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Title Page

The effectiveness of trained volunteer delivered interventions in adults at risk of malnutrition: a systematic review and meta-analysis

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Abbreviations: ADLs, activities of daily living; NHS, National Health Service; PREMS, Patient reported experience measures; PROMS, Patient-reported outcome measures; QALYs, quality adjusted life years; QoL, quality of life; RCT, randomised controlled trials; ROB Cochrane Collaboration's Risk of Bias tool; UK, United Kingdom; US, United States

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1 **Abstract**

2 Malnutrition burden is high. Trained volunteers present a growing workforce in the NHS and

3 are increasingly engaged in schemes that may be useful in tackling malnutrition in different

4 settings. A recent systematic review of trained volunteers in a hospital setting reported

5 improved patient satisfaction and some improvement in dietary intake of patients. This

6 review explored the effectiveness of trained volunteers in delivering nutritional interventions

7 in adults at risk of malnutrition in different care settings on patient-centred outcomes and

8 aimed to identify and build an evidence base for a more defined role for trained volunteers in

9 malnutrition prevention in the UK. Six electronic databases were searched to 30th October

10 2018. Abstracts and full texts of relevant studies of all study designs were screened by two

11 authors independently. Studies were examined for risk of bias and overall quality of

12 evidence of main outcomes was assessed using the GRADE approach. Narrative synthesis

13 and meta-analyses (nutritional intake) were used to combine outcome data. Seventeen eligible

14 studies were included. Three were conducted in the home setting and fourteen were hospital

15 based. Low quality evidence from one small RCT showed significant improvements in

16 physical performance and fear of falling resulting from a volunteer intervention in the home

17 setting. Very low quality evidence from meta-analysis findings indicated that trained

18 volunteer mealtime assistance significantly improved lunchtime energy intake but did not

19 significantly improve daily total energy intake in hospitals. Very low quality evidence also

20 suggested that volunteers improve patient experience and satisfaction and are safe. This paper

21 identified some evidence to suggest trained volunteer interventions may be effective in

22 improving some outcomes in nutritionally at-risk older adults in home and hospital settings.

23 Considering the high prevalence and costs of malnutrition, adequately-powered research is

24 needed in this area to identify the most effective use of resources.

27   **1. Introduction**

28   Malnutrition or undernutrition, characterized as "a state resulting from lack of intake or

29   uptake of nutrition that leads to altered body composition (decreased fat free mass) and body

30   cell mass leading to diminished physical and mental function and impaired clinical outcome

31   from disease" (1).

32   is found in individuals of all ages, all care settings and all disease categories globally (2). It

33   is estimated to affect 3 million people in the United Kingdom (UK), 93% of whom live in the

34   community (3). In Europe a total of 33 million people are affected by malnutrition (4) and it

35   is estimated to be responsible for 5.7 million lost life years and 9.1 million QALYs (quality

36   adjusted life years) (5). In the United States (US), although data on state-level burden of

37   community-based malnutrition is limited.one in three people have been found to be at risk of

38   malnutrition in the hospital through nutritional screening (6). In Australia, the prevalence of

39   malnutrition ranges from 20-50% in the acute setting and 10-30% in the community setting

40   (7). Malnutrition adversely effects morbidity, mortality and quality of life (QoL) through

41   delayed recovery and prolonged hospital stay, increased falls risk, frailty, reduced muscle

42   strength and impaired activities of daily living (ADLs). The treatment cost of malnutrition is

43   3-4 times greater for an at risk or malnourished patient compared to a non-malnourished

44   patient in England (2) and can be attributed to an additional cost of $10.7 million per year in

45   Australia (8). The total cost of managing malnutrition is estimated to be £19.6 billion in

46   England (2), $157 billion in the US (9) and €120 billion in Europe (10). Most costs are

47   incurred in hospital settings where only 2% of malnourished subjects are found (2). Effective

48   screening, prevention and treatment are essential across all settings to minimise

49   complications and costs.

50   Malnutrition is caused by a range of different factors altering body composition, metabolism

51   and biological function, with a lack of consensus on the diagnostic criteria (11, 12).

52   Immediate causes of malnutrition include acute and chronic diseases, which may be sub

53   classified as disease or injury related malnutrition with inflammation (acute or chronic) or

54   disease related malnutrition without inflammation (11, 12). Malnutrition or undernutrition

55   without disease may also be a result of decreased nutrient intake due to hunger or socio-

56   economic or psychological factors (12). Far harder to identify are the underlying causes

57   which include social isolation, physical disability, problems accessing and cooking food,

58   poverty or psychological health (13). It is not surprising therefore that the majority of

59   malnutrition is harboured in the community among older people. The growing awareness of

60   this issue has seen a rise in both clinical and social initiatives to tackle malnutrition (14). The

61   use of volunteers is one such strategy which has become more widespread in recent years

62   (14). With increasing pressures to improve quality and efficiency, volunteers present an

63   opportunity to add value to the healthcare system.

64   The focus of this review is formal volunteering which involves training and recruitment

65   through organisations in developed countries (15). In the US and Australia, national statistics

66   have shown that approximately 30% of adults volunteer through a variety of volunteer

67   organizations (16, 17). In England, around 3 million or more people, approximately 5% of

68   total population, are estimated to volunteer regularly across health and social care settings

69   recruited through voluntary organisations and the National Health Service (NHS). Currently

70   there are plans to increase training and accreditation schemes to double the number of

71   volunteers in the NHS (18, 19). This highlights the need to understand the depth and breadth

72   of the services volunteers offer for more effective utilisation of resources.

73   Volunteers are engaged in multiple interventions that may impact malnutrition across

74   different settings. They are used as mealtime assistants in institutional settings to alleviate

75 some of the time pressures and staff shortages which lead to deficiencies in the care of at risk

76 subjects and contribute significantly to malnutrition burden (20) (21). In hospitals, volunteers

77 are used to support patients in a variety of ways including assistance with completing menu

78 cards, preparation of meal trays, cleaning patients' hands, positioning the patient safely,

79 providing feeding assistance and encouragement, and promoting social interaction (22).

80 Volunteers are also increasingly being used in the community for social interventions

81 including community food projects such as escorted shopping service and lunch clubs,

82 befriending services, counselling and lifestyle advice, and recently in malnutrition screening

83 initiatives to help identify and support vulnerable people (23) (14). As volunteers are

84 continually in contact with at risk adults, they present an opportunity for early identification

85 and intervention to tackle malnutrition effectively across all settings. However, although

86 widely acknowledged to improve patient experience, there is currently a lack of scientific

87 evidence for the effectiveness of volunteer services in health and social care (15).

88 Previous systematic reviews (24, 25) reported mixed evidence that trained volunteers are

89 effective in improving the dietary intake of institutionalised patients. Volunteers were also

90 reported to improve patient and staff satisfaction of mealtime care but failure to consider the

91 validity of methods used to assess satisfaction limits the strength of this finding. In addition,

92 the inclusion of studies where the effect of volunteers on patient satisfaction was not reported

93 clearly (due to the use of co-interventions) may have influenced these findings. Another

94 review (26) reported mealtime interventions in hospitals were effective in improving dietary

95 intake of patients but included both paid staff and volunteer delivered interventions. Previous

96 reviews have included a heterogeneous group of both trained and untrained volunteers

97 delivering a range of interventions and targeting a range of underlying causes of malnutrition,

98 however, these have focused on institutionalised settings only. This systematic review aimed

99 to identify and broaden the evidence base for a more defined role for the growing trained

100   volunteer workforce across all healthcare and community settings, and to help target

101   resources towards most effective interventions or settings for malnutrition prevention in the

102   UK.

103   *Aim:*

104   To explore the effectiveness of volunteer delivered nutritional interventions in adults at risk

105   of malnutrition in different settings on patient-centred outcomes.

106   **2. Methods**

107   A systematic review was undertaken guided by the Preferred Reporting Items for Systematic

108   Reviews and Meta-Analyses: the PRISMA Statement (27) and Cochrane guidelines (28). A

109   protocol was developed and registered on PROSPERO (registration number:

110   CRD42019118851).

111   **Eligibility criteria**

112   In order to capture a full picture of the effects of volunteer interventions on a wide range of

113   outcomes, no restrictions were placed on study design. All randomised controlled trials

114   (RCTs), non-RCTs, non-intervention and qualitative studies were included to allow realistic

115   exploration of the healthcare environment where funding restrictions, ethical issues and other

116   constraints make blinding and randomisation difficult.

117   **Search strategy and study selection**

118   Six electronic databases were searched to 30th October 2018: Ovid MEDLINE, Ovid Embase,

119   Ovid PsycINFO, Web of Science (Core Collection), Cochrane Central Register of Controlled

120   Trials and PubMed. A search strategy was developed to combine the key concepts describing

121   the population and nutritional interventions: (1) volunteers, (2) nutritional interventions, and

122   (3) adults either malnourished or at risk of malnutrition. Search terms were combined with

123   suggested MeSH terms wherever possible and further refined by excluding studies on

124   obesity/overweight, animals, children, adolescents and artificial nutrition. No language or

125   publication date restrictions were applied. Further relevant studies were identified by

126   snowball searching where the reference lists of included studies were scanned for related

127   citations. Additionally, each included study was opened up in PubMed and a search

128   undertaken of all related citations.

129   Study screens for eligibility were carried out by two review authors independently (JL and

130   MD) using the PICO format **(Table 1)**. Duplicate studies were removed from all searches

131   within the electronic databases wherever possible and imported into an EndNote X8 library

132   for screening and further removal of duplicates. At the first screen, titles and abstracts of

133   studies that met the inclusion criteria were identified (Table 1). Any studies deemed not to

134   meet the inclusion criteria were excluded. Studies were excluded where interventions were

135   based in economically less developed countries, or aimed specifically at comorbidities or

136   healthy lifestyle, or did not report outcomes for volunteer interventions clearly when part of a

137   co-intervention, or were not delivered by trained volunteers where informal volunteers helped

138   care for friends or family, or were aimed at enteral/parenteral nutrition. Studies were also

139   excluded if they did not include humans or where no outcomes of interest to the present

140   review were reported. At the second screening, full texts of potentially eligible studies were

141   retrieved and assessed against the inclusion criteria. The eligibility criteria were applied and

142   reasons for exclusion noted. Any discrepancies were resolved by discussion with the two

143   senior authors (CEW and CB).

144   **Quality of evidence and risk of bias**

145   Risk of bias was assessed independently by JL and MD using the Cochrane Collaboration's

146   Risk of Bias tool (ROB) for RCTs ,the ROBINS-I tool for non-RCTS and observational

147   studies and modified CASP checklist for qualitative evidence from both qualitative and

148   mixed methods studies. Any discrepancies were resolved by discussion with a third co-

149   author. Judgements were summarised in a table and a positive (+), negative (-) or question

150   mark (?) were used for each domain to denote high, low or unclear risk of bias. The overall

151   quality of the body of evidence for each main quantitative outcome was assessed using the

152   GRADE Working Group criteria according to Cochrane guidelines by JL and MD (29).

153   Limitations in design and implementation, indirectness of evidence, unexplained

154   heterogeneity or inconsistency, imprecision and publication bias were used to lower the

155   quality. Any large magnitude or spurious effect from confounding and dose-response

156   gradient were used to increase the quality level. The overall body of evidence was given a

157   grading of very low, low, moderate or high for each outcome and displayed in a summary of

158   findings table. The summary effect size for each outcome was derived from meta-analysis of

159   findings wherever possible or based on any statistical significance reported by the relevant

160   studies. Where a measure of statistical significance was unavailable, results were presented

161   in a narrative format. Reasons for downgrading of quality of evidence were included in the

162   footnotes.

163   **Data synthesis and statistical analysis**

164   Information on population, intervention, comparator, outcomes, setting, volunteer training

165   and any additional outcomes was extracted and displayed in a characteristic of studies table

166   by JL using a data extraction form and checked by MD. Preliminary synthesis involved

167   grouping studies according to primary and secondary outcomes as per Cochrane guidelines

168   (30) (31). Results were tabulated and synthesized either in narrative or where sufficiently

169   similar outcome data were available for pooling, by meta-analysis. For all outcomes, trends

170   in the data were described according to the number of studies reporting the outcome, setting,

171   methods, study design, methods of outcome reporting, and statistical significance of results (*p*

172   *<0.05*).

173   Nutritional intake was the only outcome identified where sufficient data were reported to

174   allow a meta-analysis. Only final means and standard deviations were available. These were

175   pooled in a meta-analysis with the use of Review Manager (RevMan version 5.3; Nordic

176   Cochrane Centre) in a continuous, inverse variance, random effects analysis. Mean

177   differences were used as all the studies reported data on a similar scale (energy in

178   Kilocalories or Kilojoule) while a random effects model accounted for the variability in study

179   designs and participants (32). Energy data were all converted to kilocalories to allow

180   pooling. Heterogeneity was assessed by measuring the inconsistency (I^2) statistic based on

181   the chi-squared test (χ^2, or Chi^2). Inconsistency across studies was classified as follows: I^2

182   40% - low; 30 - 60% - moderate; 50 - 90% - Substantial; 75 - 100% - Considerable. If

183   heterogeneity was <50% (at a statistical significance of *p=0.1*, as per Cochrane guidelines*),* a

184   meta-analysis was undertaken.

185   **3. Results**

186   A total of 11,143 studies were identified. After removal of duplicates, the titles and abstracts

187   of 8533 titles were scanned for eligibility. Full text articles were obtained for a total of 114

188   studies of which 17 were selected for inclusion in the review (**Figure 1**).

189   **Preliminary synthesis**

190   Seventeen eligible studies were included in this review and all included trained volunteers

191   (**Table 2**). Seven studies were based in the UK, four in Australia, two in USA, one each in

192   Austria, Canada, the Republic of Ireland and New Zealand. All participants were older adults

193   over 65 years with mean age 74 to 89 years in studies that reported mean age. Three studies

194   were based in the home setting (n = 209 participants), of which one study had four

195   subsequent studies from the same cohort (33-37). Fourteen studies were hospital based

196   (quantitative outcomes: n = 591 participants; qualitative outcomes: n = 146 participants; two

197   studies did not specify These sample sizes). Participants differed widely in terms of

198   nutritional status, with eight out of the 17 studies reporting nutritional status using different

199   methods prior to the intervention. Five studies assessed participant nutritional status using the

200   Mini Nutritional Assessment (MNA) screening tool (33, 38-41) and two studies used the

201   Malnutrition Universal Screening Tool (MUST) (22, 42). Among the studies reporting

202   participants as 'at risk of malnutrition' or malnourished, this ranged from 20%-88% (22, 33,

203   38, 39, 42, 43). One study measured nutritional status using Body Mass Index (BMI) only

204   (41), with 20-25% of participants reported as undernourished (BMI $<18.5kg/m^2$), table 2. The

205   remainder of studies did not report nutritional status.

206

207   Among the three home-based studies, two were RCTs. Both used convenience samples

208   ranging from 80-100 and included older volunteers (>50 years) matched with participants on

209   age, gender and location. Reasons for support included frailty, malnutrition risk, social

210   isolation or access to food (problems with ADLs). One RCT (33) assessed the

211   implementation of physical exercise and nutrition education by volunteers compared to a

212   control group who received social support only from volunteers for three months. The other

213   RCT (38) used volunteers to help with meal preparation while the control group received

214   only a nutrition advice guidebook for one month. The third study (44) was a feasibility study

215   where volunteers were trained to do nutritional screening and give nutritional education.

216   The remaining 14 studies were all based in hospitals and were of varied design. Volunteers

217   assisted with mealtimes including feeding patients, opening packets, socialising and

218   providing encouragement. Reasons for volunteer support ranged from dysphagia, cognitive

219   impairment, nutritionally compromised, anorexia, or frailty to general help on geriatric ward.

220 Six were non-RCTs of which three used patients as own controls (39, 43, 45) two used

221 matched controls (42, 46) while one used controls from a previous phase of intervention (40).

222 One study was an observational pre-post design and used historical controls (47). Three were

223 project evaluations (48-50) without controls. Two were feasibility studies without controls

224 (22, 51). Two studies were qualitative (41, 52) one of which (41) used parallel controls.

225 Sample sizes varied from 8 to 407, to unspecified number of participants and included

226 patients, volunteers and staff. Length of intervention and follow up also varied considerably

227 from 2 days to 3 months whilst study duration varied from 2 to 39 months.

Quality of studies

229 Risk of bias was mostly assessed for whole studies **(Figure 2)**. For the three feasibility

230 studies (22, 44, 51), risk of bias was only assessed for outcomes of interest such as patient

231 experience, satisfaction and cost analysis. For mixed method studies (22, 43, 51) risk was

232 assessed for both quantitative and qualitative outcomes separately using the relevant ROB

233 tools as displayed in figure 2. Insufficient information on any objective or subjective

234 outcomes led to unclear risk of bias judgement. Risk of detection bias was judged to be low

235 for objective measures. The two RCTs (33, 38) were judged to be at low risk of selection

236 bias but at high risk of performance bias due to non-blinding. One (38) was at unclear risk of

237 reporting bias due to differences between reported outcomes and those in protocol. The other

238 study (33) was found to be at unclear risk of detection bias due to non-blinding during

239 collection of outcome data for subjective measures, and at high risk of reporting bias due to

240 selective reporting (multiple functional outcomes, each reported in different publications).

241 Most other studies were at unclear or low risk of selection bias but at unclear or high risk of

242 detection bias where details on subjective measures were insufficiently reported. Missing

243 information and an unclear risk of reporting bias due to a missing protocol contributed to an

244 overall unclear risk of reporting and attrition bias in most studies. Similarly, most studies

245 were at high or unclear risk of confounding due to insufficient information, not controlling

246 for assistance from visitors or family or changes in hospital menu over the long term, or

247 inappropriate or no controls. Qualitative outcomes reported by mixed methods study designs

248 (experience or satisfaction) were judged to be at unclear or high risk for most domains (22,

249 43, 51) due to insufficient information or lack of rigour on research design, methodology, and

250 participant recruitment, and data collection and analysis. All studies were at high risk of bias

251 for the domain considering the relationship between the participants and the researcher. The

252 qualitative studies (41, 52) were judged to be at unclear risk of bias for some domains due to

253 insufficient information within the data collection and participant recruitment methods and a

254 lack of rigour in the overall data analysis. Both studies had a low risk of bias for addressing

255 the study aims, the appropriateness of the qualitative methodology and research design.

256 **Effectiveness of volunteers: primary outcome assessment**

257 *Functional outcomes*

258 Two of 17 (12%) of studies (n= 180 participants) which were home-based RCTs (33, 35, 38),

259 reported on a range of functional outcomes **(Table 3)**. One RCT reported on six functional

260 outcomes. These outcomes were reported in five separate publications (33-37). The other

261 RCT reported data on one functional outcome (38). Validated methods were used for all the

262 measures; physical activity, fear of falling and self-efficacy were self-reported, frailty was

263 partly self-reported and physical performance was measured using objective methods. There

264 were significant improvements in lower limb muscle strength and overall physical

265 performance, physical activity, and fear of falling in the groups receiving volunteer

266 interventions compared to controls (low quality evidence). Improvements to self-efficacy

267 were similar in both intervention and control groups (very low quality evidence). Similarly,

268 improvements to gait speed and balance, handgrip strength and frailty were similar in both

269 intervention and control groups (low quality evidence).

270 *Quality of life*

271 One of 17 (6%) studies (n = 80 participants) which was home-based measured this outcome

272 (36) (Table 3). Volunteer intervention was associated with significant improvements in the

273 past, present and future activities domain compared with the control group (low quality

274 evidence). However, improvements in overall QoL were similar in both groups (low quality

275 evidence).

276 *Patient, staff, and carer experience and satisfaction*

277 Twelve of 17 (71%) studies (n = 297 participants from 8 studies, 4 studies did not report

278 sample size), reported on patient, staff, and/or carer experience and satisfaction, including

279 two home-based and nine hospital based summarized in **Table 4**. All studies used different

280 methods for data collection ranging from observations (43, 45, 49, 52), semi-structured

281 interviews and focus groups (22, 41, 51, 52), validated questionnaire (38) and an unclear

282 methodology (44, 46, 48, 50). Methods used to process data in qualitative studies included

283 an ethnographic approach (52) and thematic synthesis (41). Studies reported on aspects

284 related to patient/staff experience or satisfaction. In the hospital setting, volunteers were

285 valued by the patients, were viewed as proactive and helpful by staff in improving mealtime

286 care of patients and spent longer with patients than staff (very low quality evidence). In the

287 home setting they were found to be knowledgeable, useful and competent (very low quality

288 evidence).

289 *Adherence and retention*

290 Four of 17 (24%) of studies (n = 142 participants from 3 studies, 1 study did not report

291 sample size) reported data on the adherence and retention of the intervention program. One

292   home-based study (33) reported seven of 80 (8.8%) subjects replaced their buddies due to

293   illness of buddy and failure to harmonize. The retention rates of volunteers reported by two

294   hospital studies (22, 51) ranged from 49% to 76% from initial training to commencing and

295   continuing volunteering. One did not report retention rates according to age but found older

296   female volunteers (50-60 years), retired or working part time or with some experience to be

297   most helpful in delivering the intervention based on the amount of mealtime assistance

298   provided (51). The other study found volunteers aged <25 years were significantly more

299   likely than older volunteers to leave due to moving away and studying commitments and less

300   likely to leave due to work commitments and changes to the ward environment (22). One

301   study noted no incidents of patients refusing to be fed by volunteers (22) One study (48)

302   reported holding regular programme training, current waiting list and the continued support

303   of some of the volunteers. The importance of dedicated staff including management towards

304   recruitment and training, ongoing support from nursing, therapy team, dietitians and senior

305   nurses as well as the value of the volunteers was highlighted in several studies described in

306   Table 2.

307   **Effectiveness of volunteers: secondary outcome assessment**

308   *Nutritional intake*

309   Nine of seventeen (53%) of studies (n = 691 participants from 8 studies; 1 study did not

310   report a sample size) reported energy intake (Supplemental Table 1), including one home-

311   based and eight studies in hospital. In the home-based study (38), data on intake were

312   collected using two 24-hour dietary recalls per assessment and averaged. From the hospital

313   studies, five studied the effect of volunteer assistance at lunchtime only (39, 40, 42, 43, 45),

314   one (46) described volunteers helping at 'each meal' and one (47) reported volunteers

315   assisted between 10am-4pm. One study mentioned the availability of volunteers on the ward

316   to feed patients for the first time during lunch and did not provide further details (48). The

317   studies differed in methods of estimating food intake which ranged from visual estimation

318   (39), percentage intake (46), weighed plate waste (42, 43, 45), standardised food charts (47)

319   to unspecified methods (40).

320   Four studies provided sufficiently comparable data on energy intake to allow pooling for

321   meta-analysis. Meta-analysis **(Figure 3)** across the four studies showed no significant

322   difference in total energy intake as a result of volunteer assistance (very low quality

323   evidence): mean difference (MD): 292.54 Kcal (95% confidence interval (CI): 441.10,

324   1026.18); $p = 0.43$. However, heterogeneity was high ($I^2 = 72\%$). One study with significant

325   baseline differences between intervention and control groups in the level of assistance

326   provided and with borderline significant differences in weight was removed from the

327   analysis (47). Removal of this study reduced the I^2 to 0%, and there remained no significant

328   differences in energy intake between groups. Meta-analysis across three studies showed a

329   significant improvement in lunchtime energy intake when volunteers were assisting (very low

330   quality evidence); MD: 378.15Kcal (95% CI: 20.57, 735.72); $P = 0.04$, with no heterogeneity

331   ($I^2 = 0\%$).

332   The data from the remaining five studies were not amenable to meta-analysis due to missing

333   information or differences in outcome reporting. Two studies showed no difference in daily

334   energy intake compared to controls as a result of volunteer assistance (38, 42), one showed a

335   significant improvement in intake compared to controls (46), whilst one study did not report

336   quantitative data but observed 'previously reluctant eaters had eaten well and appeared to

337   have benefited from the extra time and attention that they received' when the volunteers were

338   present (48). One study (40) reported volunteer feeding resulted in a significant increase in

339   intake per patient .

340   ***Nutritional status***

341   Three of 17 (18%) of studies (n = 110 participants from 2 studies; one study did not report a

342   sample size) reported on different aspects of nutritional status (Supplemental Table 2). A

343   home-based study (33, 34, 37) looked at malnutrition and changes in lean body mass, skeletal

344   muscle mass, and inflammatory markers between intervention and control groups. A

345   significant reduction in CRP (C-reactive protein) levels was observed for the intervention

346   group compared to the controls (very low quality evidence) (intervention – MD: 0.08 (95%

347   CI: −0.16, 0.32); control - MD: 0.46 (95% CI: 0.07, 0.85); $p = 0.040$). No significant

348   differences were found between the intervention and the control group for any other outcome

349   (low quality evidence). Among the two hospital studies, one study (40) reported a

350   significant improvement in mean BMI (very low quality evidence) (MD: 0.37 Kg/m2; $p =$

351   <0.04) of the seven patients assisted by volunteers during phase 3 of a 4-phase intervention,

352   whereas mean BMI decreased significantly (MD: 0.6 Kg/m2; $p =$ <0.001) during the control

353   phase. The patients in the observation phase (phase 1) served as controls. No significant

354   changes in mid-arm circumference were detected after the intervention (very low quality

355   evidence), additionally there was no control in this study for this outcome measure. One

356   study (48) recorded a reduction in the number of patients who were at medium or high risk of

357   malnutrition (measured using the Malnutrition Universal Screening Tool (MUST)) after the

358   volunteer intervention, but no quantitative data were provided.

359   *Reliability*

360   Reliability in the present review was used as an outcome measure to describe the volunteer

361   ability to perform tasks effectively and to show initiative. Six of 17 (35%) of studies (n =

362   645 participants from 5 studies: 1 study did not report a sample size) reported different

363   aspects of the reliability of the volunteer delivered intervention. From the home-based

364   studies, one (44) tested the feasibility of training volunteers to screen for malnutrition and

365   reported 80% agreement in nutrition screening items between volunteers and dietitians and

366 recommended enhanced training. Additionally, a home-based RCT (33) found the

367 improvement in physical performance of the intervention group comparable to effects

368 obtained by strength training guided by health-care professionals. Four hospital studies (42,

369 46, 50, 52) reported volunteers as proactive in assisting staff during food service, with patient

370 communication, applying information learnt during training, in reporting missed meals or

371 food items, ordering suitable alternatives and comparable to healthcare professionals for

372 provision of service and delivering interventions.

373 *Cost-analysis outcomes*

374 Two of 17 (12%) of hospital-based studies (n = 24 participants from 1 study; 1 study did not

375 report a sample size) reported different cost-analysis outcomes without considering

376 effectiveness (very low quality evidence). One (49) reported an average estimated saving of

377 $11.94 - $26.00 per encounter (based on the number of tasks and the average time spent) had

378 the service been provided by paid staff. One study (22) estimated potential savings of

379 $34.98-$58.27/patient/day above the training costs of volunteers

380 *Patient safety*

381 Five of 17 (29% of studies (n = 188 participants from 4 studies: 1 study did not report a

382 sample size) reported on patient safety through measurement of the number of adverse events

383 (very low quality evidence). One home-based study (33) reported four adverse events (two

384 participants died and two interrupted the study for medical reasons) not caused by the

385 intervention. Four hospital studies (22, 47, 49, 51) reported no adverse patient events

386 associated with volunteer assistance.

387 **1. Discussion**

388 This review collated evidence on the effectiveness of volunteer delivered interventions on

389 outcome measures in nutritionally at-risk populations in different settings with a view to

390 identifying a more defined role for this growing 'workforce' in the UK. Volunteers were

391   found to be engaged in delivering different initiatives in nutritionally vulnerable older adults

392   in homebased and hospital settings. In hospitals, volunteers were mainly engaged in

393   mealtime assistance, while in home settings volunteers delivered physical exercise, nutrition

394   advice, mealtime help and social support. Low quality evidence from one small home-based

395   RCT (n = 80) suggests that volunteer interventions improve physical performance and fear of

396   falling but do not differ from usual care in effects on handgrip strength, nutritional status or

397   overall QoL. Very low quality evidence from small hospital studies indicates that trained

398   volunteer interventions result in improved nutritional intake. Very low quality evidence

399   suggests volunteer interventions improve patient experience and satisfaction and are safe in

400   both settings. Effects on self-efficacy, BMI, mid-arm circumference and inflammatory

401   markers were not assessed due to various limitations in study designs (Table 5).

402   **Home setting**

403   To our knowledge this is the first review to report on volunteer interventions in at risk or

404   malnourished adults in the community. Evidence from observational studies supports the

405   positive findings on functional outcomes in that these studies also found peer-led volunteers

406   to be effective in reducing falls risk in older adults (53-55). The theoretical base

407   underpinning the use of peer or age matched volunteers (used in the two homebased RCTs)

408   states that advice is more readily accepted from contemporaries (56). Functional status is

409   linked to nutritional status and QoL (13). However, in the present review the lack of effect

410   on handgrip strength, nutritional and QoL outcomes may be explained by the small sample

411   size and the use of social support as a comparator in the single RCT that reported data on

412   these outcomes (33). Social support independently has been found to affect improvements in

413   functional ability in older adults (57). As volunteers (lay buddies) also delivered the control,

414   this raises further questions about which intervention is most cost-effective and if there is a

415   need to provide an adjunct intervention to social support. Additionally, the combined exercise

416   and nutrition advice intervention in this study meant it was not possible to isolate the

417   independent effects of each. Nutritional screening showed high agreement between

418   volunteers and professionals in one study (44). It may be that nutritional screening combined

419   with social support is sufficient to allow the much needed early identification and prevention

420   of malnutrition in the community. However, confidence in these findings is limited as they

421   come from single small studies, all of which reported different outcomes.

422   **Hospital setting**

423   Previous reviews reported lack of consistency in improved intake following volunteer

424   mealtime assistance in hospitals (24, 25). Meta-analyses performed in the present review

425   revealed a statistically significant improvement in lunchtime energy intake and a greater but

426   non-significant improvement in daily energy intake when volunteers were present.

427   Interestingly, the improvement in lunchtime energy intake coincides with findings that most

428   studies (11 out of 14) reported volunteer assistance at lunchtimes. The results for total energy

429   intake may have failed to reach statistical significance for a number of reasons including the

430   small number of included studies, small sample sizes, variation in methods of data collection,

431   varied nutritional content of food as well as the possibility that looking at total intake may

432   mask the true effect of volunteers if patients compensated by eating less at other mealtimes

433   when assistance was not available.

434   Evidence suggests targeted assistance results in higher intake (47). The five studies that

435   reported improvement in intake all targeted volunteer assistance at patients who required

436   specific help (dysphagia, unable to feed themselves). In contrast, the study (Roberts et al.,

437   2017) that did not find a difference used volunteers for more general support while most

438   patients were also at relatively lower risk of malnutrition. Wright et al (47) combined

439   targeted assistance with the use of volunteers for relatively longer duration each day

440 compared to other studies (08.00–16.00h to assist during breakfast, lunch and snacks and

441 supplements).The volunteers were also trained during a week-long training schedule which

442 was also relatively longer than the other studies. They reported the greatest differences in

443 intake between the intervention and the control groups favouring volunteer assistance.

444 However, this study was at high risk for confounding due to the use of historical controls,

445 some differences in baseline characteristics and differences in measurements used for intake

446 between the control and intervention groups.

447 **Home and hospital settings**

448 Consistent with previous reviews (24, 25), all the studies reported positive patient and staff

449 experience and satisfaction in both settings. Volunteers were described as helpful, proactive,

450 knowledgeable and essential and possibly enhanced experience by spending longer with

451 patients. However, most of this evidence came from studies at high or unclear risk of bias.

452 Furthermore, the variety and lack of rigorous elements required in the measurement methods

453 and outcome reporting of the qualitative data, made inter-study comparison difficult.

454 The findings of the present review suggest that trained volunteers are able to carry out a range

455 of tasks autonomously and offer a reliable service. However, a variety of factors may

456 influence a volunteer-delivered intervention including training, age and experience of the

457 volunteer, setting and specific needs of the patient. Whilst we aimed to collate a variety of

458 volunteer-delivered interventions expanded across healthcare and home-based settings, we

459 must also recognize the heterogeneity in the underlying causes of malnutrition and nutritional

460 status among the populations included in the studies where only eight studies reported

461 nutritional status of participants. A variety of screening methods were used also highlighting

462 the lack of agreement on an international screening tool for identifying the risk of

463 malnutrition (58). Nutritional screening is an initial step in the nutrition care process for the

464 identification of individuals at nutritional risk subsequently allowing for targeted

465 interventions (12). Similarly, the diverse interventions provided by volunteers ranging from

466 food encouragement to meal preparation, targeting different underlying aetiologies in the

467 included participants (e.g. dysphagia or social isolation) makes it difficult to isolate the

468 elements of the intervention that impact outcomes, meaning that "volunteer-driven

469 interventions'' remains a 'black box'.

470 Very low-quality evidence mainly from studies with overall unclear or high risk of bias

471 suggest volunteer assistance is a safe intervention method. Although some studies reported

472 cost effectiveness associated with volunteers, accepted methods for cost-analysis were not

473 used which precludes any conclusions on cost-effectiveness.

474 **Strengths**

475 A protocol was completed and registered in order to minimise reporting bias. Two authors

476 (JL, MD) compiled a comprehensive list of key terms and searched six databases without any

477 restrictions on language or dates to capture all relevant studies as well as undertaking study

478 selection, data extraction and risk of bias assessments in duplicate. Additional references

479 were identified through snowball searching. The present review built upon previous evidence

480 on trained volunteers in hospital settings and further explored effectiveness in the home

481 setting using additional data from qualitative and recently published studies, and RCTs.

482 Studies that did not clearly report volunteer outcomes specifically were excluded (59, 60). A

483 meta-analysis was carried out which isolated the effect of volunteers in improving mealtime

484 assistance to confirm previous positive findings (26). Additionally, the quality of the overall

485 body of evidence was assessed using the GRADE framework in duplicate.

486 **Limitations**

487   Our review was limited by the variation in reporting of outcomes and hence lack of meta-

488   analyses. Results pooled into the meta-analyses were from a limited number of studies and

489   the use of final means in the meta-analyses may provide an inaccurate estimate of effect due

490   to potential differences in baseline data between studies. An assessment of publication bias

491   using a funnel plot was not possible due to the low number of studies. Grey literature was

492   not explored and authors were not contacted for missing data due to time constraints. All

493   study types were included aimed at considering different interventions in the literature,

494   especially where RCTs may not be possible (61). However, this may have contributed to the

495   low-quality evidence in our review.

496   **Generalisability**

497   The evidence for volunteer interventions in the home setting lacks generalisability to other

498   home settings mainly due to use of convenience samples. The self-recruitment of participants

499   may suggest an overall higher level of motivation, engagement and differences in health. The

500   evidence on hospital interventions lacks confidence due to small samples sizes, variability

501   and bias in methodology and measurement of outcomes due to confounding and lack of use

502   of validated measures.

503   **2. Conclusions**

504   There is currently a lack of good quality evidence on the effectiveness of trained volunteers

505   in the detection and management of malnutrition in adults especially in community settings.

506   This precludes the drawing of firm conclusions. The current paper identified some evidence

507   that trained volunteer interventions may be effective in reducing malnutrition risk in older

508   adults in home and hospital settings. However, the variety of interventions provided by

509   volunteers makes it difficult to determine which interventions are effective in targeting

510   malnutrition risk within different settings. Future research should focus on determining

511 whether interventions that target specific causes of malnutrition improve defined outcomes in

512 populations at nutritional risk before widespread translation into clinical practice.

513 Considering the high prevalence and costs of malnutrition, focused research in this area is

514 needed to identify the most efficient use of resources beginning with appropriate nutritional

515 screening and documentation in identification of at risk populations. With current NHS focus

516 on integrating care across different settings, trained volunteers present an opportunity to

517 bridge gaps and add value to the existing workforce.

518 Due to the ethical implications of RCTs and issues with blinding, adequately powered non-

519 RCTs of robust methodological design may be most appropriate and can provide similarly

520 useful data (61). The likely considerable costs and time investment of staff involved in

521 recruitment, retention, training and provision of support for volunteers necessitate

522 measurement of cost-effectiveness through measures such as QALYs (quality-adjusted life

523 years) (62). In order to understand the context, mechanism and outcomes through which

524 volunteer delivered interventions work, a realist review is recommended (63). This can be

525 especially useful in relation to understanding patient experience of volunteers consistently

526 reported across both settings. It is essential that validated PREMS (Patient reported

527 experience measures) or PROMS (Patient-reported outcome measures) are used in future

528 research to consolidate these findings (64, 65). Given the links between patient experience

529 and improved healthcare outcomes (66), and the latter being one of the key outcomes for the

530 NHS, this may provide future direction to help inform the most cost-effective design and

531 development of volunteer initiatives in malnutrition.

532

539 **Author's Contributions**

540   Design of the research; CEW, CB, MD, JL. Supervision of the research CB. Conduct

541 of the research; JL & MD. Analysis and interpretation of data; JL. Writing the manuscript;

542 JL. Final manuscript reviewed and approved by all authors. The authors have no conflicts of

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References

1.   Sobotka L, Forbes A. Basics in clinical nutrition: Galen; 2019.
2.   Elia M. The cost of malnutrition in England and potential cost savings from nutritional interventions. U.K.: British Association for Parenteral and Enteral Nutrition (BAPEN) and National Institute for Health Research Southampton Biomedical Research; 2015 10/01/19http://www.uhs.nhs.uk/Media/Southampton-Clinical-Research/BRCdownloads/ECONOM-REPORT-FULL-18.11.15.pdf.
3.   Elia M, Russell C. Combating Malnutrition: Recommendations for Action. UK; 2009.
4.   Ljungqvist O, De Man F. Under nutrition-a major health problem in Europe. Nutricion hospitalaria. 2009;24(3):369-70.
5.   Inotai A, Nuijten M, Roth E, Hegazi R, Kaló Z. Modelling the burden of disease associated malnutrition. e-SPEN Journal. 2012;7(5):e196-e204.
6.   Sauer AC, Goates S, Malone A, Mogensen KM, Gewirtz G, Sulz I, et al. Prevalence of Malnutrition Risk and the Impact of Nutrition Risk on Hospital Outcomes: Results From nutritionDay in the US. Journal of Parenteral and Enteral Nutrition. 2019.
7.   Hickman I, Tapsell L. Evidence based practice guidelines for the nutritional management of malnutrition in adult patients across the continuum of care. Nutrition & Dietetics. 2009;66(S1-S34).
8.   Rowell D, Jackson T. Additional costs of inpatient malnutrition, Victoria, Australia, 2003–2004. The European Journal of Health Economics. 2011;12(4):353-61.
9.   Snider JT, Linthicum MT, Wu Y, LaVallee C, Lakdawalla DN, Hegazi R, et al. Economic burden of community-based disease-associated malnutrition in the United States. JPEN Journal of parenteral and enteral nutrition. 2014;38(2 Suppl):77s-85s.
10.   Ljungqvist O, van Gossum A, Sanz ML, de Man F. The European fight against malnutrition. Clinical Nutrition. 2010;29(2):149-50.
11.   Cederholm T, Jensen G, Correia MIT, Gonzalez MC, Fukushima R, Higashiguchi T, et al. GLIM criteria for the diagnosis of malnutrition–A consensus report from the global clinical nutrition community. Journal of cachexia, sarcopenia and muscle. 2019;10(1):207-17.
12.   Cederholm T, Barazzoni R, Austin P, Ballmer P, Biolo G, Bischoff SC, et al. ESPEN guidelines on definitions and terminology of clinical nutrition. Clinical nutrition. 2017;36(1):49-64.
13.   Soenen S, Chapman IM. Body Weight, Anorexia, and Undernutrition in Older People. Journal of the American Medical Directors Association. 2013;14(9):642-8.
14.   Wilson L. A review and summary of the impact of manutrition in older people and the costs and benefits of interventions. UK; 2013.
15.   Naylor C, Mundle C, Weaks L, Buck D. Volunteering in health and care: Securing a sustainable future. London: The King's fund; 2013.
16.   . NaCS. Volunteering in America: AmeriCorps and Senior Corps; n.d. [Available from: https://www.nationalservice.gov/serve/via.
17.   Australian Bureau of Statistics. General Social Survey: Summary Results, Australia, 2014 2015 [Available from: https://www.abs.gov.au/ausstats/abs@.nsf/Latestproducts/4159.0Main Features152014.
18.   NHS. Five Year Forward view. England: National Health Service; 2014.
19.   NHS. NHS Long Term Plan. England: National Health Service 2019.
20.   Abbott RA, Whear R, Thompson-Coon J, Ukoumunne OC, Rogers M, Bethel A, et al. Effectiveness of mealtime interventions on nutritional outcomes for the elderly living in residential care: a systematic review and meta-analysis. Ageing Res Rev. 2013;12(4):967-81.
21.   Walton K, Williams P, Tapsell L, Hoyle M, Shen ZW, Gladman L, et al. Observations of mealtimes in hospital aged care rehabilitation wards. Appetite. 2013;67:16-21.
22.   Howson FFA, Robinson SM, Lin SX, Orlando R, Cooper C, Sayer AAP, et al. Can trained volunteers improve the mealtime care of older hospital patients? An implementation study in one English hospital. BMJ Open. 2018;8(8).

23. Wilson L. Preventing malnutrition in later life: The role of community food projects. London; 2009.

24. Green SM, Martin HJ, Roberts HC, Sayer AA. A systematic review of the use of volunteers to improve mealtime care of adult patients or residents in institutional settings. J Clin Nurs. 2011;20(13-14):1810-23.

25. Howson FFA, Sayer AA, Roberts HC. The Impact of Trained Volunteer Mealtime Assistants on Dietary Intake and Satisfaction with Mealtime Care in Adult Hospital Inpatients: A Systematic Review. J Nutr Health Aging. 2017;21(9):1038-49.

26. Tassone EC, Tovey JA, Paciepnik JE, Keeton IM, Khoo AY, Van Veenendaal NG, et al. Should we implement mealtime assistance in the hospital setting? A systematic literature review with meta-analyses. J Clin Nurs. 2015;24(19-20):2710-21.

27. Liberati A, Altman DG, Tetzlaff J, Mulrow C, Gøtzsche PC, Ioannidis JPA, et al. The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate healthcare interventions: explanation and elaboration. BMJ. 2009;339.

28. Cochrane Public Health Group. Guide for developing a Cochrane protocol: The Cochrane Collaboration

; 2011 [Available from: https://ph.cochrane.org/sites/ph.cochrane.org/files/public/uploads/Guide for PH protocol_Nov 2011_final for website.pdf.

29. Higgins JPT, Green S. Handbook for Systematic Reviews of Interventions Version 5.1.0 [updated March 2011]: The Cochrane Collaboration; 2011.

30. Ryan R. Cochrane Consumers and Communication Review Group: data synthesis and analysis: Cochrane Consumers and Communication Review Group; 2013 [Available from: http://cccrg.cochrane.org/.

31. Popay J, Roberts H, Sowden A, Petticrew M, Arai L, Rodgers M, et al. Gudance on the Conduct of Narrative Synthesis in Systematic Reviews. U.K.; 2006.

32. Borenstein M, Hedges L, Rothstein H. Meta-Analysis Fixed effects Vs random effects cochrane 2007 [Available from: www.Meta-Analysis.com

33. Haider S, Dorner TE, Luger E, Kapan A, Titze S, Lackinger C, et al. Impact of a home-based physical and nutritional intervention program conducted by lay-volunteers on handgrip strength in prefrail and frail older adults: A randomized control trial. PLoS ONE. 2017;12(1).

34. Haider S, Grabovac I, Winzer E, Kapan A, Schindler KE, Lackinger C, et al. Change in inflammatory parameters in prefrail and frail persons obtaining physical training and nutritional support provided by lay volunteers: A randomized controlled trial. PLoS ONE. 2017;12(10).

35. Kapan A, Luger E, Haider S, Titze S, Schindler K, Lackinger C, et al. Fear of falling reduced by a lay led home-based program in frail community-dwelling older adults: A randomised controlled trial. Archives of Gerontology and Geriatrics. 2017;68(pp 25-32).

36. Kapan A, Winzer E, Haider S, Titze S, Schindler K, Lackinger C, et al. Impact of a lay-led home-based intervention programme on quality of life in community-dwelling pre-frail and frail older adults: a randomized controlled trial. BMC geriatr. 2017;17(1):154.

37. Luger E, Dorner TE, Haider S, Kapan A, Lackinger C, Schindler K. Effects of a Home-Based and Volunteer-Administered Physical Training, Nutritional, and Social Support Program on Malnutrition and Frailty in Older Persons: A Randomized Controlled Trial. Journal of the American Medical Directors Association. 2016;17(7).

38. McHugh Power JE, Lee O, Aspell N, McCormack E, Loftus M, Connolly L, et al. RelAte: pilot study of the effects of a mealtime intervention on social cognitive factors and energy intake among older adults living alone. Br J Nutr. 2016;116(9):1573-81.

39. Huang CS, Dutkowski K, Fuller A, Walton K. Evaluation of a pilot volunteer feeding assistance program: Influences on the dietary intakes of elderly hospitalised patients and lessons learnt. Journal of Nutrition, Health and Aging. 2015;19(2):206-10.

40.   Wong A, Burford S, Wyles CL, Mundy H, Sainsbury R. Evaluation of strategies to improve nutrition in people with dementia in an assessment unit. Journal of Nutrition, Health and Aging. 2008;12(5):309-12.

41.   Robison J, Pilgrim AL, Rood G, Diaper N, Elia M, Jackson AA, et al. Can trained volunteers make a difference at mealtimes for older people in hospital? A qualitative study of the views and experience of nurses, patients, relatives and volunteers in the Southampton Mealtime Assistance Study. Int J Older People Nurs. 2015;10(2):136-45.

42.   Roberts HC, Pilgrim AL, Jameson KA, Cooper C, Sayer AA, Robinson S. The impact of trained volunteer mealtime assistants on the dietary intake of older female in-patients: The Southampton Mealtime Assistance Study. Journal of Nutrition, Health and Aging. 2017;21(3):320-8.

43.   Manning F, Harris K, Duncan R, Walton K, Bracks J, Larby L, et al. Additional feeding assistance improves the energy and protein intakes of hospitalised elderly patients. A health services evaluation. Appetite. 2012;59(2):471-7.

44.   Laforest S, Goldin B, Nour K, Roy MA, Payette H. Nutrition risk in home-bound older adults: Using dietician-trained and supervised nutrition volunteers for screening and intervention. Canadian Journal on Aging. 2007;26(4):305-15.

45.   Walton K, Williams P, Bracks J, Zhang Q, Pond L, Smoothy R, et al. A volunteer feeding assistance program can improve dietary intakes of elderly patients - A Pilot Study. Appetite. 2008;51(2):244-8.

46.   Robinson S, Clump D, Weitzel T, Henderson L, Lee K, Schwartz C, et al. The memorial meal mates: A program to improve nutrition in hospitalized older adults. Geriatric Nursing. 2002;23(6):332-5.

47.   Wright L, Cotter D, Hickson M. The effectiveness of targeted feeding assistance to improve the nutritional intake of elderly dysphagic patients in hospital. Journal of Human Nutrition and Dietetics. 2008;21(6):555-62.

48.   Brown H, Jones L. The role of dining companions in supporting nursing care. Nursing standard (Royal College of Nursing (Great Britain) : 1987). 2009;23(41):40-6.

49.   Buys DR, Flood KL, Real K, Chang M, Locher JL. Mealtime assistance for hospitalized older adults - A report on the spoons volunteer program. Journal of Gerontological Nursing. 2013;39(9):18-22.

50.   Sneddon J. Using mealtime volunteers to support patients. Nursing times. 2011;107(41):21-3.

51.   Roberts HC, De Wet S, Porter K, Rood G, Diaper N, Robison J, et al. The feasibility and acceptability of training volunteer mealtime assistants to help older acute hospital inpatients: the Southampton Mealtime Assistance Study. J Clin Nurs. 2014;23(21-22):3240-9.

52.   Ottrey E, Palermo C, Huggins CE, Porter J. Exploring staff perceptions and experiences of volunteers and visitors on the hospital ward at mealtimes using an ethnographic approach. J Clin Nurs. 2018;27(7-8):E1571-E9.

53.   Nanduri AP, Fullman S, Morell L, Buyske S, Wagner ML. Pilot Study for Implementing an Osteoporosis Education and Exercise Program in an Assisted Living Facility and Senior Community. Journal of Applied Gerontology. 2016;37(6):745-62.

54.   Wurzer B, Waters DL, Hale LA, Leon de la Barra S. Long-Term Participation in Peer-Led Fall Prevention Classes Predicts Lower Fall Incidence. Archives of Physical Medicine and Rehabilitation. 2014;95(6):1060-6.

55.   Baczynska AM, Lim SER, Sayer AA, Roberts HC. The use of volunteers to help older medical patients mobilise in hospital: a systematic review. J Clin Nurs. 2016;25(21-22):3102-12.

56.   Peel NM, Warburton J. Using senior volunteers as peer educators: What is the evidence of effectiveness in falls prevention? 2009;28(1):7-11.

57.   Ng TP, Feng L, Nyunt MSZ, Feng L, Niti M, Tan BY, et al. Nutritional, Physical, Cognitive, and Combination Interventions and Frailty Reversal Among Older Adults: A Randomized Controlled Trial. The American Journal of Medicine. 2015;128(11):1225-36.e1.

58.   Bokhorst-de van der Schueren M, Guaitoli PR, Jansma EP. Nutrition screening tools: does one size fit all? A systematic review of screening tools for the hospital setting. 2014.

59.   Huxtable S, Palmer M. The efficacy of protected mealtimes in reducing mealtime interruptions and improving mealtime assistance in adult inpatients in an Australian hospital. European Journal of Clinical Nutrition. 2013;67(9):904-10.

60.   Murray C. Improving nutrition for older people. Nursing older people. 2006;18(6):18-22.

61.   Benson K, Hartz AJ. A Comparison of Observational Studies and Randomized, Controlled Trials. 2000;342(25):1878-86.

62.   Bergmo TS. How to Measure Costs and Benefits of eHealth Interventions: An Overview of Methods and Frameworks. Journal of medical Internet research. 2015;17(11):e254-e.

63.   Pawson R, Greenhalgh T Fau - Harvey G, Harvey G Fau - Walshe K, Walshe K. Realist review--a new method of systematic review designed for complex policy interventions. 2005(1355-8196 (Print)).

64.   Beattie M, Murphy DJ, Atherton I, Lauder W. Instruments to measure patient experience of healthcare quality in hospitals: a systematic review. Systematic reviews. 2015;4:97.

65.   LaVela SL, Gallan A. Evaluation and Measurement of Patient Experience. Pateint Experience journal. 2014;1(1).

66.   Doyle C, Lennox L, Bell D. A systematic review of evidence on the links between patient experience and clinical safety and effectiveness. BMJ Open. 2013;3.

67.   Roberts HC, Denison HJ, Martin HJ, Patel HP, Syddall H, Cooper C, et al. A review of the measurement of grip strength in clinical and epidemiological studies: towards a standardised approach. Age and ageing. 2011;40(4):423-9.

68.   Simonsick EM, Guralnik JM, Ferrucci L, Glynn RJ, Berkman LF, Blazer DG, et al. A Short Physical Performance Battery Assessing Lower Extremity Function: Association With Self-Reported Disability and Prediction of Mortality and Nursing Home Admission. Journal of Gerontology. 1994;49(2):M85-M94.

69.   Washburn RA, Smith KW, Jette AM, Janney CA. The physical activity scale for the elderly (PASE): Development and evaluation. Journal of Clinical Epidemiology. 1993;46(2):153-62.

70.   Romero-Ortuno R, Walsh CD, Lawlor BA, Kenny RA. A Frailty Instrument for primary care: findings from the Survey of Health, Ageing and Retirement in Europe (SHARE). BMC geriatr. 2010;10(1):57.

71.   Delbaere K, Close JCT, Mikolaizak AS, Sachdev PS, Brodaty H, Lord SR. The Falls Efficacy Scale International (FES-I). A comprehensive longitudinal validation study. Age and ageing. 2010;39(2):210-6.

72.   Skevington SM, Lotfy M, O'Connell KA. The World Health Organization's WHOQOL-BREF quality of life assessment: Psychometric properties and results of the international field trial. A Report from the WHOQOL Group. Quality of Life Research. 2004;13(2):299-310.

73.   Power M, Quinn K, Schmidt S, Group W-O. Development of the WHOQOL-Old Module. Quality of Life Research. 2005;14(10):2197-214.

74.   Gollub EA, Weddle DO. Improvements in nutritional intake and quality of life among frail homebound older adults receiving home-delivered breakfast and lunch. Journal of the American Dietetic Association. 2004;104(8):1227-35.

Table 1: Eligibility criteria based on PICOS

PICOS	Inclusion Criteria
Population	Volunteers: identified as formally recruited and trained personnel in order to reflect a realistic workforce. Adults ≥18 years at risk of malnutrition: identified as at risk either within the study or those judged to be at risk by the author including hospitalised patients and patients with conditions such as stroke, cognitive impairment or frailty associated with malnutrition.
Intervention	Any volunteer delivered interventions addressing immediate or underlying causes of malnutrition including mealtime assistance, involvement in schemes such as Meals on Wheels, red tray initiatives or dining companions, dietary advice, nutritional screening or training, home meal delivery, local luncheon clubs, social support and any interventions to promote independence were included.
Control or Comparison	No restrictions ware placed on the comparator to include qualitative outcomes on experience and satisfaction.
Outcomes	In order to explore the effect on participants directly, patient centred outcome measures were focused on: Descriptions of types, settings and the modes of nutritional interventions 1. Primary outcomes: Functional outcomes, quality of life, self-management Patient/staff/carer experience and satisfaction e.g. reduction in carer/staff burden 2. Secondary outcomes: Nutritional, clinical/healthcare related, economic outcomes and patient safety Other outcomes: volunteer related outcomes e.g. feasibility, adherence and retention
Studies	All randomised controlled trials (RCTs), non-RCTs, non-intervention and qualitative studies were included to allow realistic exploration of the healthcare environment where funding restrictions, ethical issues and other constraints make blinding and randomisation difficult.

Table 2: Summary of key study characteristics based on intervention setting

Study ID	Study design, location	Duration and follow up	Participant Characteristics	Sample size	Intervention	Volunteer recruitment and training	Comparator	Outcomes
Interventions delivered by volunteers in home settings								
(33)[a]	RCT, Vienna, Austria	12 weeks	83.8% female; mean age: 82.8 (SD: 8.0) years; 52 (65.0%) frail, 27 (33.8%) pre-frail, 1 (1.2%) participant robust; nutritional status (MNA): 38 (47.5%) at risk of malnutrition/malnourished	I: 39 C: 41 Convenience sample	Physical training, nutrition advice and social support by lay volunteers	Buddy volunteers; > 50 years; recruited via a social organisation; trained four times for ~ 3 hours each session	Social support by non-volunteers (conversation and cognitive support provided using a guide book)	• Handgrip strength • Physical performance balance (gait speed, lower limb muscle strength) • Lean body mass Appendicular skeletal mass
(34)[a]	RCT, Vienna, Austria	12 weeks	84.8% female; mean age: 82.4 (SD: 8.2) years; 38 (65.5%) frail; 19 (32.8%) pre-fail; 1 (1.6%) robust but at risk of malnutrition	I: 34 C: 23 Convenience sample	Physical training, nutrition advice and social support by lay volunteers	Buddy volunteers; > 5o years; recruited via a social organisation; trained four times for ~ 3 hours each session	Social support by non-volunteers (conversation and cognitive support provided using a guide book)	Inflammatory markers: TNF-α, IL-6, CRP, total leukocytes
(35)[a]	RCT, Vienna, Austria	12 weeks	84% female; mean age:82.6 (SD: 8.1) years	I: 39 C: 41 Convenience sample	Physical training, nutrition advice and social support by lay volunteers	Buddy volunteers; > 5o years; recruited via a social organisation; trained four times for ~ 3 hours each session	Social support by non-volunteers (conversation and cognitive support provided using a guide book)	• Fear of falling • Physical activity
(36)[a]	RCT, Vienna, Austria	12 weeks	84% female; mean age; 82.6 (SD: 8.1) years; 24 (62%) frail; 14 (36%) pre-frail; 1 (3%) robust	I: 39 C: 41 Convenience sample	Physical training, nutrition advice and social support by lay volunteers	Buddy volunteers; > 5o years; recruited via a social organisation; trained four times for ~ 3 hours each session	Social support by non-volunteers (conversation and cognitive support provided using a guide book)	Overall QoL: physical health, psychological health, social relationship, environment, sensory abilities, autonomy, past present and future activities, social participation

Ref	Design/Location	Duration	Participants	Sample	Intervention	Volunteer details	Control	Outcomes
(37)[a]	RCT, Vienna, Austria	12 weeks	84% female; mean age: 82.8 (SD: 8.0) years; 64% frail; 35% pre-frail; 1% robust; nutritional status (MNA): 51% normal nourished; 45% at risk of malnutrition; 4% malnourished	I: 39 C: 42 Convenience sample	Physical training, nutrition advice and social support by lay volunteers	Buddy volunteers; > 5o years; recruited via a social organisation; trained four times for ~ 3 hours each session	Social support by non-volunteers (conversation and cognitive support provided using a guide book)	• Malnutrition scores (MNA-LF) • Frailty scores • Prevalence of impaired nutritional status Prevalence of frailty
(44)	Pilot, 6 weeks, Canada	6 weeks	86% female; mean age: 82.5 years; no. experiencing problems with ADLs - washing (62%); grooming (55%); meal preparation (66%); > 69% required assistance with grocery shopping; 24% reported receiving help with meal preparation; received Meals on Wheels (14% hot; 17% frozen).	29 Convenience sample	Feasibility of nutrition screening and nutrition education by volunteers under the supervision of dietitians and case managers	30 volunteers; two 3-hours training sessions by dietitian	No control	• Participant satisfaction • Volunteer perspectives • Case manager perspectives *Other*: Inter-rater reliability of nutrition screening tool used by volunteers compared to dietitians
(38)	Parallel randomised control design, B-FU: 8-weeks, Republic of Ireland	8 weeks; F/U: 12 & 26 week	I: Mean age: 75.3 (SD: 7.82; range - 60-91); Nutritional status (MNA): normal 35 (72.9%, at risk 10 (20.8%), malnourished 3 (6.3%); C: Mean age: 74.4 (SD: 7.61; range - 60-89); Nutritional status (MNA): normal 28 (58.3%), at risk 17(35.4%), malnourished 3 (6.3%).	I: 50 C: 50 Convenience sample	Weekly visit from a trained volunteer who prepared and shared a meal with them	Peer volunteers; 55 years; recruited via local social groups, national media, parish and research newsletters; 1 day of training on intervention fidelity, nutritional education (covering the food pyramid, portion size guidelines, tips for healthy eating, tips for maintenance of bone health, bowel health, blood health), culinary skills and interpersonal skills	No volunteer visit; received a guidebook and nutritional and culinary information and advice	• Self-efficacy • Food enjoyment • Energy intake

Interventions delivered by volunteers in hospital settings

(48)	Pilot, UK	12 months	Frail, older patients on modified diets, whose swallowing had 'plateaued' and were no longer in acute phase of experiencing swallowing difficulties, needed encouragement with eating, drinking, as well as to be given more time'	Not specified	Dining companions programme; mealtime assistance at lunchtime: helped patients that required more time and needed encouragement with eating and drinking	6 volunteers; Locally recruited nursing students from College; trained by speech and language therapist and dietitian; needs, assistance requirements of ordering meals, safety, when to seek help	No control	Oral intake • Nursing staff reports *Other:* Rate of nutritional screening
(49)	Observational programme evaluation, U.S.A.	39 months	Mean age: over 65 years; Patients likely to benefit from socialization, required assistance with tray set-up, required prompting to eat, or feeding assistance and did not have dysphagia and were cognitively able to interact with a volunteer	236 observations	Mealtime assistance: assistance with passing out or collecting trays, tray set-up, verbal encouragement and prompting to eat, and feeding the patients	Trained over three sessions by unit coordinator and OT; hand washing and sanitation, adjusting beds and positioning, feeding and other techniques, patient-communication skills	No control	• Potential savings on staff time and cost *Other*: Tasks completed by the volunteer; Time spent with each patient; Volunteer comments about experience; Adverse events
(22)	Mixed methods, Quasi experimental, UK	15 months	Mean age: over 70 years; nutritional status: median BMI at or above the normal range; most patients at low risk of malnutrition (MUST); significant anorexia among many patients in all departments	8 patients, 7 staff members, 9 volunteers	Mealtime assistance at weekday lunchtime and evening meals: Social interaction, encouragement, preparation, assisting food to mouth, feeding	65 volunteers; 17-77 years; recruitment via hospital's pre-existing voluntary services team; standardised half-day training session delivered by the research team on nutrition in older patients, safe feeding strategies, a practical session on feeding and assessment of competency	No control	• Total cost evaluation of the programme *Other*: Number of volunteers recruited, trained and their activity; patient, ward staff and volunteers' views on barriers and enablers

(39)	Pilot, Australia	2 months, data collected for 4 days for each patient (2 weekday days with volunteer assistance and 2 days at weekend without)	Mean age: 83 years (SD: 4.5 years) nutritional status (MNA): 7 malnourished; 1 'at risk'; 7 receiving high protein, high energy texture modified diets (3 Puree, 3 Minced, 1 Soft); 1 on a Full diet.	8 patients	Targeted mealtime assistance at lunchtimes: assisting nutritionally 'at risk' patients with feeding, correctly positioning meal trays, cutting up foods, handling cutlery, opening packaging, and encouraging conversation and socialisation	Volunteers trained by dietetics, speech pathology and nursing staff -	Patient acted as their own controls	• Macronutrient and energy intakes • Nursing staff and volunteers' views and experiences
(43)	Cross-sectional, Mixed methods design, Australia	2 months, Data collected for 4 days for each patient (2 weekday days with volunteer assistance and 2 days at weekend without)	Mean age: 83.2 years (SD: 8.9); nutritional status: mean BMI 24.3 kg/m2; 87% nutritionally compromised (52% at risk; 35% malnourished; MNA); predominantly on a full or soft diet;	23 patients convenience sample	Targeted feeding assistance across 2 wards at lunchtimes: assisting with opening packages, tray set up, feeding, encouragement and other meal related tasks	Volunteers from ongoing volunteer feeding assistance programme; trained via a training programme; feeding patients, encourage higher protein and energy intakes, when to request help	Patients acted as their own controls	• Energy and protein intake *Other*: Time with patient, type of assistance carried out by volunteer, patient, nurses and volunteer opinion
(52)	Qualitative, ethnographic approach, Australia	3 months, 67 hours of field work	Patients admitted to subacute ward for geriatric care and rehabilitation	61 staff, volunteers and visitors	Mealtime assistance at lunchtimes	12 volunteers on one subacute ward; trained to encourage and engage patients via conversation and activities, provide mealtime assistance, and completion of other tasks as required by staff	Another subacute ward without volunteers	• Perspectives and experiences of volunteer and visitor involvement and interactions at hospital mealtimes • How the volunteer and visitor role is perceived within the hospital system

(51)[b]	Mixed methods evaluation, UK.	1 year	Female acute inpatients; aged ≥ 70 years; not on tube feeds or nil by mouth or end of life	N/A for monitoring of recruitment and training of volunteers; focus groups and interviews: 12 volunteers (convenience sample), 9 patients, 17 nursing staff (purposive sample)	Mealtime assistance on one acute ward at lunchtimes: feeding two patients, encouraging and assisting another seven, preparing tables and cleaning hands of all nine patients before lunch	Trained in half day sessions 7 times developed by SALT and dietitian; encouragement to eat, cleaning patent hands, support with opening packets, setting up the meal tray, cutting up food, helping guide the food to the patient's mouth and feeding patients	None	• Acceptability of training and volunteers' role • Monitoring of volunteers' recruitment, training, activity and retention • Adverse events
(42)[b]	Quasi experimental 2-year pre and post- test study design, UK	2 years (intervention year and non-intervention year)	Female acute inpatients from 4 wards; Mean age ranged from 87.1 (5.3) to 87.9 (SD: 5.1) years Nutritional status: In both years most patients had a BMI within normal range, low MUST score, confusion common - Mean MUST: score 0 ranged from 46 (61.3%) to 63 (70.8%) patients; score 1 ranged from 10 (11.2%) to 12 (13.0%) patients; score ≥ 2 ranged from 16 (18.0%) to 25 (27.8%) patients	I: 221 C: 186	General mealtime assistance during weekday lunchtimes in 2 acute wards at lunchtimes: specific assistance included (indicated by nursing staff) cleaning hands and trays, encouragement to eat, opening up packages, cutting up food and feeding patients, volunteers offered additional help to other patients	29 volunteers trained in half day sessions 7 times by SALT and dietitian; encouragement to eat, support with opening packets, setting up the meal tray, cutting up food, helping guide the food to the patient's mouth and feeding patients	Historical controls from non-intervention year and parallel control ward in the intervention year - usual care by nursing staff	• Energy and protein intake

(46)	Pilot study, U.S.A.	2 months	I: Mean age: 77.8 years C: Mean age: 78.2 years For both groups - 41% of the patients required assistance/encouragement; 59% required total feeding; 29% of patients experienced confusion; 56% experienced generalized weakness; 9% could not use an upper extremity; 5% were too short of breath to complete a meal without help; 1 (3%) patient in each group was blind	I: 34 C: 34	Targeted mealtime assistance 'at each meal': charge nurse helped locate patients requiring assistance	15 college students and 4 current volunteers; 3-hour in-service by interdisciplinary team; information on factors that influence appetite and techniques to improve intake, an experience in which the volunteers fed each other, also taught to estimate and record percentage of tray consumed and record the percentage eaten on the bedside nursing record,	Control: Usual care by nursing staff Matched (age, type of assistance, reason help was required)	• Total dietary intake
(41)[b]	Qualitative 1 year before and after intervention, UK	2 years	Female patients from 2 wards; age range - 70 - 90+ years Nutritional status: BMI/Kg/m^2 - < 18.5: Ranged from 3 (20%) to 5 (25%) patients; 18.5-24.9: 7 (47%) to 9 (45%) patients; 25-29.9: 3 (20%) to 4 (20%) patients; 30+: 2 (13%) to 2 (10%) patients	19 staff (purposive sample), 25 patients, 5 relatives from each year, 12 volunteers	Mealtime assistance at lunchtimes	Trained in half day sessions 7 times developed by SALT and dietitian; encouragement to eat, cleaning patent hands, support with opening packets, setting up the meal tray, cutting up food, helping guide the food to the patient's mouth and feeding patients	Parallel comparison with a control ward	• Perspectives on nutritional care of older inpatients • Acceptability of trained volunteers *Other:* Elements of their assistance
(50)	Programme Evaluation, UK	April 2010 – August 2011	Patients on wards requiring assistance at mealtimes	Not specified	Mealtime assistance at lunch and supper times	35 volunteers trained during seven 3-hour sessions by SALT and nutrition nurse specialist; best position for eating, the normal swallow, how it feels to be fed by someone else, the type of patients that may require assistance at mealtimes, completing menu cards with patients, how to fill in food and fluid charts	No control	• Nursing staff experience • Patient experience *Other*: Mealtime volunteer experience

| (45) | Pilot study, Australia | 1 month; Data collected for 4 days for each patient (2 weekday days with volunteer assistance and 2 days at weekend without) | 3 males, 6 females from 1 ward; mean age: 89 years (SD: 4.6); patients identified as 'at risk' requiring assistance with feeding, opening packages, encouragement and/ or social support at meal times | 9 convenience sample

13 nurses and 14 volunteers provided data on opinions | Targeted feeding assistance during lunch: Patients referred by Nurse Unit Manager and Clinical Care Coordinator | 25 volunteers, specifically recruited and trained; encourage high protein, high energy components of the meal first, when to call for nursing assistance | Patients acted as their own control | • Average energy and protein intake Opinions of nurses and volunteers about the programme and patient feeding *Other*: Comparison of average daily energy and protein intakes to average estimated daily requirements |
|---|---|---|---|---|---|---|---|---|
| (40) | Observation phase followed by sequential interventions, New Zealand | 4 phases of 12-week duration (5-week gap between phases) | Older people with cognitive impairment in a short stay unit

I (phase 3): 5 males, 2 females; mean age: 77.0 (SD: 6.5) years; nutritional status: BMI/Kg/m2: 24.3 (SD 3.5); MNA (scores of < 9 indicate malnutrition): 8.6 (3.3)

C (phase 1): 12 males, 11 females; mean age 80.0 (SD: 7.9); nutritional status: BMI/Kg/m2: 23.9 (SD: 3.7); MNA: not available | I: (Phase 3) - 7 C: (Phase 1) - 23 | Phase 1: Observation; Phase 2: Encouraging dietary, 'Grazing'; Phase 3: Volunteer assistance at lunchtimes to maximise food and fluid intake by assisting semi-independent eaters and freeing staff to assist more specialist patients; Phase 4: Improving dining room ambience by playing soothing music. | No information | Patients observed during the observation phase | • BMI • Mid arm circumference Caloric intake |

(47)	Prospective observational trial design for intervention with a retrospective control group, UK	I: collected August to December 2005 C: collected May to September 2003	Dysphagic older patients on a texture modified diet and/or thickened fluids + no family/carer available to help at mealtimes I - 44% female; Mean age 76.1 (SD: 11.2) years; mean weight 55.9Kg (SD: 19.5) C - 48% female; mean age 81.8 (SD: 8.7) years; mean weight 59.9Kg (SD: 14.3) No significant differences between the two groups for age, gender distribution or type of diet; difference in weight was of borderline significant and there were clear differences in supervision level	I: 16 C: 30	Targeted mealtime assistance: each patient was assisted for 3 days between the period of 08.00–16.00h to include breakfast and lunch and in between meal snacks and supplements.	1-week training programme by an experienced dietitian and SALT on targeted assistance	No mealtime assistance	Energy and protein intake

[a] Same cohort of same study; [b] Partly same cohort of same study; I - intervention group; C - control group; SD - standard deviation; BMI - body mass index; MNA - Mini Nutritional Assessment; MUST - Malnutrition Universal Screening Tool; CRP - C-reactive protein; IL-6 - interleukin 6; TNF-α - tumour necrosis factor-α; SALT – speech and language therapist; ADL – activities of daily living

Table 3: Summary of outcomes data from studies reporting on functional outcomes and quality of life

Functional outcome	Study ID	Sample Size (n)	Methods	Results			
				Within group MD (95% CI)	**P value**	**Between group MD (95% CI)**	**P value**
Handgrip strength/Kg	(33)	I:39 C:41	Hydraulic hand dynamometer (67)	I: 2.4 (1.0 to 3.8) C: 0.8 (−0.4 to 2.0)	0.001 0.189	**1.3 (−0.3 to 2.9)**	0.105
Overall Physical performance (SPPB)	(33)	I:39 C:41	Short Physical Performance Battery (68)	I: 1.2 (0.3 to 2.1) C: 0.5 (0.1 to 0.9)	0.009 0.011	**1.0 (0.0 to 2.0)**	**0.044**
Balance					<0.001 0.002	**0.0 (−0.5 to 0.4)**	0.934
Gait speed				I: 0.4 (0.0 to 0.8) C: 0.5 (0.2 to 0.8)	0.316 0.688	**0.2 (-0.2 to 0.7)** **0.6 (0.2 to 1.1)**	0.231
Lower limb muscle strength				I: 0.2 (−0.2 to 0.6) C: −0.1 (−0.3 to 0.2) I: 0.6 (0.2 to 1.0) C: 0.1 (-0.2 to 0.3)	0.003 0.464		**0.007**
Physical activity scale	(33)	I:39 C:41	Physical Activity Scale (69)	I: 17.1 (24)[a] C: 1.9 (18.6)[a]	<0.001 N.S.	**15.20 (5.76 to 24.64)**	**<0.001**
Frailty scale	(36)	I:39 C:41	SHARE-FI scale (70)	I: -0.71[b] (-1.07 to -0.35) C: -0.35[b] (-0.66 to -0.44)	<0.001 0.027	**-0.30 (-0.75 to 0.15)**	0.187
Frailty prevalence				I: 0.45[b] (0.23 to 0.86) C: 0.53[b] (0.26 to 1.08)	0.014 0.079	**0.80 (0.33 to 1.99)**	0.635
Fear of falling scale	(35)	I:39 C:41	Falls Efficacy Scale – International (71)	I: 4.2 (7.36)[a] C: 0.1 (0.32)[a]	<0.001 0.016	**4.10 (1.79 to 6.41)**	**0.016**
Self-efficacy scale	(38)	I:50 C:50	Validated General Self-Efficacy scale	I: 0.14 (0.165)[a] C: 0.12 (0.14)[a]		**0.02 (-0.04 to 0.08)**	0.054
Overall Quality of life scale MD (95% CI)	(36)	I:39 C:41	WHOQOL-BREF (72) and WHOQOL-OLD (73).	I: 5.6 (0.95 to 10.33) C: 2.5 (-1.66 to 6.54)	<0.05 N.S. ized <0.05 N.S.	**3.16 (−2.59 to 8.91)** **3.66 (0.13 to 7.18)**	0.277 **0.039**
Past, present and future activities				I: 4.7 (1.99 to 7.42) C: −0.1 (−3.23 to 2.95)			

I - intervention; C - control; MD - mean difference; CI - confidence interval; SD - standard deviation; OR – odds ratio; N.S- not statistically significant; WHOQOL- BREF – World Health Organisation Quality of Life Brief version; WHOQOL- OLD – World Health Organisation Quality of Life Older people; [a] SD; [b] OR

Table 4: Summary of findings on patient and staff satisfaction and experience with the intervention program according to type of setting

Study ID	Methods and sample size	Outcomes related to patient/staff/carer/family experience and/or satisfaction
(38)	Validated food enjoyment questionnaire (74) I: 50, C: 50	Intervention group improved their food enjoyment over time more than control group Intervention group showed significant improvements for food enjoyment relative to controls
(44)	Satisfaction questionnaire; no information whether it was validated I: 29 No control	**Participating clients**: 100% satisfied with their relationships with the nutrition volunteers 83% felt volunteers were knowledgeable about nutrition 86% felt they had provided useful information 86% very satisfied with the length of contact 90% appreciated nutrition volunteers arranging services for them All felt intervention was worthwhile service (one exception) **Case managers**: 71% felt their clientele could benefit from intervention 73% felt the older adult nutrition volunteers were well suited to carry out nutrition screening 91% felt they were well suited to deliver nutrition education 1/3 believed nutrition volunteers should develop intervention plans 83% were satisfied with how the intervention was implemented 72% felt intervention could be integrated into their ongoing practice
(48)	Not reported	**Nursing staff report:** improved patient care and felt supported to maintain protected mealtimes, record food intake and had a greater awareness of nutritional care
(49)	236 observations	Volunteers spent average of 47.8 minutes per patient
(22)	Semi-structured interviews by 1 researcher; purposive sample of 8 patients, 7 staff members, 9 volunteers	**Patients and staff**: universally valued the volunteers and felt they were skilled at encouraging reluctant eaters
(43)	Observations of mealtime environments, patient interviews, nurse and volunteer surveys I: 23, C: 23	**Patient interviews**: found volunteers ''encouraging'' ''wonderful'' ''helpful'' **Nurses**: all were positive about the program and considered it to be effective, helpful and essential **Volunteers:** spent an average of 12.3 minutes per patient compared to 4.7 minutes by nurses
(51)*	Interviews and focus groups; 12 volunteers, 9 patients, 17 nursing staff	**Nursing staff**: felt the service ''runs more smoothly. Because we've got more support from the mealtime assistant, we can do a lot more'' **Patients and ward staff**: valued the volunteer contribution **Patients**: felt the intervention was ''very good'' found the volunteers helpful and expressed that regular volunteers present the opportunity to develop ''good relationship''
(46)	Patient, family and staff experience; method not reported I: 34, C: 34	**Nursing staff, patients, and family members**: expressed much satisfaction and appreciation of the service Improved intake was influenced by both the knowledge and sensitivity of caring volunteers Volunteers applied specific dysphagia related knowledge learnt during training

(50)	Patient and nursing staff experience; method and sample size not reported	**Nurses:** Gave positive feedback about mealtime volunteers. Several wards with more experienced volunteers have expanded their roles, for example, they now write out menu cards, including those with dietary requirements. Nurses have found they are not required to assist at all with menu selections when the volunteers are in. Mealtime volunteers help with the quick, efficient delivery of meals, freeing up time so the nursing team can assist those in need physical or verbal encouragement to eat. **Patients:** Main benefit of mealtime volunteers was the chance to "have a chat". The volunteer was someone who was there to help them at mealtimes but, because they were not in uniform, they were seen as being less busy than the nurses. Longer-stay patients looked forward to the days when the mealtime volunteers came in. One patient said she not only looked forward to them coming in, but also that their presence helped her try harder to eat more to get well.
(45)	Overt observations of main meal with volunteers, patients and staff; Patients were asked about their mid meal intakes and appetite; 13 nurses and 10 volunteers surveys	**Nurses**: all reported the volunteer feeding assistance program to be of value on the ward 54% of them expressed concern about a lack of time or staffing resources at meal times and a desire for the volunteer program to be extended to other meals Volunteers more likely to socialise, encourage and spend longer with patients
(52)	Mealtime observations; 61 staff, volunteers and visitors interviewed in 75 ethnographic and semi-structured interviews; data inductively and thematically analysed	Key theme related to volunteers: 'Help' – volunteers and visitors were considered helpful **Nurses**: volunteers assisted at mealtimes by helping patients, supervising those eating their meal in the dining room, proactive when working with foodservice staff, assisting with communication by updating communication boards in patient rooms
(41)*	Semi-structured interviews and focus groups in baseline and intervention years; purposively sampled 19 nursing staff, 25 patients, 5 relatives, 12 volunteers; data collected by one researcher, digitally recorded and thematically analysed	Before the intervention: **Staff**: felt under pressure with insufficient people assisting at mealtimes After volunteers were introduced: **Staff and patients**: volunteers improve quality of mealtime care, viewed as extra pairs of hands to support patients needing more straightforward help, enabling nurses to feed patients with swallowing difficulties and be available for other care

*Partly same cohort from the same study

Table 5 : Summary of findings for the main outcomes

Outcome	Participants (number of studies)	Quality of evidence (GRADE)	Volunteer intervention Vs usual care, MD (95% CI)
Functional outcomes Overall Physical Performance (score)	80 (1)	++ Low quality[1,2]	**Favoured volunteer intervention** 1.0 (0.0 to 2.0)
Balance (score)	80 (1)	++ Low quality[1,2]	1.0 (−0.5 to 0.4)
Gait speed (score)	80 (1)	++ Low quality[1,2]	0.2 (-0.2 to 0.7)
Lower limb muscle strength (score)	80 (1)	++ Low quality[1,2]	**Favoured volunteer intervention** 0.6 (0.2 to 1.1)
Physical activity	80 (1)	++ Low quality[1,2]	**Favoured volunteer intervention** 15.20 (5.76 to 24.64)
Fear of falling	80 (1)	++ Low quality[1,2]	**Favoured volunteer intervention** 4.10 (1.79 to 6.41)
Handgrip strength	80 (1)	++ Low quality[1,2]	1.3 (−0.3 to 2.9)
Frailty	80 (1)	++ Low quality[1,2]	-0.30 (-0.75 to 0.15)
Self-efficacy	100 (1)	+ Very low quality[1,2,3]	Not estimable
Overall QoL	80 (1)	++ Low quality[1,2]	3.16 (−2.59 to 8.91)
Patient satisfaction	129 (2)	+ Very low[1,3]	One study reported a significant effect of volunteers on subjects' food enjoyment using a validated questionnaire. The other study did not assess statistical significance, and did not specify whether the questionnaire used was validated but noted satisfaction rate of >80% for most items
Patient experience	Not specified (9)	+ Very low[3]	All studies reported a positive experience but most were at high or unclear risk of bias
Nutritional Intake **Total energy**	56 (4)	+ Very low[1,3]	870.93 [-269.92, 2011.79]
Lunchtime energy	40 (3)	+ Very low[1,3]	Favoured volunteer intervention 378.15 [20.57 to 735.72]
Nutritional status			
BMI (Kg/m^2)	30 (1)	+ Very low[1,3,4]	Not estimable
Mid arm circumference	7 (1)	+ Very low[1,3,4]	Not estimable

Lean body mass	80 (1)	++ Low[1,2]	-0.4 (-1.7 to 1.0)
Skeletal muscle mass	80 (1)	++ Low[1,2]	0.1 (-0.5 to 0.6)
Malnutrition score	80 (1)	++ Low[1,2]	0.27 (1.13 to 1.67)
Malnutrition prevalence	57 (1)	++ Low[1,2]	1.26 (0.57 to 2.76)
Inflammatory markers **TNF-α** **IL-6** **Total leukocytes** **CRP**	57 (1)	Very low[1,2,5]	Not estimable
Cost	236 observations (1 evaluation project) Number not specified (1 feasibility study)	+ Very low[3]	One study noted cost savings but did not take into account cost of training. The other study reported cost saving and took training and admin costs into account but did not undertake a cost-effectiveness analysis.
Patient safety	188 (4), Not specified (1 evaluation project: 236 observations)	+ Very low[3]	None of the studies reported adverse events related to volunteers.

Abbreviations**: MD - Mean difference; CI - confidence interval; QoL - quality of life; BMI - body mass index; TNF-α - tumour necrosis factor-α; IL-6 - interleukin 6; CRP - C-reactive protein**

Grade (Grading of Recommendations Assessment, Development and Evaluation) Working Group grades of evidence (29)

High Quality**: Further research is very unlikely to change our confidence in the estimate of effects**

Moderate quality**: Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate**

Low Quality**: Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate**

Very low quality**: We are very uncertain about the estimate**

1 - Small number of studies with small sample sizes

2 - indirectness due to use of convenience sample in RCT

3 - evidence mainly from studies with unclear or high risk of bias for several domains

4 - design and methodological limitations (no/poorly matched control)

5 - inconsistency

Figure 1: Study selection process

Figure 2: Risk of bias summary table: Judgements of review on study quality based on Cochrane Collaboration's Risk of bias tool, ROBINS-I and CASP checklist.
Key: + low risk; - high risk; ? unclear risk of bias (Review Manager v5.3)

Figure 1: Meta-analysis of the effects of volunteer mealtime assistance on mean total energy (KJ) and mean lunchtime energy (KJ) intakes among hospitalised patients