

Effect of nutrition care provided by primary health professionals on adults' dietary behaviours: a systematic review

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1 **TITLE PAGE**

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11
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19
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21 disease.

22 **Effect of nutrition care provided by primary health professionals on adults' dietary**
23 **behaviours: A systematic review.**

24

25 **Abstract**

26 **Background:** 'Nutrition care' refers to any practice conducted by a health professional to
27 support a patient to improve their dietary behaviours. Better understanding about the
28 effectiveness of nutrition care is required to identify ways to enhance success of future
29 interventions.

30 **Objective:** Systematically review literature that investigated the effect of nutrition care
31 provided by primary health professionals on adult patients' dietary behaviours.

32 **Methods:** The systematic review included all studies published between January 2000 and
33 January 2015 that involved nutrition care by one or more primary health professionals to
34 adult patients, and incorporated at least one quantified food-related outcome measure (e.g.
35 daily intake of vegetables in grams, weekly servings of lean meats). After data extraction, the
36 methodological quality of each study was appraised using the Mixed Methods Appraisal
37 Tool.

38 **Results:** Twenty one studies, totaling 12497 participants were included. The design,
39 intensity, theoretical underpinning and follow-up period of interventions were diverse.
40 Twelve studies found significant improvements in participants' dietary behaviours, such as
41 increased daily consumption of fruit, vegetables, high-fibre bread and fish. However, seven
42 studies did not identify any improvement in dietary behaviours; one observed equal
43 improvements amongst participants in the intervention and control groups; and one found a
44 reduction in participants' daily fruit and vegetable intake.

45 **Conclusion:** Interventions involving nutrition care provided by primary health professionals
46 have the potential to improve patients' dietary behaviours. However, the consistency and

47 clinical significance of intervention outcomes are unclear. Further consideration of factors
48 that may influence the effectiveness of interventions, but not traditionally measured, are
49 required.

50 **Introduction**

51 Poor dietary behaviours contribute significantly to the prevalence of lifestyle-related chronic
52 diseases (1, 2). Despite the existence of evidence-based guidelines for healthy eating (3), it is
53 estimated that most (93%) adults have poor dietary behaviours (4). As a result, the promotion
54 of healthy dietary behaviours is a priority for primary health care, and a key component of
55 best-practice guidelines for primary health professionals (5, 6). Improvements in dietary
56 behaviours based on foods and food groups (such as increased fresh fruit, vegetables,
57 wholegrains and decreased meat) show more consistent and convincing associations with
58 reduced risk of chronic disease, compared with improvements based on single nutrients (such
59 as decreased saturated fat, cholesterol, or increased fibre) (7). Therefore, the promotion of
60 healthy dietary behaviours by primary health professionals should focus on changes in dietary
61 behaviours based on foods and food groups.

62

63 ‘Nutrition care’ refers to any practice conducted by a health professional to support a patient
64 to improve their dietary behaviours and subsequent biomarkers of chronic disease (8).
65 Nutrition care may include any aspect of nutrition assessment, nutrition advice, nutrition
66 counseling, as well as referral to other nutrition-focused health professionals and relevant
67 services (8). Many primary health professionals (including General Practitioners (GPs),
68 Nurses, Dietitians and Exercise Professionals) provide nutrition care to patients (9, 10). The
69 delivery of nutrition care is diverse in terms of counseling style and content, and is generally
70 considered to be less frequent than ideal (11). However, these professionals also report
71 considerable challenges in providing nutrition care, such as lack of time, knowledge and low
72 self-efficacy (12-14).

73

74 Numerous primary health chronic disease interventions have utilised nutrition care in order
75 to support patients to have healthy dietary behaviours. Generally, these interventions show
76 promising, but only modest outcomes on biomarkers such as weight, waist circumference,
77 and glycaemic control (15, 16). Some interventions report the actual change in dietary
78 behaviours of participants as a secondary outcome measure (17-19), but rarely is this
79 considered a possible reason for modest outcomes in biomarkers for chronic disease. As a
80 result, further investigation of the effectiveness of nutrition care provided by primary health
81 professionals is required to identify possible ways to enhance future intervention success.

82

83 Two systematic reviews have investigated the effectiveness of interventions aimed at
84 improving patients' dietary behaviours. In 2011, Greaves at al., identified intervention
85 components associated with improved dietary behaviours and/or physical activity in
86 individuals at risk of type 2 diabetes (20). Their review found that a wide range of health
87 professionals including GPs, Nurses, Dietitians, Nutritionists, and Exercise Professionals
88 could deliver effective interventions for improving dietary behaviours and/or physical
89 activity. However, the review was broad and did not describe or critically review individual
90 studies, limiting the ability to utilise the studies to inform future work. In 2013, Bhattarai et
91 al., reviewed the effectiveness of interventions conducted in the primary health care setting
92 at improving participants' dietary behaviours (21). Their review of ten studies found small
93 changes in dietary behaviours. However, the review was limited to Randomised Controlled
94 Trials (RCTs) with individuals who did not currently have a chronic disease, and it mostly
95 focused on patients' intake of nutrients (fat, fibre and cholesterol), rather than on foods
96 and/or food groups. Finally, not all studies involved the provision of nutrition care (e.g. the
97 review included postal newsletters and computer-generated interventions that did not involve
98 a health professional).

100 In order to advance understanding on the effectiveness of nutrition care by primary health
101 professionals, there is a need to better understand the expected food-related dietary outcomes
102 of relevant previous interventions. This understanding will help identify the nature of
103 interventions that have been previously conducted, the extent that the interventions have
104 resulted in improvements in patients' food-related dietary behaviours, and the potential
105 factors that contribute to positive outcomes in these interventions. The information can be
106 used to directly inform future interventions designed to promote effective nutrition care by
107 primary health professionals. Therefore, this study synthesised previous literature by
108 undertaking a systematic review of studies that aimed to improve adult patients' food-related
109 dietary behaviours through the provision of nutrition care by primary health professionals.

110

111 **Methods**

112 A systematic review was conducted to identify and critically review studies that aimed to
113 improve adult patients' food-related dietary behaviours through the provision of nutrition
114 care by primary health professionals. All applicable items from the PRISMA guidelines for
115 reporting of systematic reviews were included (22).

116

117 *Search Strategy*

118 A literature search was conducted in January 2015 using ScienceDirect, ProQuest Family
119 Health, Web of Science, Scopus, PubMed Central, MEDLINE®, CINAHL, and Cochrane
120 databases. All studies published from the year 2000 with at least one search term from the
121 following two categories in the title or abstract were included for consideration.

122 - *For nutrition care:* Nutrition Care OR Nutrition Advice OR Nutrition Therapy (MeSH)
123 OR Diet (MeSH) OR Dietary Behaviours OR Diet Therapy (MeSH) Or Food Habits

124 (MeSH).
125 - *For primary health care:* Primary Care (MeSH) OR Primary Health Care (MeSH) OR
126 General Practice (MeSH) OR General Practitioners (MeSH) OR Family Practice (MeSH)
127 OR Primary Care Physicians OR Allied Health Personnel (MeSH)

128 No limit was applied to the intervention design or length of study. Cross-matching reference
129 lists and forward citation searching was conducted in order to identify additional studies for
130 consideration. A health-focused librarian provided support during the search process to
131 further enhance search quality.

132

133 *Study Selection*

134 The study selection process is illustrated in Figure 1. Interventions that involved the provision
135 of nutrition care exclusively by one or more primary health professionals in order to support
136 adult patients (aged ≥ 18 years) to improve their dietary behaviours were included in the
137 review. A primary health professional was defined as a health professional who usually
138 provided a first point of contact in a health care system, and included GPs, Nurses, Dietitians,
139 Nutritionists, Exercise Professionals and their assistants (23). Nutrition care was defined as
140 any practice conducted to support a patient to improve their dietary behaviours, and could
141 include components of nutrition assessment, nutrition advice, and nutrition counseling as well
142 as referral to other nutrition-focused health professionals and relevant services (8). Studies
143 that did not include at least one quantified food-related outcome measure (e.g. daily intake of
144 vegetables in grams, weekly servings of lean meats) and determine its change over time were
145 excluded.

146

147 *Data Extraction*

148 Articles for inclusion were selected independently by two researchers (LB & SC) using the
149 same search strategy. Differences in selections were discussed prior to reaching final
150 consensus. After careful review of each manuscript, information regarding study design,
151 recruitment, participants, intervention and its theoretical underpinning, health professional
152 training, relevant outcome measures and results were extracted by LB into two tables (Tables
153 1 and 2), and cross-checked by SC.

154

155 *Quality Assessment*

156 The methodological quality of each study was appraised by LB and SC using the Mixed
157 Methods Appraisal Tool (MMAT), and differences in scores were discussed prior to reaching
158 final consensus (24). The MMAT is designed for systematic reviews that include quantitative,
159 mixed methods and qualitative studies, and has proven content-validity and reliability (24).
160 The MMAT quality assessment process involves answering four questions that are
161 appropriate to the study design regarding recruitment, randomisation (if applicable),
162 appropriateness of outcome measures and attrition rate/completeness of data. Studies were
163 scored as: - (0% of quality criteria met); * (25% of quality criteria met); ** (50% of quality
164 criteria met); *** (75% of quality criteria met); or **** (100% of quality criteria met), and
165 are displayed in Table 2.

166

167 **Results**

168 The initial database search identified 3375 publications for consideration, of which 21 studies
169 (from 23 publications) were selected for inclusion (25-47). The reasons for excluding
170 publications fell within four criteria, as outlined in Figure 1. After excluding articles that did
171 not involve nutrition care provided by a primary health professional (such as mailed
172 pamphlets (48), nutrition care provided by student counsellors (49)), the most common

173 reason for excluding articles was that they did not include a quantified food-related outcome
174 measure. For example, some studies were excluded because they reported on the change in
175 proportion of patients following a healthy diet (50, 51), or the number of participants who
176 reported to be following a healthy diet (52, 53), but did not present a quantified outcome
177 measure (e.g. daily intake of vegetables in grams, weekly servings of lean meats). For one
178 study, two intervention arms met the inclusion criteria, and the third intervention arm did not
179 involve nutrition care provided by a primary health professional (27). Therefore, the two
180 applicable arms were included in the review.

181

182 The characteristics of the 21 studies included in the review are outlined in Table 1. Most
183 studies were conducted in UK/Europe (n=14, 67%) (25, 28, 30, 32, 35, 37-41, 43, 44, 46, 47),
184 with fewer from Australia/New Zealand (n=3, 14%) (31, 34, 36), USA (n=3, 14%) (27, 42,
185 45) and Asia (n=1, 5%) (26). Most studies were RCTs (n=13, 62%) (27, 28, 30, 32, 39-47),
186 with fewer Cluster-RCTs (n=5, 24%) (26, 30, 35, 37, 38), and longitudinal pretest-posttest
187 studies (n=3, 14%) (25, 34, 36). A total of 12,497 (median n=326) individuals participated in
188 the studies, and were usually recruited by letters sent to participants on clinic records or via
189 verbal invitation when attending a clinic. Fourteen studies included both men and women
190 (25-28, 30-32, 35, 36, 39, 40, 43, 44, 47), five included women only (34, 37, 38, 42, 45), and
191 two included men only (41, 46). Nearly all studies recruited individuals with at least one risk
192 factor for chronic disease, but without diagnosis of a chronic disease such as Type 2 diabetes.

193

194 A description of the interventions tested is outlined in Table 2. Most interventions involved
195 multiple consultations (usually four or fewer) over the intervention period (n=18, 86%) (26-
196 28, 30-32, 34-38, 40, 42-47), although three (14%) involved a ‘once-off’ intervention within
197 a single consultation (25, 39, 41). Interventions were delivered by a range of primary health

198 professionals including multidisciplinary teams (n=6, 29%) (25, 28, 30-32, 36), Nurses (n=8,
199 38%) (34, 35, 37, 38, 40, 42-44), Dietitians (n=3, 14%) (26, 41, 46), GPs (n=2, 10%) (27,
200 39), or a Health Counsellor (n=1, 5%) (45). Nine studies (43%) used empirical guidelines to
201 inform the nutrition care such as best-practice guidelines or national dietary guidelines (26,
202 27, 30-32, 37-39, 47), nine (43%) were underpinning by theory, such as Motivational
203 Interviewing and behaviour change theories such as Stages of Change(28, 34-36, 42-45, 47),
204 whereas four (19%) did not report the use of any evidence to inform their intervention (25,
205 40, 41, 46).

206

207 All studies included a food outcome measure related to fruit and/or vegetable consumption,
208 with three also investigating fish intake, three also investigating breads/cereal and dairy
209 intake and one also investigating alcoholic beverage consumption. Eleven studies measured
210 food intake through a general questionnaire, eight utilised a food frequency questionnaire,
211 one utilised a food diary and one utilised a dietary recall. Approximately half of the studies
212 included a follow-up period of between three months and five years after the intervention
213 ceased (n=11, 53%) (25, 30, 31, 34-36, 39-41, 44-46), whereas half did not follow-up
214 participants after the intervention ceased (n=10, 47%) (26-28, 32, 35, 37, 38, 42, 43, 47).
215 None of the studies compared the food outcome measure to clinically meaningful changes,
216 such as minimum consumption associated with reduced chronic disease risk (2).

217

218 Twelve of the studies observed significant improvements in participants' dietary behaviours.
219 Examples of improvements include an increase in daily vegetable intake of 25.5g (26), an
220 increase in daily fruit and vegetable intake of 0.8 serves (37), an increase in proportion of
221 high-fibre bread consumed (38), and an increase in daily fish intake of 8.3g (41). However,
222 seven studies did not observe any improvement in dietary behaviours of participants (25, 27,

223 28, 30, 35, 36, 42) after the intervention, one study observed equal improvements in fruit and
224 vegetable intake amongst participants in the intervention and control groups (32) and one
225 study observed a reduction in participants' daily fruit and vegetable intake of 70g (40) after
226 the intervention.

227

228 The quality attributes of each study are displayed in Table 2. Two studies received a rating of
229 - (41, 42), two received a rating of * (30, 37), ten received a rating of ** (25, 27, 28, 32, 34,
230 38, 44-47), three received a rating of *** (35, 36, 43), and four received the highest possible
231 rating of **** (26, 31, 39, 40). For the longitudinal pretest-posttest studies, the most common
232 reason for a lower methodological quality score was a considerable opportunity for selection
233 bias when recruiting participants. Similarly for randomised trials, the most common reason
234 for a lower methodological quality score was a lack of clear description of randomisation of
235 participants. Due to the nature of some interventions, it was not possible to conceal
236 participants' allocation from primary health professionals, which also reduced the
237 methodological quality score.

238

239 **Discussion**

240 This systematic review investigated the effectiveness of nutrition care provided by primary
241 health professionals at improving patients' dietary behaviours. Significant improvements in
242 dietary behaviours were observed in around half of the studies. The results suggest that there
243 is a potential to for primary health professionals to facilitate improvements in patients'
244 dietary behaviours. However, the inconsistency in findings suggests that the effectiveness of
245 interventions may be dependent on factors such as the theoretical underpinning, delivery,
246 intensity and content of nutrition care.

247

248 Significant improvements in patients' dietary behaviours were apparent in interventions with
249 diverse designs, intensity, theoretical underpinning and follow-up periods. This suggests that
250 it is possible to elicit positive improvements in patients' dietary behaviours with different
251 interventions. For example, improvements were seen in interventions with nutrition care
252 provided by a range of primary health professionals (mostly a combination of GPs (39),
253 Nurses (34, 37) and Dietitians (26, 31)), a range of intensities (mostly four or fewer
254 consultations (26, 43-46)), and a range of designs (including individual (44, 46), group (34,
255 47) and phone consultations (43, 45)). Notably, despite statistical improvements in measures
256 of dietary behaviour, the clinical significance of the improvements was not considered in any
257 study. Therefore, it is unclear whether the improvements in dietary behaviours were sufficient
258 to result in an improvement in health outcomes associated with chronic disease, and future
259 interventions are recommended to include measures of dietary behaviours as well as
260 biomarkers of chronic disease.

261

262 Interventions that are informed by theory are recognised as more likely to elicit positive
263 outcomes (54), including dietary behaviours (55). Four studies did not report the use of any
264 theory or other empirical evidence to inform their intervention (25, 40, 41, 46). Of these
265 studies, one observed an improvement in patients' dietary behaviours (46), two did not
266 observe any change in patients' dietary behaviours (25, 41), and one observed a reduction in
267 the quality of patients' dietary behaviours (40). It is possible that a lack of theory may
268 indicate a less rigorous approach to planning and development of the intervention, and may
269 explain the absence of consistent improvements in food-related outcome measures. Studies
270 that utilised theory to develop their intervention observed success with approaches such as
271 Stages of Change (56), Motivational Interviewing (57), and Social Learning Theory (58).
272 These theoretical underpinnings predominantly stem from counselling and psychological

273 disciplines to inform behaviour change techniques, and have been utilised in many primary
274 care interventions, with varying effectiveness (59). Importantly, other theories such as those
275 used for knowledge translation suggest that a wide range of approaches may facilitate
276 behaviour change (60), and warrant consideration in future interventions.

277

278 The studies with the largest sample sizes (>500 total participants) tended to utilise existing
279 patient databases to identify and invite potential participants (28, 42, 45), or expand the
280 recruitment over numerous general practice clinics (>30 clinics) (31, 39). This approach
281 appears more feasible than opportunistic recruitment through clinic attendance (37, 38), and
282 should be considered based on target sample sizes in future interventions. Similarly, the
283 studies with the highest retention rates (92% at 12 months after intervention) tended to
284 incorporate nutrition care as part of usual care and then measure the outcomes (31), and this
285 is likely to have a low burden on patients. However, other studies with interventions that
286 were independent to usual care were still able to observe high retention rates during follow-
287 up (>80%), showing that interventions with moderate intensity (four or fewer consultations)
288 are tolerated by patients (26, 43-46).

289

290 The methodological quality of the reviewed interventions requires consideration.
291 Interestingly, the only study to report a reduction in the quality of patients' dietary behaviours
292 achieved the maximum quality rating possible (40), and two studies with extremely low
293 methodological quality observed some improvements in patients' dietary behaviours (37, 41).
294 This suggests that although the methodological quality of future interventions could be
295 strengthened compared to existing studies, the success of interventions requires consideration
296 of factors beyond methodological quality. Some of these factors may include the delivery,
297 content and intensity of nutrition care.

298

299 Intervention components beyond the delivery, content and intensity of nutrition care have the
300 potential to influence the effectiveness of intervention outcomes. For example, nearly all of
301 the studies utilised an RCT or cluster-RCT design, which likely prevents the tailoring of
302 nutrition care to patients' needs or preferences. Furthermore, the authors of one study that did
303 not observe any difference in dietary behaviour change between participants in the
304 intervention and control groups suggested that the Nurses who provided nutrition care were
305 very eager, to the extent that the study may have been contaminated because there may not
306 have been considerable differences between the care provided to the two groups (35). In
307 addition, factors such as patients' satisfaction, expectations and broader perceptions of health
308 care experiences have been identified as having an influence on patients' self-efficacy,
309 lifestyle behaviours, and ultimately health outcomes (61, 62). Therefore, future interventions
310 should consider broader indicators of success, including positive health care experiences and
311 improved self-efficacy towards improved dietary behaviours.

312

313 A notable limitation to the reviewed studies is the variation in measures of dietary
314 behaviours. Over half of the studies utilised a general questionnaire to assess dietary
315 behaviours, with the remainder using a food frequency questionnaire, food diary, or dietary
316 recall. Importantly, there is no recognised gold-standard approach to assessing dietary
317 behaviours, and each approach used in the reviewed studies has inherent strengths and
318 limitations. One valid approach used within large population nutrition surveys is the
319 Automated Multiple-Pass Method for a 24-hour dietary recalls (63), which requires
320 significant time and equipment resources for data collection and analysis, and may not be
321 feasible for many studies. Furthermore, the most appropriate component of dietary behaviour
322 that relates to risk of chronic disease is not well recognised. Whilst associations between fruit

323 and vegetable intake and many conditions such as cardiovascular disease (64, 65), Type 2
324 Diabetes (66, 67) and overweight/obesity are strong (68-70); associations between other
325 foods and food groups such as cereals, meat and fish are less clear (69-71). This suggests that
326 while fruit and vegetables are appropriate indicators of dietary behaviour for risk of chronic
327 disease, other indicators are less clear and warrant caution prior to use.

328

329 This review suggests that nutrition care provided by primary health professionals has the
330 potential to improve patients' dietary behaviours. It appears that successful outcomes are
331 possible with a range of intervention approaches. However, the consistency and clinical
332 significance of outcomes are unclear, and further consideration of factors that may influence
333 the effectiveness of interventions are required. Researchers developing future interventions
334 are encouraged to utilise theory to inform the intervention, include a moderate intensity
335 intervention, consider the validity of the food-related outcome measure and feasibility of
336 recruitment approaches, and consider other factors that may influence outcomes such as
337 patients' perceptions of their health care experience.

338

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