

29 **ABSTRACT**

30 *Objective.* To systematically review the effectiveness of intervention studies promoting diet
31 and physical activity (PA) in nurses.

32 *Data source.* English language manuscripts published between 1970 and 2014 in PubMed,
33 Scopus and CINAHL, EMBASE and PICO tool.

34 *Study Inclusion and Exclusion Criteria.* Inclusion criteria (1) nurses/student nurses working in
35 a health care setting; (2) Interventions where PA and/or diet behaviours were the primary
36 outcome. Exclusion criteria (1) non-peer reviewed articles or conference abstracts; (2)
37 interventions focused on treatment of chronic conditions or lifestyle factors other than PA or
38 diet in nurses.

39 *Data Extraction.* **Seventy-one** full-texts were retrieved and assessed for inclusion by two
40 reviewers. Data was extracted by one reviewer and checked for accuracy by a second
41 reviewer.

42 *Data synthesis.* Extracted data was synthesised in a tabular format and narrative summary.

43 *Results.* Nine (**n=737 nurses**) studies met the inclusion criteria. Quality of the studies was low
44 to moderate. Four studies reported an increase in self-reported PA, through structured exercise
45 and goal-setting. Dietary outcomes were generally positive, but were only measured in three
46 studies with some limitations in the assessment methods. Two studies reported improved
47 body composition without significant changes in diet or PA.

48 *Conclusions.* Outcomes of interventions to change nurses' PA and diet behaviour are
49 promising, but inconsistent. Additional and higher quality interventions that include objective
50 and validated outcome measures and appropriate process evaluation are required.

51 **KEYWORDS.** Systematic review, Health promotion, Workplace, **Nutrition, Physical**
52 **Activity.**

53 **INDEXING WORDS:** Manuscript format: literature review; Research purpose: descriptive;

54 Study design: Systematic review; Outcome measure: behavioral; Setting: workplace; Health
55 focus: physical activity, nutrition. Strategy: behaviour change; Target population: adult
56 nurses; Target population circumstances: all education levels, all income levels, all locations,
57 all races/ethnicities.

58

59 **OBJECTIVE**

60 The majority of the adult population is in the workforce, with individuals spending more than
61 a third of their waking hours at work. Both the workplace and job characteristics have a
62 significant impact on an individual's lifestyle.¹ Nursing is an occupation where overtime,
63 irregular shifts, and stress, both physical and emotional, are common. An Australian cross-
64 sectional study reported that 60% of nurses are overweight and obese,² which is higher than
65 the 55% reported for the Australian female population.³ Although nursing seems to be an
66 occupation that includes frequent walking bouts, almost 50% of nurses reported low physical
67 activity levels,⁴⁻⁸ with occupational energy expenditure negatively associated with leisure
68 time physical activity and meeting physical activity guidelines.^{9,10} Other unhealthy behaviours
69 associated with this job include emotional eating, irregular meals, and frequent high-energy
70 snacking.^{4,11-13} Physical activity and diet play a major role in obesity development and the
71 onset of non-communicable disease. These behavioural factors are strong independent
72 predictors of all-cause mortality,^{14,15} and are key targets of interventions designed to prevent
73 chronic disease.¹⁶⁻¹⁸

74

75 Diet and physical activity promotion at the workplace has gained popularity in recent years,
76 because of the potential to reach large numbers of adults.¹ Workplace interventions in hospital
77 settings have effectively improved physical activity levels, BMI and dietary patterns.^{8,19-25}
78 Employees included in those interventions, such as technical staff, allied health,

79 administrative, are different from nurses whose shifts are usually longer and more irregular
80 due to the 24-h patient care service.²⁶ Nurses' working environment is also different, as it has
81 been described as particularly hostile and unsupportive.²⁷ Therefore, nurses' job may impact
82 their availability and time to engage with health promotion programs, together with lack of
83 motivation for self-care, as suggested by an online survey.²⁸ Previous studies in hospital
84 settings have not provided a nurse sub-group analysis, therefore the extent of nurse
85 participation and benefits from diet and physical activity intervention is not well understood.

86
87 A 2012 systematic review of interventions aimed to improve a variety of health behaviours in
88 nurses (e.g. smoking, alcohol intake, diet and physical activity) found just three studies.²⁹
89 However, only one study aimed to improve physical activity and the other two targeted
90 smoking cessation.

91
92 The aim of this systematic review was to assess the effectiveness of any workplace
93 intervention studies specifically promoting diet and/or physical activity behaviour in nurses.

94

95 **METHODS**

96 Data sources

97 This systematic review was performed according to the PRISMA statement (Preferred
98 Reported Items for Systematic Reviews and Meta-Analyses) guidelines.³⁰ Relevant studies
99 were identified through a comprehensive search, using four electronic databases (PubMed,
100 Scopus, CINAHL, and EMBASE). PICO tool (PubMed-NIH) and snowball search from
101 relevant papers were also used. Databases were searched from the earliest time point until
102 October 2014 using a combination of key words related to population and limited to English
103 language (e.g. 'Nurs*', 'Health care', 'health care worker'), settings (e.g. 'Workplace',

104 'Worksite', 'Hospital'), type of study (e.g. 'Lifestyle intervention', 'workplace intervention',
105 'intervention'), and intervention outcomes (e.g. 'Exercise', 'Physical Activity', 'Nutri*',
106 'Diet', 'lifestyle'). We used broad search terms in order to capture all relevant studies,
107 including any intervention design and publication year.

108

109 Inclusion and exclusion criteria

110 Studies were considered eligible for inclusion if they met the following criteria regarding
111 population, intervention, comparator, outcomes, and study design:

- 112 • Nurses or nursing students currently working in a health care setting
- 113 • Physical activity and/or nutrition intervention
- 114 • Any control condition (e.g. usual diet and physical activity) or no control (e.g. pre-
115 post test)
- 116 • Outcome measures of change in either diet and/or physical activity behaviour.
117 Secondary health outcomes such as BMI and weight were included in the review
118 where reported.
- 119 • Randomised or non-randomised controlled trials (cluster or individual), clinical
120 controlled trials, quasi-experimental, pilot studies or single group pre-post studies with
121 or without control group.

122

123 We excluded studies that were not published in a peer-reviewed journal, editorials, opinions,
124 and studies available only as conference abstracts. Papers were excluded if the intervention
125 was directed towards patients and led by nurses. Studies were also excluded if the main
126 purpose was to treat other conditions in nurses (e.g. musculoskeletal pain, burnout and stress,
127 anxiety, depression). Interventions that focused only on improving physical fitness and/or

128 with supervised exercise, as opposed to physical activity, or aimed to change other lifestyle
129 factors (e.g. limit alcohol intake and smoking), were also excluded.

130

131 **Data Extraction**

132 The study selection process followed three steps. First, one author (LT) reviewed all abstracts
133 and titles and excluded irrelevant studies, which was checked by the second reviewer (TP).
134 Secondly, full-text were retrieved for the papers selected in Step 1. All authors reviewed the
135 full papers for eligibility and decisions on inclusions were made by consensus. **Thirdly, two**
136 **studies met all inclusion criteria except they included a mix of nurses and other health**
137 **professionals. The authors** of these two manuscripts were contacted to ascertain study
138 population and availability of nurses' only data, leading to their inclusion.^{31,32} Third, one
139 author (LT) extracted data following a standardised data extraction form. This process was
140 checked by the other three authors (ML, TP, TKA). Data extracted included patient
141 characteristics (e.g. sex, age, marital status), intervention characteristics (e.g. duration,
142 delivery method), control group conditions, outcomes measures, and study quality. Study
143 design was classified as randomized controlled trial (RCT), quasi-experimental and quasi-
144 experimental pre-post test (no control group).

145

146 **Data synthesis**

147 Results were grouped in three different outcomes of interest to the aims of the study: Physical
148 activity, Diet and Body composition. **Characteristics of studies, interventions and participants**
149 **were summarised in tables.** Risk of bias and study quality was assessed using previously
150 published criteria relevant to controlled studies.^{33,34} Bias categories included 1) Random
151 sequence generation (selection bias), 2) Allocation concealment (selection bias), 3) Blinding
152 of outcome assessment (detection bias, patient-reported outcomes), 4) Baseline

153 characteristics, 5) Statistical power calculation, 6) Intention to treat analysis; 7) Missing data
154 reported (incomplete outcome data), and 8) Handling of missing data addressed (attrition
155 bias). All authors assessed study quality independently, agreeing on scores by consensus.

156

157 **RESULTS**

158 Search outcome

159 Our bibliographic search yielded 17,065 articles, from which 71 full-text manuscripts were
160 retrieved. After full review, 62 articles were excluded, mainly based on type of study or type
161 of outcomes (*see Figure 1*). Nine studies were identified as meeting the inclusion criteria.

162

163 Characteristics of the included studies

164 Characteristics of the included studies are summarised in Table 1. **Of** the nine studies, three
165 were RCT and six were quasi-experimental studies (including two pilot, two pre-post design)
166 with a total of 737 participants. Study settings were different across the interventions: three
167 were based at University's Health services and Hospital,^{32,35,36} two in nursing home/long term
168 care,^{37,38} one within 3 medical surgical units,³⁹ and three in general hospitals and health
169 centers.^{31,40,41}

170

171 The shortest interventions were one and two days,^{31,36} and the longest was 6 months.³⁷ Six
172 interventions were between 8 and 12 weeks in length.^{35,38-41} **Intervention strategies included**

173 individual-based exercise and self-monitoring of physical activity³⁹; education material and
174 individual planning to improve physical activity and diet³⁴; lectures and workshops about
175 physical activity and/or diet^{30,35,36}; on-site exercise sessions, toolkit and manipulation of
176 workplace with social reinforcement³⁸; and a nurse champion to deliver information, on-going
177 motivation and on-site exercise classes³⁷. All studies collected data at baseline, and

178 immediately after the intervention, with the exception of one study³⁵ where data was collected
179 two months after the intervention. Only three studies performed additional follow-up
180 measurements at six- and twelve-months.^{32,38,41} Characteristics of interventions are presented
181 in **Table 1**.

182

183 Inclusion and exclusion criteria varied across the studies; all studies included participants
184 older than 18 years, and currently working as a nurse or nursing aid. One study included nurse
185 managers only.⁴⁰ This study was included in the review because Furukawa et al.⁴⁰ reported
186 that these participants face similar barriers to healthy lifestyle as Registered Nurses, in
187 particular for physical activity. Only one study required participants have 1.5 years minimum
188 of work experience.³⁹ Two studies restricted the target population to workers from minority
189 groups, African American women,³⁸ and working mothers with children of 1-16 years old.³⁹
190 In the later, participants with chronic disease and current smokers were excluded. Pregnancy
191 was considered an exclusion factor by three studies.³⁸⁻⁴⁰

192

193 Characteristics of participants are summarised in **Table 1**. The participants' age ranged from
194 19-67 years. All the participants were female in five studies, and the female participants in the
195 remaining four studies ranged from 72-97%^{31,35-37}. The majority of participants were
196 Caucasians (range 79.6-100%).

197

198 Intervention outcomes are presented in **Table 1**. Outcome measures varied between
199 interventions and can be summarised into three key risk factors: physical activity, body
200 composition, and diet. All studies included physical activity behaviour outcomes, such as:
201 increasing number of daily steps, aerobic minutes, weekly exercise sessions and energy
202 expenditure. Body composition was investigated in six studies, using different outcomes such

203 as BMI, weight, fat/lean indexes and waist circumference.^{31,32,35,38,39,41} Only four studies
204 measured dietary outcomes using measures of fruit and vegetable intake, diet behaviour and
205 nutrition health promoting behaviour.^{31,35,36,38} Additionally, two studies mentioned nutritional
206 education classes as part of the intervention, but no information about the strategy or expected
207 outcomes was provided.^{37,41} Finally, two studies measured cardiovascular disease risk factors
208 including glucose metabolism, insulin, lipid profile and blood pressure.^{38,40}

209

210 Risk of bias and study quality

211 **Table 2** summarises the results of risk of bias and study quality. Only the RCTs generated a
212 random allocation sequence and detailed allocation concealment.^{35,37,40} Although outcome
213 blinding of participants and intervention staff is not always feasible for these types of studies,
214 Brox & Frøystein³⁷ blinded outcome researchers, and Luszczynska & Haynes³⁵ blinded
215 participants, where the the intervention was based on planning. The reporting of missing data
216 was detailed for most studies, and the handling of missing data for five out of nine studies.
217 Power analysis was reported for five of the nine studies, with intention to treat analysis only
218 reported for the RCT studies.^{35,37,40} All studies were similar at baseline. Overall the quality of
219 the RCT studies was good,^{35,37,40} the quality of the quasi-experimental studies was
220 low,^{31,36,39,40} and the quality of the pre-post studies was low to moderate.^{32,41}

221

222 Physical activity outcomes

223 Six studies reported significant intervention effects in either energy expenditure^{32,40} or
224 physical activity levels.^{36-38,41} Providing individual-based exercise plans and walking targets
225 significantly increased steps (+1795±1630 vs. +629±1372 steps/day), exercise energy
226 expenditure (+1.14±0.98 vs. +0.46±0.68 kcal/kg/d), and total energy expenditure (+2.3±2.2
227 vs. +0.9±1.3 kcal/kg/d) in the intervention group compared with the control condition.⁴⁰ Total

228 energy expenditure was significantly enhanced in the intervention group (Baseline:
229 805.07±112.52, 3-month: 2235.57±259.87, 6-month: 2014.57±267.27 kcal/week) by a step-up
230 jogging program specifically designed for inactive woman.³² Interactive lectures and 1h/week
231 of aerobic exercise classes significantly increased physical activity levels.^{36,37} However,
232 McElligott et al.³⁶ used the HPLP tool (Health Promoting Lifestyle Profile- identifies
233 behavioural outcomes assigning overall and subscale scores) to report changes in the physical
234 activity score. And Brox & Frøystein³⁷ assessed physical activity with self-report methods
235 without providing any p-values. Although reported to be significant changes, both studies
236 showed small effects.

237

238 Having a nurse champion and 3x10-min exercise breaks at work, only increased average
239 aerobic minutes at 12-wk (60 steps/min and walk for at least 10 consecutive min).⁴² This was
240 9.54±12.77 average daily minutes for the experimental group and 6.00±16.49 in the control
241 group.³⁸ Sitting behaviour was assessed in one study.⁴¹ Sitting time was significantly reduced
242 from 356.68±250.52 minutes/weekday at baseline, to 286.60±193.90 minutes/weekday at the
243 end of the program (8-wk), to 249.19±166.51 at 6-month follow up, for nurses participating in
244 a pedometer challenge and a website where they could monitor their physical activity. The
245 remaining studies did not find any significant changes in the measured outcomes, including
246 steps, MET/minutes of physical activity and physical activity levels.^{31,35,38,39}

247

248 Overall, findings indicate that only half of the interventions showed significant changes in
249 physical activity outcomes. These included steps, physical activity daily minutes, energy
250 expenditure and sitting time.^{32,38,40,41}

251

252 Diet outcomes

253 Although dietary behaviour and nutrition was targeted in six studies, only four assessed
254 changes and they all used different outcome measures.^{31,35,36,38} Luszczynska and Haynes³⁵
255 reported a higher fruit and vegetable intake in the experimental group (2.65 ± 0.99
256 portions/day) compared to the control group (2.41 ± 0.84 portions/day). They provided
257 educational materials and encouraged participants to make their own plan to increase fruit and
258 vegetable intake. Seemingly, McElligott et al.³⁶ asked nurses to design a self-care plan
259 strategy to improve their diet. The Health Promoting Lifestyle Profile tool (HPLP) was used
260 to assess health-promoting behaviours towards nutrition, with experimental scores increasing
261 significantly at post-test (Experimental group score: 2.33 ± 0.64 , control group: 2.25 ± 0.76).
262 Group education lectures achieved a significant increase of Diet Outcomes Expectations
263 scores in the experimental group (9.71 ± 0.76) compared to the control group (7.17 ± 3.82).³⁸
264 Finally, in the fourth study, the frequency of avoiding saturated fat intake (1-10 scale)
265 increased in the control group rather than the intervention group (6.7 ± 12 vs 5.6 ± 8.4 ,
266 respectively).³¹

267
268 Despite some of the interventions providing diet and nutrition education, they did not perform
269 pre and post intervention measurements.^{31,37,41} These interventions included nutrition and
270 stress management classes,³⁷ lectures and activities promoting healthy food choices,³¹ and 1-h
271 lunch lectures together with fruit and vegetable intake self-monitoring on program's
272 website.⁴¹

273

274 Body composition

275 Six studies assessed different body composition parameters as secondary
276 outcomes,^{31,32,35,38,39,41} but only two found significant changes.^{35,39} Tucker et al.³⁹ reported

277 significant changes between intervention and control groups in fat index (-0.23 vs -0.04
278 Kg/m²), fat mass (-0.60 vs -0.09 Kg), median fat mass (-1.06 vs +0.04 %), and median lean
279 mass (+1.05 vs - 0.05%), respectively. The second study only found changes in BMI when
280 doing sub-group analysis of participants with BMI>25 at baseline.³⁵ At 4-month follow up,
281 BMI in the intervention group was 28.89±7.68 compared with 31.79±7.77 in the control
282 group.

283
284 Overall there were modest improvements on participants' BMI and body composition.
285 However, the inconsistencies in the physical activity and diet measures make it unclear
286 whether changes were a result of increased physical activity, improved diet or a combination
287 of both.

288

289 **DISCUSSION**

290 The main finding from this systematic review was that there is inconsistent evidence on the
291 effectiveness of workplace health promotion programmes in nurses for diet and physical
292 activity behaviour. The evidence is largely inconsistent due to the limited number and quality
293 of studies, and heterogeneity in outcome measures used, rather than an absence of effect. In
294 particular, RCTs lacked appropriated outcome measures, which lead to unclear intervention
295 effects despite having good scientific rigour.

296

297 Overall, there was a positive outcome on physical activity behaviour including energy
298 expenditure, steps and sitting time. However, these outcomes were observed in four out of
299 nine studies.^{32,38,40,41} Strategies including tailored intervention programmes and pedometer
300 challenges seemed to be more effective for promoting physical activity behaviours, compared
301 with more passive strategies such as educational material and lectures. Education strategies

302 also showed limited effects on diet outcomes. This is in line with current evidence in
303 practice⁴³ and similar interventions in other populations and settings.⁴⁴⁻⁴⁷ Compared with
304 educational messages used in the control condition, tailored material (e.g. goals,
305 information)^{46,47} and pedometers⁴⁴ favoured intervention group for increased physical activity.
306

307 Given the lack of proper diet behaviour assessment, there was insufficient evidence to support
308 effectiveness or indicate which strategies are more effective at improving nurses' dietary
309 behaviour. Among the six interventions that included a diet and nutrition component, three
310 did not assess any diet outcomes; whereas the others presented heterogeneous outcome
311 measures (e.g. fruit and vegetable intake, diet self-efficacy, diet behaviour based on a general
312 lifestyle tool score). Quality of measurement tools and reporting was poor. Interventions used
313 self-report and indirect behaviour measures of diet instead of validated tools, and in some
314 cases, baseline measures were missing or were reported without control and experimental
315 group distinction. Clearly further research is warranted to determine if diet behaviours can be
316 improved in nurse populations.

317
318 This review highlights the scarcity of interventions designed to promote diet and physical
319 activity behaviours in nurses. This is consistent with the lack of studies promoting healthy
320 lifestyle, reported by an earlier review²⁹ that included only three studies (two targeted
321 smoking behaviour and only one promoted physical activity). Our review included eight
322 additional papers that were not considered previously, which allows for a better consideration
323 of the potential impact of interventions on nurses' lifestyle behaviours and health. Although
324 the evidence on effectiveness was limited, our results add to the existing literature by
325 indicating some strategies that could increase nurses' physical activity.

326

327 Nurses' poor dietary habits and low levels of physical activity places them at increased risk
328 for chronic disease and should therefore be prioritised as a target group for workplace health
329 promotion initiatives. Nurses' health can challenge both recruitment and retention rates,
330 which have a significant impact on health care delivery.⁴⁸ Health and absenteeism are
331 predictors of turnover. Health influences absenteeism, which increases the working pressure
332 of the staff left behind. In turn, this negatively impacts remaining staff's motivation to go to
333 work, triggering the withdrawal process that leads to turnover.⁴⁹ A cohort study showed how
334 nurses with poor self-rated health were more likely to take long sick leave and resign (odds
335 ratio 2.16 and 1.35, respectively).⁵⁰ Here, two in ten nurses who originally reported poor
336 health left their job after only three years. Good health was also associated with lower sick
337 days in another similar study.⁵¹ On the other hand, a nurses weight-loss intervention did not
338 significantly change short sickness absence but did improve productivity after 3-months in the
339 treatment group.⁵² Promoting diet and physical activity has the potential to improve nurses'
340 health and perhaps contribute to limit the current high rates of turnover. This is of vital
341 importance for the Health Care industry, as turnover negatively affects both patient outcome
342 and costs, which are estimated to be AUD\$150,000/year per nurse.⁵³ The Health Care
343 industry is the major employer of Australia, with nursing being the largest workforce here
344 (55% of total health professionals).⁵⁴

345
346 Prior studies in similar settings suggest that workplace interventions can be effective.
347 Previous workplace physical activity and diet interventions in hospital and health care settings
348 reported significant improvements on employee's health (physical activity levels, BMI, fruit
349 and vegetables and fat intake).^{8,19-25} Strategies in these studies included cholesterol screening
350 and dietary intervention¹⁹ lifestyle advice and setting of health targets²⁰ information materials
351 for diet and pedometer goals,²² dietary advice and cognitive behavioural training,²⁴ worksite

352 manipulation,⁸ free fruit and tailored exercise program,²³ internet support, goal-setting and
353 self-monitoring of weight, diet and exercise.^{21,25} However, the extent of nurses' participation
354 and benefit was not clear in those studies, due to the targeting of all hospital employees
355 (including technicians, administration employees, allied health, etc.), whose job and shifts are
356 usually different from nurses'. Because of their occupation, nurses are exposed to many
357 traumatic events in their workplace such as patient injuries, suffering, death, and even verbal
358 and physical aggression.^{55,56} These events influence their attitude towards diet and physical
359 activity behaviours.⁵⁷ Their workload is also different to other health professionals, as patient
360 care is nurses' main responsibility and priority, directly influencing their working hours,
361 shifts and days off.²⁷ Therefore, nurses' ability to engage with general staff health promotion
362 programs might be limited by their availability, time, job characteristics and needs. For this
363 reason, nurse-only intervention studies are needed to determine effective strategies and factors
364 influencing participation and effectiveness in this population.

365

366 Limitations

367 Every effort was made to reduce potential bias in this review. We conducted this study
368 following the PRISMA statement and performing a comprehensive search that yielded high
369 number of studies We used electronic searches including searching of reference lists of
370 included studies and predefined inclusion criteria, which were applied by consensus across
371 two or more reviewers. However, some studies may have been overlooked, for example, as a
372 result of the English language search filter. Further, due to the differing and poor outcome
373 measurement tools we were unable to synthesize the data quantitatively through meta-
374 analysis. Although the majority of studies were either North American or European, there was
375 one East Asian and one Middle Eastern study to support the generalizability of the review.

376

377 **CONCLUSION**

378 We found inconsistent evidence on the effectiveness of workplace health promotion in nurses.
379 Although there was a modest increase in some measures of physical activity and a positive
380 effect on participants' BMI and body composition, results should be interpreted with caution.
381 Future studies should include appropriate theoretical frameworks and validated objective tools
382 for outcome measures. Understanding how best to promote diet and physical activity in
383 nurses is important because they represent one of the largest health workforces at increased
384 risk of chronic disease development.

385

386 **FUNDING**

387 Authors have not received any external funding to conduct this study and prepare this
388 manuscript.

389

390 **SO WHAT? Implications for Health Promotion Practitioners and Researchers**

391 **What is already known on this topic?**

392 Diet and physical activity are well-know behavioural risk factors for the onset of chronic
393 disease. There is sufficient evidence to support the effectiveness and beneficial effects of
394 workplace health promotion interventions. Job characteristics detrimental effect on nurses'
395 lifestyle, have been widely described in the literature. However, a previous review highlighted
396 the general lack of health promotion interventions for this workforce.

397

398 **What does this article add?**

399 This article adds to the literature by reviewing and discussing the effectiveness of
400 contemporary interventions targeting nurses, and focused on diet and physical activity
401 promotion. It offers information about the evidence and effectiveness of intervention

402 strategies, and given the need for better design studies, it provides recommendations for
403 future interventions.

404

405 **What are the implications for health promotion practice or research?**

406 Nurses' working days and hours depend on patient load and care demand, which leads to
407 alternating day and night shift-work, with long working hours. Intervention should be feasible
408 to limit the burden of participation. Future interventions should include a clear theoretical
409 framework, and tailored to participants' needs and feedback, with objective and validated
410 measures of physical activity and diet, such as accelerometers and food records.

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Revised manuscript

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Figure 1
Flowchart of research outcome and study selection

Revised manuscript

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Table 1
Summary of studies examining diet and physical activity interventions in nurses

Study, design, and intervention length	Participants and Setting	Intervention description	Main outcomes	Results*
Furukawa et al., 2003 ³⁹ • RCT • Duration: 12-weeks • 12-week follow up	• Ex: n= 26; con: n= 26 • Attrition: ex 8%; con 4% • Mean age: ex 40.8±5.1; con 42.1±6.9 • Gender (female): 100% • General Hospital, Kinki, Japan	• Individual-based exercise plan • Walking pattern (encouraging brisk walking) and a target for level of exercise energy expenditure. • PA self-monitoring through electronic device • Control: oral information about brisk walking	• Total Energy Expenditure (kcal/kg/d) • Exercise EE (kcal/kg/d) • Steps	+ + +
Brox &Frøystein, 2005 ³⁶ • RCT • Duration: 6 months • 6-month follow up	• Ex: n=63; Con: n= 56 • Attrition: ex 27%; con 9% • Mean age: 42.5 • Gender (female): 97% • Nursing home in Norway	• 1-hour light aerobic exercise classes held twice weekly • Classes regarding nutrition and stress management • Control: No intervention, usual work.	• “Increase in physical activity”	+/-
Luszczynska & Haynes, 2009 ³⁴ • RCT • Duration: 9-weeks • 4-month follow up	• Ex: n= 104; Con: n=78 • Attrition: 34% • Mean age: 28.7±9.51 • Gender (female): 89% • University South-Western England	• Hand outs with education material • Planning forms to make own plans about PA • Nutrition hand outs with education material • Making own plans about fruit and vegetable intake • Control: education materials	• Number of weekly PA sessions • Portions of fruit and veg • BMI	- + +/-
Shahar et al., 2009 ³⁰ • Quasi-experimental • Duration: 2-days • 6-month follow up	• Ex: n=41; Con: n=6 • Attrition: 0% • Mean age: 49.2±1.4 • Gender (female): 72% • Maccabi Health Services, Israel	• Demonstration and activities about PA • Lectures, demonstration and activities promoting healthy dietary choices • Control: No intervention, usual work.	• PA (hours/week) • Saturated fat reduction (1-10 likelihood) • BMI • Waist circumference	- +/- +/- +/-
McElligott et al., 2010 ³⁵ • Quasi-experimental • Duration: 1-day • 3-month follow up	• Ex: n=73; Con: n=85 • Attrition: ex 29%; con 17% • Age (range): 39 (23-64) • Gender (female): 95% • Academic medical centre, USA	• Eight-hour program with interactive lectures on the Collaborative Care Model • Design of self-care plan for PA based on HPLP II (Health Promoting Lifestyle Profiles II) survey results • Self-care plan for diet based on HPLP II results • Control: No intervention, usual work.	• PA (HPLP II scores) • Nutrition (HPLP II scores) • BMI	+ + -

Tucker et al., 2011 ³⁸	<ul style="list-style-type: none"> • Ex: n=30; Con: n=28 • Attrition: ex 7%; con 0% • Mean age: ex 34±6.85; con 36±6.94 • Gender (female): 100% • Medical surgical units in USA 	<ul style="list-style-type: none"> • One 30- to 60-min introduction session • Manipulation of the worksite and social reinforcements (e.g. cues for taking stairs) • Toolkit to promote PA at and away from work. • Daily 30-min walking treadmill/standing workstations. • Extra activity with Nintendo Wii, 3min Energy-Burst video • Control: No intervention, usual work. 	<ul style="list-style-type: none"> • Mean daily steps • Fat index • Fat mass (Kg) 	<ul style="list-style-type: none"> + + +
Flannery et al., 2012 ³⁷	<ul style="list-style-type: none"> • Ex: n=24; Con: n= 15 • Attrition: ex 25%; con 33% • Mean age: ex 43.3±13.07; con 39.3±13.06 • Gender (female): 100% • Long-term care facilities, Maryland USA 	<ul style="list-style-type: none"> • Nurse specifically trained (WHIIP nurse) to deliver information, on-going motivation and lead PA. • 3x10-min physical activity breaks each day, exercise classes led by the WHIIP nurse. • One 30min group education lecture held by the WHIIP nurse, using self-efficacy enhancement techniques and daily diet tips. • No control 	<ul style="list-style-type: none"> • Mean steps • Mean 'aerobic' steps • Mean 'aerobic' minutes 	<ul style="list-style-type: none"> - - +
Baschung Pfister et al., 2013 ³¹	<ul style="list-style-type: none"> • n= 22 • Attrition: 36% • Mean age: 53.43±3.92 • Gender (female): 100% • University Hospital of Zurich, Switzerland 	<ul style="list-style-type: none"> • Step-up jogging training, delivered 2x/week by physical therapist • Program specifically designed for inactive women, aimed to train participants to run 5km. • Motivational flyers about exercise, behaviour change and health • No control 	<ul style="list-style-type: none"> • Energy expenditure (kcal) • BMI 	<ul style="list-style-type: none"> + -
Lavoie-Tremblay et al., 2014 ⁴⁰	<ul style="list-style-type: none"> • n=60 • Attrition: 15% • Mean age: 47.9±8.91 • Gender (female): 100% • Multisite health care centre, Canada 	<ul style="list-style-type: none"> • Pedometer challenge (10,000 step goal) • Tracking PA and Health assessment on dedicated website • 1-hour lecture on PA and diet (baseline only) • Tracking fruit and vegetable consumption on dedicated website • No control 	<ul style="list-style-type: none"> • Total PA (METs) • Vigorous PA (METs) • Moderate PA (METs) • Walking (METs) • Steps • Sitting 	<ul style="list-style-type: none"> - - - - - +

Ex = experimental group; Con = control group; kcal/kg/d = kilocalories/kilogram/day; PA = physical activity; BMI = body mass index; METS = metabolic equivalents

* + = p<0.05; +/- = marginal change or p value not reported; - no significant change

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Table 2
Risk of Bias

	Random sequence generation	Allocation concealment	Outcome blinding	Similar baseline characteristics	Power analysis	Intention to treat analysis	Missing data reported	Handling of missing data
Furukawa et al., 2003 ³⁹	+	+	-	+	+	+	+	+
Brox &Frøystein 2005 ³⁶	+	+	+	+	+	+	+	+
Luszczynska & Haynes, 2009 ³⁴	+	+	+	+	+	+	+	+
Shahar et al., 2009 ³⁰	-	-	-	+	-	-	-	-
McElligott et al., 2010 ³⁵	-	-	-	+	+	-	+	-
Tucker et al., 2011 ³⁸	-	-	-	+	-	-	+	+
Flannery et al., 2012 ³⁷	-	-	-	+	-	-	+	+
Baschung Pfister et al., 2013 ³¹	NA	NA	-	+	-	-	+	-
Lavoie-Tremblay et al., 2014 ⁴⁰	NA	NA	-	+	+	-	+	-

+ = Reported; - = not reported; NA = not applicable to study design