

1 **Barriers and facilitators to screening and treating malnutrition in older adults living in**
2 **the community: A mixed-methods synthesis**

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Abstract

58 **Background.** Malnutrition (specifically undernutrition) in older, community-dwelling
59 adults reduces well-being and predisposes to disease. Implementation of screen-and-treat
60 policies could help to systematically detect and treat at-risk and malnourished patients. We
61 aimed to identify barriers and facilitators to implementing malnutrition screen and treat
62 policies in primary/community care, which barriers have been addressed and which
63 facilitators have been successfully incorporated in existing interventions.

64 **Method.** A data-base search was conducted using MEDLINE, Embase, PsycINFO,
65 DARE, CINAHL, Cochrane Central and Cochrane Database of Systematic Reviews from
66 2012 to June 2016 to identify relevant qualitative and quantitative literature from
67 primary/community care. Studies were included if participants were older, community-
68 dwelling adults (65+) or healthcare professionals who would screen and treat such patients.
69 Barriers and facilitators were extracted and mapped onto intervention features to determine
70 whether these had addressed barriers.

71 **Results.** Of a total of 2182 studies identified, 21 were included (6 qualitative, 12
72 quantitative and 3 mixed; 14 studies targeting patients and 7 targeting healthcare
73 professionals). Facilitators addressing a wide range of barriers were identified, yet few
74 interventions addressed psychosocial barriers to screen-and-treat policies for patients, such as

75 loneliness and reluctance to be screened, or healthcare professionals' reservations about
76 prescribing oral nutritional supplements.

77 **Conclusion.** The studies reviewed identified several barriers and facilitators and
78 addressed some of these in intervention design, although a prominent gap appeared to be
79 psychosocial barriers. No single included study addressed all barriers or made use of all
80 facilitators, although this appears to be possible. Interventions aiming to implement screen-
81 and-treat approaches to malnutrition in primary care should consider barriers that both
82 patients and healthcare professionals may face.

83 **Review registration.** PROSPERO: CRD42017071398. The review protocol was
84 registered retrospectively

85

86 **Keywords.** Primary health care, general practice, malnutrition, independent living,
87 health services for the aged, dietary supplements.

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Background

91 Malnutrition (specifically undernutrition) can impair wound healing, reduce muscle
92 strength and weaken the immune response, increasing many health risks including infections
93 and delayed recovery from illness¹. Increased prevalence of long-term health conditions
94 makes older adults particularly vulnerable to malnutrition^{2,3}. Malnutrition can have medical
95 or physiological causes (e.g. difficulties chewing or swallowing), psychosocial (e.g. poverty
96 or depression²), or a combination of these.

97 In the UK, more than 3 million people are believed to be malnourished⁴, and the cost
98 associated with malnutrition across health and social care was estimated to be £20 billion in
99 2015⁵. Among community-dwelling older adults in the UK and Ireland, 14% may be at risk

100 of malnutrition⁶, though estimates vary depending on the specific sub-groups and screening
101 tools studied⁷. The terms malnutrition and undernutrition are commonly used to define the
102 same state, which can arise through inadequate intake of nutrients or an inability of the body
103 to make use of nutrients⁸. However, *risk* of malnutrition is sometimes conceptualised as
104 increasing over time for as long as undernutrition continues⁷. The Global Leadership
105 Initiative on Malnutrition (GLIM) recently agreed diagnostic criteria for malnutrition, which
106 include meeting at least one of the following criteria (non-volitional weight loss, low body
107 mass or low muscle strength) and additionally at least one of the following criteria (reduced
108 food intake or assimilation or disease burden or inflammation)⁸.

109 Treating malnutrition in older adults may improve their health, quality of life^{10;11} and
110 reduce healthcare costs⁵. In the hospital setting, malnutrition-screen-and-treat policies are
111 recommended¹², but there is little evidence for their implementation and value in primary
112 care. Systematic screening, using validated tools such as the Malnutrition Universal
113 Screening Tool¹³, improves identification of individuals who may be at risk of malnutrition⁴
114 allowing treatment which may prevent malnutrition and its consequences¹⁴. Treatment
115 includes providing dietary advice¹⁵, meals¹⁶ or oral nutritional supplements (ONS¹⁷).
116 Treatment may differ depending on the severity of malnutrition risk, and several care
117 pathways, including for the community¹⁸, have been developed. Care pathways include tools
118 to aid diagnosis of underlying diseases or conditions that make eating or digestion difficult,
119 so that these can be treated⁹. However, malnutrition remains under-recognised and untreated
120 across all healthcare settings¹⁹ because healthcare professionals (HCP) often fail to diagnose
121 it²⁰ or attach low priority to nutrition in older patients²¹. Clinical guidelines recommend that
122 screening should be carried out by HCPs who have received appropriate training^{12,22}, but do
123 not specify how screening should be enacted or the training delivered despite urgent calls to
124 improve HCPs' nutrition education²³. Uncertainty remains about which of various approaches

125 are most practicable and acceptable to HCPs and older adults²⁴. Further, the evidence in
126 support of systematic use of screening tools²⁵ and treatment approaches such as giving ONS¹⁷
127 has largely emerged from research in secondary care, and comparatively little is known about
128 how this translates to those living at home.

129 More research on the barriers to nutritional screening and treatment in older,
130 community-dwelling adults^{24,26} has been called for. Previous reviews have focused on
131 patient²⁷ or HCP barriers^{14,28} in isolation, or on the effectiveness of randomised controlled
132 trials (RCTs)²⁴. Given the limited evidence available²⁶, the current synthesis seeks to extend
133 the literature by reviewing findings about older patients and HCPs, from both qualitative and
134 quantitative studies, including non-RCT studies, which can, if well designed, be considered
135 strong evidence²⁶ and can inform us of the acceptability and feasibility of intervention
136 features. The core analysis, and novel contribution to the literature, is a mapping²⁹ of barriers,
137 facilitators and intervention features to identify how the content and design of interventions
138 can be optimised and to identify gaps in recent intervention research.

139 The aims of this synthesis are to: 1) identify barriers and facilitators to implementing
140 malnutrition screen and treat policies in primary/community care; 2) map barriers and
141 facilitators to features in existing interventions; and 3) make recommendations for the design
142 of interventions targeting malnutrition in older adults and nutrition education for HCPs.

143 **Methods**

144 Barriers and facilitators to screen-and-treat approaches were extracted³⁰ and mapped
145 onto intervention features²⁹ to determine whether barriers had been addressed and what
146 solutions were available and feasible. A meta-analytic, causal approach to the quantitative
147 studies was considered, but deemed unsuitable because of the heterogeneity of the
148 interventions. Instead, we used thematic synthesis and aspects of Intervention Component
149 Analysis³⁰ to describe and critically interpret the findings (see ³⁰. The protocol can be found

150 here: https://www.crd.york.ac.uk/PROSPERO/display_record.php?RecordID=71398

151 (PROSPERO registration number CRD42017071398).

152 **Literature search**

153 Seven databases (MEDLINE, Embase, PsycINFO, DARE, CINAHL, Cochrane
154 Central and Cochrane Reviews) were searched in June 2016. Search terms are shown in
155 Additional file 1. The search was restricted to references from 2012 onwards, to focus on
156 publications since Cochrane reviews on malnutrition screening³² and interventions for
157 malnutrition⁶². LP, DG and JS screened titles and abstracts and excluded irrelevant
158 references. LP and PH screened full text publications for eligibility. Qualitative and
159 quantitative intervention studies and studies exploring older people's eating patterns or
160 appetite or health professionals' experiences in relation to undernutrition were included if
161 participants were either adults 65+ living at home or healthcare professionals who would care
162 for these participants. Studies were excluded if participants were care home residents or
163 hospital inpatients, or if participants presented with a terminal disease, cancer, dementia or
164 diabetes, who may have specific nutritional requirements due to their conditions. Studies
165 were also excluded if they were not in English. Inclusion/exclusion criteria are shown in
166 Additional file 2.

167 **Data coding, extraction and synthesis**

168 Key study characteristics were extracted and tabulated (Supplementary Tables 4-5).
169 Figure 1 is a flow chart outlining eligible studies containing qualitative and quantitative data;
170 those presenting primarily quantitative data will be referred to as "interventions" and
171 included RCTs ($n = 6$), RCT feasibility ($n = 3$) and pre-post designs ($n = 4$).

172 Papers reporting on the studies (all sections bar the introduction, following Corbett
173 and colleagues³⁰) were coded line-by-line and codes organised into descriptive themes, in line
174 with thematic synthesis³³. PH and LP established an initial coding manual with the aim of

175 capturing barriers and facilitators to malnutrition-screen-and-treat approaches and
176 intervention features designed to address barriers and incorporate facilitators. PH and LP
177 double-coded a subset of studies (8 of 21) using this coding manual. Discrepancies were
178 discussed and the coding manual was refined accordingly. PH coded the remaining studies.
179 LP read all remaining studies and resulting codes, and the findings and additional codes were
180 discussed with all authors. The emerging codes were organised into barriers and facilitators,
181 for patients and HCPs, to screening, nutritional self-care and ONS use.

182 Following Shepherd and colleagues²⁹, the resulting data were first analysed and
183 synthesised narratively to provide an overview of included studies. Syntheses are not reported
184 here; findings are similar to previous reviews, e.g.^{24,28}. Then, novel to malnutrition screening
185 literature and reported here, intervention and qualitative studies were synthesised to map
186 barriers and facilitators onto intervention features in a matrix, identifying which interventions
187 (if any) had addressed barriers or incorporated facilitators. Figures 1-3 show an overview of
188 the results (see Supplementary Tables 1-3 for more details). Of note, in some instances no
189 facilitator was explicitly named in the reviewed studies, but a possible solution to addressing
190 the barrier was found in intervention features. All authors read and commented on the draft
191 synthesis and provided clinical and / or nutritional expertise during search strategy
192 development and analysis of findings.

193 **Critical appraisal**

194 Studies were assessed using the Mixed-Methods Appraisal Tool (MMAT³⁴). The
195 MMAT differentiates studies based on how many quality criteria they meet: High quality
196 studies meet at least 2 of 4 quality criteria, whereas low quality studies meet fewer than 2
197 criteria. LP and PH first trialled the MMAT on a small selection of papers. Overall,
198 agreement was acceptable (76%), but some criteria were identified as ambiguous (criteria 1.3,

199 1.4, 2.3, 3.4 and 4.4). The raters agreed on a mutual understanding of these before each
200 independently assessing all remaining studies.

201 **Results**

202

203 [Insert Figure 1 here]

204 *Figure 1.* Flow chart of studies included in the synthesis.

205

206 Of the 21 included studies (Figure 1), seven focused on HCPs and 14 on older people,
207 who are referred to as ‘patients’, though some were not recruited or treated by HCPs; see
208 Supplementary Tables 4-5 for details of HCPs and patients. Around half of all studies (seven
209 interventions and three qualitative) met MMAT criteria for high quality³⁴, however no low
210 quality studies are excluded from the results presented below³⁵. Results drawn from
211 interventions deemed to be of higher or lower quality are summarised separately in
212 Supplementary Tables 1-3, to show which results are likely to be more reliable.

213 All extracted barriers and facilitators can be found in Supplementary Tables 1-3 and
214 all study characteristics can be found in Supplementary Tables 4-5. Of note, the ten
215 interventions targeting patients varied considerably in content. As detailed in Supplementary
216 Table 4, seven³⁶⁻⁴² provided individual nutritional counselling from dietitians or nutritionists.
217 In three of these³⁷⁻³⁹, this was complemented with support from physicians, nurses,
218 physiotherapists or occupational therapists, in a multi-disciplinary approach. In three other
219 interventions⁴³⁻⁴⁵, participants received nutrition: one intervention provided participants with
220 ONS, one with food and one with snacks. The reported effectiveness of all interventions was
221 varied and inconclusive, echoing previous reviews^{24,46}. For example, some of the nutritional
222 counselling interventions showed some promising effects on body weight^{36,42} and physical
223 functioning³⁶, whilst others did not^{40,41}.

224 Figures 1-3 show whether interventions have incorporated the barriers and facilitators
225 that emerged from qualitative studies. In the figures, these are separated by barriers and
226 facilitators that patients and healthcare professionals may experience. In the following text,
227 they are described together to emphasise areas where barriers and facilitators overlapped or
228 differed.

229 **Barriers and facilitators to screening.** Barriers to screening were common to both
230 patients and HCPs: time taken to screen and reservations toward screening. Duration of
231 screening was mostly addressed through shorter screening tools. The burden on HCPs' time
232 was additionally alleviated by patients filling in parts of the screener themselves, which
233 seemed acceptable to patients and HCPs and mostly accurate (see Supplementary Table 1).
234 Screening was not currently part of practice routine (see²⁸, but possible solutions included
235 screening during routine appointments.

236 Patients were reluctant to describe their diet, for example because they were
237 uncomfortable disclosing a poor diet⁴⁷, whereas HCPs had doubts over the need for and
238 benefits of screening. Interventions educated HCPs on the purpose and importance of
239 screening, but no intervention reported doing the same for patients. No intervention measured
240 whether HCPs' scepticism had been alleviated through training and only one intervention
241 reported the number of patients who turned down screening (20%⁴⁵).

242 **Barriers and facilitators to treating malnutrition.** Patients perceived physiological
243 and practical barriers to nutritional self-care (e.g. difficulties chewing, swallowing, shopping
244 or preparing food). Multidisciplinary approaches addressed these by referring to the relevant
245 specialist (e.g. dentist, physiotherapist or occupational therapist). Conversely, interventions
246 that provided nutritional or dietitian counselling addressed physiological barriers, such as
247 being unable to eat big portions, through self-help advice. Changes to eating behaviour, e.g.

248 eating smaller portions or adding energy-rich food, was often central to these and appeared
249 feasible and acceptable^{36,40-42}.

250 Psychosocial barriers were the most frequent to not be addressed by interventions.
251 More specifically, older adults may not consider nutrition as important, or fail to recognise
252 the problem^{47,48,50,49} because they perceive themselves as healthy, and consequently avoid
253 ‘unhealthy’, energy-dense food^{44,50,49}. No facilitators to these barriers emerged from the
254 qualitative studies.

255 No intervention addressed the barrier of loneliness. Qualitative studies showed older
256 adults may struggle with cooking^{45,48,49} and eating alone⁵⁰. A possible solution may be to
257 offer ideas to help patients connect with others, but none of the interventions offered such
258 self-help advice.

259 A further gap was how the intervention is presented to patients. Patients may be
260 dissuaded from engaging if told that the aim is for them to gain weight, which may be
261 perceived aversive⁵². No intervention explicitly stated how the intervention was presented to
262 patients.

263 Key barriers faced by HCPs were lack of time and low efficacy in malnutrition
264 treatment pathways. Provision of written resources to alleviate burden placed on HCPs was a
265 common feature of interventions and well-received by HCPs. Training to raise self-efficacy
266 and build motivation for the importance of nutritional care was provided by only one high
267 quality intervention⁴⁰. No other solutions were identified in qualitative studies or tested in
268 interventions.

269 **Barriers or facilitators to ONS uptake.** Giving patients ONS is one treatment
270 approach in the reviewed studies. No interventions recorded (by measuring compliance)
271 whether patients were persuaded to consume ONS. Of note, in the intervention where ONS
272 uptake resulted in improved weight and physical function⁴⁴, participants received clear

273 instructions on how to take ONS, which no others reported. A notable psychosocial barrier
274 was that patients may be reluctant to consume it publicly due to unwanted attention. A
275 possible facilitator mentioned was to normalise consumption, by treating ONS as food not
276 medicine, but interventions did not address this.

277 HCPs had reservations about prescribing ONS. These reservations were only
278 addressed in one intervention⁵³ (deemed low quality), despite ONS frequently being a
279 component of interventions. It is not yet clear what an effective training programme for HCPs
280 needs to incorporate, but simple solutions have been proposed such as explaining that
281 appropriate prescribing can save money.

282

283 [Insert Figure 2 here]

284 *Figure 2.* Practical barriers to screen-and-treat approaches to malnutrition.

285 [Insert Figure 3 here]

286 *Figure 3.* Physiological barriers to screen-and-treat approaches to malnutrition.

287 [Insert Figure 4 here]

288 *Figure 4.* Psychosocial barriers to screen-and-treat approaches to malnutrition.

289

290 **Discussion**

291 **Summary**

292 This synthesis identified, from recent literature, barriers and facilitators to screening
293 and treating malnutrition in community-dwelling older adults in primary care, and
294 demonstrated whether and how interventions have incorporated these. The studies document
295 numerous physiological, practical and psychosocial barriers to patients' and HCPs'
296 engagement with screening and treating malnutrition, but our novel approach to mapping

297 these onto intervention features revealed the following gaps: interventions did not address
298 patients' scepticism about malnutrition screening, endeavour to increase readiness to be
299 screened (e.g. through education) or measure reactions to screening. We currently have little
300 data on how older adults perceive screening or why they are reluctant to be screened^{47,48}.
301 Notably, findings relating to patients' barriers to screening emerged largely from HCPs'
302 experiences^{47,48,54}. Moreover, we noted some conflicting findings, such as that some patients
303 are willing to be screened when the purpose of screening is explained to them⁵⁴, whilst others
304 seem to prefer not to know⁵⁴. Similarly, some patients in a qualitative study were surprised or
305 offended to be told they were 'at risk' after screening, while others were unconcerned⁵⁵. Such
306 differences may be due to preferences of individual patients, their experience of the patient-
307 practitioner relationship or the way that risk information is conveyed. Further studies
308 exploring older patients' experience of being screened in primary care are needed to promote
309 and support their self-management and identify effective ways to convince patients of the
310 value of screening.

311 Practical and physiological barriers and facilitators to nutritional self-care were
312 incorporated in the interventions reviewed, and steps taken to overcome these barriers are in
313 line with those suggested by care pathways for the management of disease-related
314 malnutrition¹⁸. However, a prominent gap was in considering psychosocial barriers, which
315 may link to psychosocial causes of malnutrition². These included loneliness, and patients
316 perceiving themselves as healthy and avoiding 'unhealthy' food, highlighting the potential
317 benefit of screening regardless of whether patients report any health issues. A recent
318 randomised controlled intervention study identified additional beliefs that interfered with
319 patients' adoption of self-care components, including not believing that the recommended
320 action would solve the problem⁵⁶.

321 A psychosocial barrier to engaging in nutritional interventions may be how an
322 intervention is presented to patients (e.g. whether its aim is ‘weight gain’). Interventions did
323 not explicitly report how they were presented to patients, but it could be a factor that may
324 promote or hinder engagement. Van der Pols-Vijlbrief and colleagues⁵⁶ also suggest that
325 easy-to-execute actions such as tips promoting 3 or more snacks a day and increased physical
326 activity may be adopted more readily.

327 Previous research shows ONS to be effective in hospital patients in terms of weight
328 gain²², reduced complications and mortality, and may be effective in community settings,
329 including care homes, sheltered housing or among free-living older adults, particularly when
330 ONS is initiated during a hospital stay⁵⁷. However, good quality prospective studies are
331 needed to establish whether ONS is beneficial when initiated in primary care⁵⁸. Future studies
332 are needed to test whether ONS can make a difference to the nutritional status of free-living
333 older adults who are at risk, but who have not yet had an acute episode that triggers
334 malnutrition screening. However, this is unlikely to address the underlying issue of patients
335 not recognising the problem, for example where malnourishment is related to social factors².
336 In order to test the effectiveness of ONS in the community, HCPs need to be convinced of the
337 need to test the potential value of ONS and to prescribe according to protocol. Our synthesis
338 therefore emphasises that interventions need to address engagement of HCPs and patients
339 with the idea of prescribing or consuming ONS to treat malnutrition where necessary,
340 otherwise tests of the effectiveness of ONS may not be valid. HCPs’ reservations need to be
341 countered, and patients need to be given practical and psychological support to enhance
342 consumption. For example, ONS may be uncomfortable to consume, though no intervention
343 in this synthesis considered this, but which could be addressed through practical advice (e.g.
344 drinking through a straw). Results showed that interventions providing patients with ONS
345 rarely reported incorporating such education or support. It seems theoretically possible that

346 informed education on the benefits of ONS for HCPs could help, but for this to be effective,
347 further research is needed in order to explore and address the underlying reasons for their
348 reservations.

349 **Strengths and limitations**

350 This synthesis highlights how considering qualitative data alongside quantitative data
351 may help explain quantitative findings and can lead to different conclusions than considering
352 each in isolation⁵⁹. First, those studies with mixed-methods approaches provided the richest
353 findings, e.g. documenting patients' reasons for discontinuing an intervention⁴³, which can
354 help improve future interventions⁶⁰. Second, the mixed-methods approach of this synthesis
355 allowed for greater scope and insights into whether interventions can address older,
356 community-dwelling adults' barriers to nutritional self-care.

357 Interventions tended to be complex (thus making it difficult to isolate the active
358 ingredient), to involve small, diverse samples, and to vary substantially (e.g. in their duration
359 and geographical location). Some baseline variables, such as HCPs' existing levels of
360 nutrition knowledge, were unknown. This heterogeneity precluded a meta-analytic approach
361 to quantifying effects and made direct comparisons across studies difficult. However, as the
362 number of interventions being trialled is steadily growing, the available evidence may soon
363 be rich enough to conduct such meta-analyses.

364 We included only studies published since the Cochrane review on dietary counselling
365 and ONS⁶², yet barriers and facilitators to screen and treat may have been identified in studies
366 published prior to 2012. However, only four studies identified by Baldwin et al⁶² focused on
367 community-dwelling older adults, and we considered that practice is likely to have changed
368 since these publications from 1985, 1995, 2003 and 2008.

369 A further limitation was the quality of included studies. Around half the studies were
370 judged to be of low quality and conclusions drawn from these must be treated with caution.

371 This concurs with other reviews on malnutrition interventions^{15,16,46,61,62}. It is noteworthy,
372 however, that low scores on the MMAT were often due to reviewers having to assign the
373 category ‘Can’t Tell’ (in 18% of classifications). The MMAT is a relatively new tool
374 designed to assess the quality of a number of study types, and the number of ‘can’t tell’
375 classifications we made may indicate that improvements are needed. Thus, studies may have
376 been well designed, but insufficient reporting and / or limitations of the MMAT reduced our
377 ability to judge study quality, highlighting the importance of adhering to accepted reporting
378 standards (e.g.⁶³). Insufficient reporting further limited our ability to judge whether some
379 interventions incorporated named facilitators, such as providing evidence on the effectiveness
380 of screening in HCPs’ training.

381 **Comparison with existing literature**

382 Although the synthesis makes an important contribution by identifying key barriers,
383 possible solutions and areas where future interventions must be targeted, it is not yet possible
384 to identify the key ingredients of an effective intervention. We calculated effect sizes where
385 possible (Supplementary Table 4), but only a few studies reported the relevant statistics,
386 limiting our ability to compare and judge effectiveness. This echoes previous reviews on
387 malnutrition interventions targeting older, community-dwelling adults^{24,46} and the most recent
388 clinical guidelines in the UK¹².

389 The findings regarding HCPs’ barriers and facilitators to screening show coherence
390 with the results of a previous review²⁸. The results further strengthen the argument that
391 screening alone is insufficient^{26,64} and must be accompanied with appropriate nutrition care
392 pathways.

393 **Implications for research and practice**

394 When intervention targets (e.g. ONS consumption) are not met, the effectiveness of
395 an intervention should be questioned^{46,65}. Two points follow on from this: first, this could

396 explain some of the inconsistent effects observed in this synthesis, as compliance varied
397 overall (and was not reported for ONS). Second, participation in screening should be
398 considered a crucial aspect of intervention fidelity. As this synthesis demonstrates, screening
399 harbours its own set of barriers for both HCPs and patients, and thus it is informative to know
400 how both reacted to screening. Studies should report the number of patients who refused
401 screening (which only one study in this synthesis did⁴⁵). It would be informative to explore
402 patients' perceptions of screening and speak to those who refuse screening⁶⁶.

403 **Conclusion**

404 In this synthesis we have identified multiple barriers to implementing screen and treat
405 policies in primary/community care for both HCPs and patients. We have also identified
406 possible facilitators to address these barriers, both from studies exploring HCPs' and patients'
407 perspectives and from previously tested interventions. We have also identified barriers that
408 were not addressed within the reviewed interventions, but which could be addressed with
409 well-designed intervention features (e.g. addressing misconceptions about 'unhealthy' food
410 for older adults through education and overcoming HCP scepticism for screening). Future
411 interventions need to be developed with the complex barriers of both HCPs and patients in
412 mind. Research is now needed to establish whether interventions designed to address the
413 identified barriers to screening and treatment of malnutrition are effective.

414

415 **Abbreviations**

416 HCPs Healthcare professionals
417 MMAT Mixed Methods Appraisal Tool
418 MUST Malnutrition Universal Screening Tool
419 ONS Oral nutritional supplements
420 RCT Randomised controlled trial

421

422 **Declarations**

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435 *Availability of data and materials*

436 All data generated or analysed during this study are included in this published article and its
437 supplementary information files.

438 *Author contributions*

439 LM, LY, LP and PH conceptualised the study design. LP created the search strategy. LP, DG
440 and JS carried out abstract screening. PH and LP carried out full text screening. PH and LP
441 carried out coding and thematic analysis. LM, PH and LP participated in critical
442 interpretation of the data. PH drafted the manuscript. LP and LM adjusted the manuscript in
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446 ***Competing interests***

447 Helen Roberts declares that she is a member of the nutrition advisory board for Apetito. None
448 of the other authors has anything to declare.

449 ***Consent for publication***

450 Not applicable

451 ***Ethics approval and consent to participate***

452 All data analysed for this study was from published sources of data from previous studies. No
453 primary data was collected, so no ethical approval was required.

454 ***Open access***

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460 Dedication waiver (<http://creativecommons.org/publicdomain/zero/1.0/>) applies to the data
461 made available in this article, unless otherwise stated.

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661 ***Additional files***

662 Additional file 1: Search strategy

663 [Insert Additional file 1 here]

664

665 Additional file 2: Inclusion and exclusion criteria

666 [Insert Additional file 2 here]

667

668 Additional file 3: Supplementary tables 1-3

669 [Insert Additional file 3 here]

670

671 Additional file 4: Supplementary tables 4-5

672 [Insert Additional file 4 here]

673 **Figures**

674 *Figure 1.* Flow chart of studies included in the synthesis.

675 *Figure 2.* Practical barriers to screen-and-treat approaches to malnutrition.

676 *Figure 3.* Physiological barriers to screen-and-treat approaches to malnutrition.

677 *Figure 4.* Psychosocial barriers to screen-and-treat approaches to malnutrition.