) and DSM-5 diagnostic criteria for
232 MDD and BAD³⁸ concerning weight loss and appetite changes.<sup>3,9,28,29,43,44,47,52,59,63-67,70-72,76-
233 79,81,82,84-98,100,101,103-106,108,109,111-131</sup> Definite construct overlap was observed between frailty
234 items concerning fatigue and the DSM-5 diagnostic criteria for MDD, BAD and GAD³⁸
235 concerning fatigue in 21/48 tools.^{3,9,28,43,47,52-55,68,69,76-79,81,83,85,87,93,97,103-105,108-118,121-131} In 9/48
236 tools, definite construct overlap was established between cognitive items relating to
237 concentration and processing skills and the DSM-5 diagnostic criteria for MDD, BAD and
238 GAD,³⁸ concerning diminished ability to think or concentrate.<sup>28,44,45,67,70-72,76,77,80,87,100,107,119-
239 ¹³⁰ Definite construct overlap was observed between the frailty item 'slowness' and</sup>

240 psychomotor retardation; a DSM-5 diagnostic criteria for MDD, BAD³⁸ in 8/48 tools.^{3,9,43,53-}
241 ^{55,82,103-105,107-109,111-115}Definite construct overlap was observed between frailty indicators
242 concerning reduced activity levels and the DSM-5 diagnostic criteria for schizophrenia,³⁸
243 concerning negative symptoms in 8/48 tools.^{39,50-52,64,65,77,82,105-108,111,114-118} Definite construct
244 overlap was also identified between sleep disturbance domains and the DSM-5 diagnostic
245 criteria for MDD, BAD and GAD,³⁸ concerning sleep disturbance in 4/48 tools.^{47,67,74,76,77} A
246 detailed summary of all construct overlap between all 48 frailty assessment tool items and
247 DSM-5 diagnostic criteria for MDD, BAD, schizophrenia, GAD, SAD, SP & PD is provided in
248 Supplementary tables 4-10, respectively.

249 Of the 31 tools for which there is a clear cut-off point to distinguish between individuals
250 who are frail or robust, an individual could be classified as frail solely on the basis of their
251 mental health symptoms in 11/31 tools,^{3,9,28,43,44,70-72,78,79,100,103-105,107-109,116-120} and as pre-
252 frail on a further 4/31^{45,58,110-115} (15/31total).

253 21/48 multi-component frailty assessment tools identified in this review contain a
254 psychological assessment domain (domains/items concerning 'psychological indicators of
255 frailty' defined by the author).^{28,43-47,52,56,57,59-66,68-72,76-78,81,84-92,94,100,101,109,110}

256 18/48 tools include the presence of depressed mood and/or anxiety as specific
257 measurement items indicating frailty.^{28,43-47,52,56,57,59-66,68-72,76,77,81,84-92,94,100,101} 12/48 tools
258 include items from existing psychiatric assessment tools; five of which use items from the
259 Centre for Epidemiological Studies-Depression Scale (CES-D).^{3,9,43,58,68,79,104,105,108} Other tools
260 included the Hospital Anxiety and Depression Scale (HADS)⁵⁹ and the Beck Depression
261 Inventory II.⁹⁴ However, in the majority of these cases, items included from existing mental

262 health tools were used to assess fatigue (7/12),^{3,9,43,58,68,79,81,93,104,105,108} rather than the
263 presence of mental illness (5/12).^{28,44,45,63,70-72,94,100}

264 **DISCUSSION:**

265 To the authors' knowledge, this is the first systematic review that has considered frailty
266 assessment in the context of psychiatric disorder in older people.

267 In summary, no tool identified in this review has been developed for or validated in older
268 adult populations with psychiatric disorder. One tool that has been tested in a
269 psychogeriatric population; the Prognostic Risk Score,¹⁰⁷ was developed for and validated in a
270 cohort of whom 80.8% had a dementia diagnosis. This identifies a gap in the current
271 research.

272 Only seven tools were identified as having no definite construct overlap with DSM-5
273 diagnostic criteria: Brief Clinical Instrument to Classify Frailty⁴²⁻⁴⁴ and CFS,⁴⁸⁻⁵¹ which are
274 screening instruments designed for use in general hospitals; FORECAST^{54,55,73}, which was
275 designed to assess frailty following cardiac surgery; FI-LAB⁷⁵, which is based on common
276 laboratory tests for use in long-term residential care facilities; KLoSHA Frailty Index⁹⁹,
277 developed for use with community-dwelling elderly Korean population; Palumbo Frailty
278 Index¹⁰², designed to assess frailty in multiple myeloma patients; and 9-Item Frailty
279 Measure¹³², designed for use in routine geriatric practice. However, as noted, none of these
280 tools have been developed for use in a mental health setting, or with consideration for the
281 complex interactions between frailty and psychiatric disorder. Significant construct overlap
282 was identified between indicators of frailty as conceptualised in existing frailty assessment
283 tools and DSM-5 diagnostic criteria for seven common psychiatric disorders. The diagnostic
284 criteria for MDD (and thus the depression criteria for BAD) had the highest proportion of

285 definite construct overlap with frailty assessment items (41/48 tools). The diagnostic criteria
286 for GAD also had a high proportion of definite construct overlap (34/48 tools). The
287 diagnostic criteria for SAD and SP had the lowest proportion of definite construct overlap
288 observed (11/48 tools and 10/48 tools respectively).

289 21/48 frailty assessment tools contained a psychological assessment domain, with 18/48
290 tools including the presence of depressed mood and/or anxiety as a frailty indicator. The
291 frailty indicators and DSM-5 diagnostic criteria that had the most construct overlap
292 concerned weight loss (29/48 tools) and fatigue (21/48). This construct overlap was further
293 confounded by the inclusion of questions from existing psychiatric assessment tools to
294 assess fatigue in 7/48 tools. For the tools for which there is a clear cut-off point to
295 distinguish between individuals who are frail or robust; an individual could be classified as
296 frail or pre-frail solely based on their mental health symptoms in half of them (15/31 tools).
297 This thus demonstrates significant potential for inaccurate assessment and recognition of
298 frailty in psychiatric populations.

299 Specifically, significant construct overlap and confounding was observed for the frailty
300 assessment tools with the most extensive reliability and validity testing;²⁶ FI-CGA²⁸ and TFI²⁹.
301 FI-CGA²⁸ items such as 'problems with mood', 'problems with motivation' and 'changes in
302 weight' were observed to have definite construct overlap with DSM-5 diagnostic criteria for
303 MDD. On FI-CGA²⁸ it is possible to be assessed as frail based on psychiatric symptoms alone;
304 the tool contains a psychological assessment domain and utilises questions from the
305 Geriatric Depression Scale¹³³ to assess mood, further increasing confounding. TFI²⁹ items
306 such as 'unexplained weight loss', 'physical tiredness' and 'feeling down' were observed to
307 have definite construct overlap with DSM-5 diagnostic criteria for MDD. The TFI also

308 includes a psychological assessment domain. Whilst it is not possible to be assessed as frail
309 based purely on the definite construct overlap observed for TFI, the level of overlap is such
310 that it is likely to confound frailty assessment in psychiatric populations. Definite construct
311 overlap was also observed for tools based on the prominent Cumulative Deficit Model⁷⁴ and
312 Phenotype Model⁹, increasing the risks of confounding when assessing frailty with such
313 tools in psychiatric populations.

314 It is of note that there were many frailty assessment items for which a direct plausible
315 association with DSM-5 diagnostic criteria was observed, but which did not meet the criteria
316 for definite construct overlap. For example, tools such as the FI-LAB⁷⁵ contain a measure of
317 serum albumin as part of a nutritive domain, with low levels indicating malnutrition. Whilst
318 this cannot be classified as definite construct overlap with the MDD diagnostic criterion
319 'unintentional weight loss', there is a direct and plausible association. Tools such as the Brief
320 Frailty Index⁴⁵ and Prognostic Risk Score¹⁰⁷ included 'low body mass index' as an indicator of
321 frailty, which again whilst highly associated with 'unintentional weight loss', did not meet
322 the criteria for definite overlap. Another example are tools such as the Palumbo Frailty
323 Index¹⁰² and the KLoSHA Frailty Index⁹⁹ which include a functional assessment of
324 instrumental activities of daily living (IADL). Whilst no definite construct overlap was
325 identified, there is a plausible association between IADL assessment performance and the
326 symptoms of fatigue and reduced interest in activities and concentration associated with
327 MDD.

328 Research and clinical implications

329 No frailty assessment tool identified in this review has been developed for use with, nor had
330 its reliability or validity tested in older adult psychiatric populations. Consequently, the

331 evidence-base for each frailty assessment tool lacks interpretability and generalisability in
332 relation to psychiatric populations, significantly increasing the risk of invalid assessment and
333 identification of frailty. Additionally,, the risk of invalid frailty assessment in psychiatric
334 populations is increased with the application of frailty assessment tools: i) for which definite
335 construct overlap was observed between assessment items and DSM-5 diagnostic criteria; ii)
336 that include a psychological assessment domain; and iii) include items derived from
337 psychiatric assessments.

338 Given the established high level of comorbidity of frailty with psychiatric disorders and
339 evidenced associations between psychiatric disorders and frailty, inaccurate assessment of
340 frailty in psychiatric populations holds substantial clinical risks. If frailty is not recognised
341 and treated within this high-risk population, the potential for adverse outcomes including
342 worsening of psychiatric symptoms and delayed psychiatric remission increases.^{13,21,25}

343 Similarly, if an individual is inaccurately assessed as being frail or pre-frail based on
344 psychiatric symptoms alone, then this could inappropriately or unnecessarily inform
345 treatment planning and provisions. At a wider level, the presence of frailty and psychiatric
346 disorders individually represent increased risks of adverse outcomes including functional
347 decline, institutionalisation and mortality.^{1-5,22} Accurate assessment and thus treatment of
348 frailty in the context of psychiatric disorder is essential in minimising risks of such adverse
349 outcomes and associated increased healthcare service utilisation.

350 In research terms, the implications of inaccurately assessing frailty are also substantial,
351 including an increased likelihood of the interpretation and reporting of flawed results. There
352 exists the potential to identify a research population as frail based on their mental health
353 symptoms alone, thus limiting the potential to identify a 'true' frail psychiatric population.

354 Considering the established research priorities specific to this population, including the need
355 to develop specialist treatments and preventative interventions, the impact of this is
356 considerable.

357 Further research is necessary to establish a reliable and valid tool to accurately assess frailty
358 in older adults with a diagnosis of psychiatric disorder. Some level of construct overlap and
359 confounding between the indicators of frailty and of psychiatric disorder is inevitable. For
360 example, sarcopenia is widely considered to be a fundamental component of the frailty
361 syndrome, and unintentional weight loss is an established symptom of MDD, both of which
362 are highly related concepts. However, it may be possible to minimise this construct overlap
363 by considering the way that indicators are conceptualised and measured, for example, by
364 defining and measuring the frailty indicator 'slowness' in a way that minimises construct
365 overlap with psychomotor retardation. Future research is required to establish this.

366 Limitations of the review

367 This review has several limitations. The search strategy was completed in February 2017,
368 therefore any potentially relevant studies published after this date were not considered for
369 review. Studies were assessed against inclusion criteria by the lead author (JLS) only,
370 increasing the risk of selection bias. This was minimised by strict adherence to the search
371 strategy and following the PRISMA standards for reporting in systematic reviews. Data
372 extraction concerning the content of frailty assessment tools was also completed by JLS
373 only, however all analysis including assessments of construct overlap were completed by
374 two independent raters. Studies concerning tools that were not explicitly developed to
375 assess frailty were excluded, limiting the scope of this review but deemed appropriate given
376 the multifaceted nature of the frailty presentation. The COSMIN checklist applied also has a

377 number of limitations (see previous review for discussion of these limitations)¹⁶. However,
378 COSMIN is a standardized tool for evaluating the methodological quality of studies
379 examining measurement properties of health-related instruments, so it was deemed
380 appropriate. In establishing construct overlap between frailty assessment tool items and
381 psychiatric indicators, the use of a different set of diagnostic criteria for mental illnesses
382 such as the 10th revision of the International Statistical Classification of Diseases and
383 Related Health Problems (ICD-10)¹³⁴ may have produced variation in the areas of construct
384 overlap identified. Due to the large volume tools reviewed, it was not possible to apply two
385 separate sets of diagnostic criteria. As the DSM-5 provides in-depth descriptions of
386 diagnostic criteria and is widely used, it was considered appropriate. Finally, whilst the
387 majority of construct overlap observed was due to actual construct overlap; a small amount
388 could be attributed to ambiguous wording of the frailty assessment tool items. For example,
389 the term “problems with” allows for a large range of symptoms to be scored under one
390 item.

391 Conclusions

392 To date, no multi-component frailty assessment tool has been developed for or validated in
393 older adult populations with psychiatric disorders. This review has provided an in-depth
394 analysis of construct overlap and confounding between the indicators of frailty as
395 conceptualised in existing frailty assessment tools and DSM-5 diagnostic criteria for seven
396 common psychiatric disorders. In designing a tool for use with older adults with a diagnosis
397 of psychiatric disorder, special consideration should be given, where possible, to minimising
398 the construct overlap identified in this review. Further research is necessary to establish a
399 reliable and valid tool to accurately assess frailty in this specific population.

400

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