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6 **Title Page:**

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

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

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

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45 **ABSTRACT:**

46 **Objective:** To review evidence evaluating the use of multi-component frailty assessment
47 tools in assessing frailty in older adults with psychiatric disorders. **Methods:** A systematic
48 literature review was conducted to identify all multi-component frailty assessment tools (i.e.
49 a tool that assesses ≥ 2 indicators of frailty). The items of each frailty assessment tool were
50 compared to DSM-5 diagnostic criteria for psychiatric disorders to assess construct overlap.
51 Studies conducted in community, inpatient and outpatient clinical settings were considered
52 for inclusion. **Participants:** Adults aged ≥ 60 years old. **Results:** 5,639 records in total were
53 identified following the removal of duplicates; from which 95 studies were included for
54 review. Of the 48 multi-component frailty assessment tools identified, no tool had been
55 developed for, or validated in, older adult populations with psychiatric disorder. 20/48
56 frailty assessment tools contained a psychological assessment domain, with 17/48 tools
57 citing presence of depressed mood and/or anxiety as a frailty indicator. Common areas of
58 construct overlap in frailty assessment tools and DSM-5 diagnostic criteria included weight
59 loss (29/48) and fatigue (21/48). **Conclusions:** Significant construct overlap exists between
60 the indicators of frailty as conceptualised in existing frailty assessment tools and DSM-5
61 diagnostic criteria for common psychiatric disorders, including Major Depressive Episode
62 and Generalised Anxiety Disorder, which has the potential to confound frailty assessment
63 results. Further research is necessary to establish a reliable and valid tool to assess frailty in
64 this population.

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

66 INTRODUCTION:

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

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

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

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

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

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

127

128 **METHODS:**

129 Search strategy

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

134 frailty assessment identified through the above search strategy were also searched
135 manually.

136 Selection criteria

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

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

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

153

154

155 Data extraction and analysis

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

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

174 Assessment of methodological quality of studies included for review

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

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

186 Reporting

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

188

189 **RESULTS:**

190 Literature search and inclusion for review:

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

194 Study characteristics

195 A full outline of study characteristics is provided in supplementary table 1. Forty-eight multi-
196 component frailty assessment tools were examined across 95 studies.^{3,9,28,29,42-132} The most
197 frequently observed study design was prospective cohort (32/95 studies).<sup>3,9,42-46,48-51,59,70-
198 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,

199 follow-up periods ranged from 1 month^{53,64,73} to 348 months.¹¹⁹ The total number of
200 participants per study ranged from 14¹²¹ to 931,541.⁶⁷ The overall total percentage of
201 female participants, calculated by pooling the percentage female population from the 84/95
202 studies with data available, was 65.9%. The overall mean age of participants, calculated by
203 pooling the mean ages from the 73/95 studies with data available, was 74.9 years.
204 Participants were most commonly sampled from The Netherlands (29/95 studies).<sup>29,60-
205 62,68,76,77,84,86-92,95,96,98,101,102,107,111,113-115,125-128</sup> The cohorts were predominantly community
206 based, general older adult populations (51/95).<sup>3,9,29,42,46,48,50,56-58,60-62,67,69,70,74,76,77,79,81,82,84-
207 88,90,95-99,103,105,106,108,109,111,118,119,123-132</sup> Only one of the 95 cohorts consisted of
208 ‘psychogeriatric patients’ (80.8% diagnosed with dementia, 5% depression, 11% unspecified,
209 3% no mental disorder).¹⁰⁷ Data regarding participant mental health diagnoses were not
210 available in the remaining 94 studies.

211 Methodological quality of studies included for review

212 The COSMIN checklist results are detailed in supplementary table 2. In total, 7/95 studies
213 had one aspect of methodological quality rated as excellent.^{48,56,59,84,99,111,132} All ratings of
214 excellent were in relation to content validity. A further 7/95 studies^{67,73,88,101,103,122,123} had at
215 least one aspect of methodological quality rated as good; hypothesis testing being the
216 measurement property with the highest number of good ratings (4/7). 70/95 studies had at
217 least one aspect of methodological quality rated as fair.<sup>3,9,28,29,42,44,45,47,48,51-60,62,64,66,69-72,74-
218 77,81-87,89-99,101-103,106,107,109-118,120,124,125,127-129</sup> Hypothesis testing had the greatest number of
219 fair ratings (65/70). 42/95 studies had at least one aspect of methodological quality rated as
220 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}

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

223 Construct overlap between multi-component frailty assessment tool items and psychiatric
224 disorder

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

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

253 Of the 31 tools for which there is a clear cut-off point to distinguish between individuals
254 who are frail or robust, an individual could be classified as frail solely on the basis of their
255 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-
256 frail on a further 5/31^{45,58,81,110-115} (16/31total).

257 20/48 multi-component frailty assessment tools identified in this review contain a
258 psychological assessment domain (domains/items concerning 'psychological indicators of
259 frailty' defined by the author).^{28,43-47,52,56,57,59-66,68-72,76-78,,84-92,94,100,101,109,110}

260 17/48 tools include the presence of depressed mood and/or anxiety as specific
261 measurement items indicating frailty.^{28,43-47,52,56,57,59-66,68-72,76,77,,84-92,94,100,101} 11/48 tools
262 include items from existing psychiatric assessment tools; five of which use items from the
263 Centre for Epidemiological Studies-Depression Scale (CES-D).^{3,9,43,58,68,79,104,105,108} Other tools
264 included the Hospital Anxiety and Depression Scale (HADS)⁵⁹ and the Beck Depression
265 Inventory II.⁹⁴ However, in the majority of these cases, items included from existing mental

266 health tools were used to assess fatigue (6/12),^{3,9,43,58,68,79,93,104,105,108} rather than the
267 presence of mental illness (5/12).^{28,44,45,63,70-72,94,100}

268 **DISCUSSION:**

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

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

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

289 definite construct overlap with frailty assessment items (41/48 tools). The diagnostic criteria
290 for GAD also had a high proportion of definite construct overlap (34/48 tools). The
291 diagnostic criteria for SAD and SP had the lowest proportion of definite construct overlap
292 observed (12/48 tools and 11/48 tools respectively).

293 20/48 frailty assessment tools contained a psychological assessment domain, with 17/48
294 tools including the presence of depressed mood and/or anxiety as a frailty indicator. The
295 frailty indicators and DSM-5 diagnostic criteria that had the most construct overlap
296 concerned weight loss (29/48 tools) and fatigue (21/48). This construct overlap was further
297 confounded by the inclusion of questions from existing psychiatric assessment tools to
298 assess fatigue in 6/48 tools. For the tools for which there is a clear cut-off point to
299 distinguish between individuals who are frail or robust; an individual could be classified as
300 frail or pre-frail solely based on their mental health symptoms in half of them (16/31 tools).
301 This thus demonstrates significant potential for inaccurate assessment and recognition of
302 frailty in psychiatric populations.

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

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

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

332 Research and clinical implications

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

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

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

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

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

358 Considering the established research priorities specific to this population, including the need
359 to develop specialist treatments and preventative interventions, the impact of this is
360 considerable.

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

370 Limitations of the review

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

381 number of limitations (see previous review for discussion of these limitations)²⁶. However,
382 COSMIN is a standardized tool for evaluating the methodological quality of studies
383 examining measurement properties of health-related instruments, so it was deemed
384 appropriate. In establishing construct overlap between frailty assessment tool items and
385 psychiatric indicators, the use of a different set of diagnostic criteria for mental illnesses
386 such as the 10th revision of the International Statistical Classification of Diseases and
387 Related Health Problems (ICD-10)¹³⁴ may have produced variation in the areas of construct
388 overlap identified. Due to the large volume tools reviewed, it was not possible to apply two
389 separate sets of diagnostic criteria. As the DSM-5 provides in-depth descriptions of
390 diagnostic criteria and is widely used, it was considered appropriate. Finally, whilst the
391 majority of construct overlap observed was due to actual construct overlap; a small amount
392 could be attributed to ambiguous wording of the frailty assessment tool items. For example,
393 the term “problems with” allows for a large range of symptoms to be scored under one
394 item.

395 Conclusions

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

404

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Figure legends:

Figure 1: Process of study selection

Supplementary material:

Supplementary data file 1: Expanded explanation of study selection criteria

Supplementary data file 2: PRISMA checklist

Supplementary table 1: General characteristics of studies

Supplementary table 2: Results of COnsensus based Standards for the selection of health Measurement Instruments (COSMIN) Checklist^{27,39,40}

Supplementary table 3: Definite construct overlap between multi-component frailty assessment tools and DSM-5 diagnostic criteria²⁹ for seven psychiatric disorders

Supplementary table 4: Definite construct overlap between existing multi-component frailty assessment tools and DSM-5 diagnostic criteria for Major Depressive Episode²⁹

Supplementary table 5: Definite construct overlap between existing multi-component frailty assessment tools and DSM-5 diagnostic criteria for Bipolar Affective Disorder²⁹

Supplementary table 6: Definite construct overlap between existing multi-component frailty assessment tools and DSM-5 diagnostic criteria for Schizophrenia²⁹

Supplementary table 7: Definite construct overlap between existing multi-component frailty assessment tools and DSM-5 diagnostic criteria for Generalised Anxiety Disorder²⁹

Supplementary table 8: Definite construct overlap between existing multi-component frailty assessment tools and DSM-5 diagnostic criteria for Social Anxiety Disorder²⁹

Supplementary table 9: Definite construct overlap between existing multi-component frailty assessment tools and DSM-5 diagnostic criteria for Specific Phobia²⁹

Supplementary table 10: Definite construct overlap between existing multi-component frailty assessment tools and DSM-5 diagnostic criteria for Panic Disorder²⁹

