

What do we know about brief interventions for physical activity that could be delivered in primary care consultations? A systematic review of reviews

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Highlights

- Brief interventions (BIs) can increase short-term, self-reported physical activity.
- Uncertainty remains about the long-term impact of BIs on physical activity.
- Definitions of BIs include interventions that may not be feasible in primary care.
- Future research should develop and evaluate very brief interventions (VBIs).

1 **Abstract**

2 This systematic review of reviews aims to investigate how brief interventions (BIs) are
3 defined, whether they increase physical activity, which factors influence their effectiveness,
4 who they are effective for, and whether they are feasible and acceptable. We searched
5 CINAHL, Cochrane database of systematic reviews, DARE, HTA database, EMBASE,
6 MEDLINE, PsycINFO, Science Citation Index-Expanded and Social Sciences Citation Index,
7 and Scottish Intercollegiate Guidelines Network from their inception until May 2015 to
8 identify systematic reviews of the effectiveness of BIs aimed at promoting physical activity
9 in adults, reporting a physical activity outcome and at least one BI that could be delivered in a
10 primary care setting. A narrative synthesis was conducted. We identified three specific BI
11 reviews and thirteen general reviews of physical activity interventions that met the inclusion
12 criteria. The BI reviews reported varying definitions of BIs, only one of which specified a
13 maximum duration of 30 minutes. BIs can increase self-reported physical activity in the short
14 term, but there is insufficient evidence about their long-term impact, their impact on
15 objectively measured physical activity, and about the factors that influence their
16 effectiveness, feasibility and acceptability. Current definitions include BIs that are too long
17 for primary care consultations. Practitioners, commissioners and policy makers should be
18 aware of this when interpreting evidence about BIs, and future research should develop and
19 evaluate *very* brief interventions (of five minutes or less) that could be delivered in a primary
20 care consultation.

21 **Keywords:** Systematic review; Physical activity; Brief interventions; Primary care

22 **Abbreviations**

23 BI: brief intervention; PA: physical activity; VBI: very brief intervention.

24 **Introduction**

25 There is strong evidence that physical activity benefits health [1], and that physical inactivity
26 is a major health problem worldwide and an important modifiable risk factor for non-
27 communicable diseases (NCDs) such as cardiovascular disease, some cancers and type 2
28 diabetes [1]. Furthermore, physical activity is not increasing, despite more countries having a
29 physical activity policy or plan [2], and it has been estimated that physical inactivity cost
30 healthcare systems INT\$53.8 billion worldwide in 2013 [3]. Physical inactivity is a large-
31 scale problem that requires a large-scale solution. However, currently there is a lack of
32 effective physical activity interventions that are low-cost- and can be implemented at scale
33 and fully-embedded in a system (e.g. primary care) [4].

34 Given the public health burden associated with sedentary lifestyles, there is a need for
35 effective, scalable, low-cost interventions to enhance the adoption and maintenance of regular
36 physical activity along the continuum of individual and population-based interventions. One
37 promising avenue is so-called ‘brief interventions’ (BIs) in health care settings. The ‘make
38 every contact count’ (MECC) agenda in the UK [5] has highlighted how a relatively ‘low-
39 cost’ programme that capitalises on the opportunity that practitioners in health care settings
40 have to support behaviour change in their patients can improve population level behaviour
41 change. Additionally, in the UK, the National Institute for Health and Care Excellence
42 (NICE) recommends that primary care practitioners deliver tailored, ‘brief’ physical activity
43 advice to inactive adults, and follow this up at subsequent appointments [6]. In this guidance,
44 NICE defines brief advice as: “*verbal advice, discussion, negotiation or encouragement, with*
45 *or without written or other support or follow-up. It can vary from basic advice to a more*
46 *extended, individually focused discussion*” [6, p7]. A recent systematic review suggested that
47 BIs may be as effective as more intensive interventions [7], supporting the idea that BIs

48 delivered in primary care have the potential to reduce the public health burden of inactivity at
49 relatively low-cost [5].

50 However, there is currently no agreed definition as to what constitutes a ‘brief’ intervention,
51 and varying definitions have been used for “brief interventions” and “brief advice” [6-13].

52 Consequently, uncertainty remains about how BIs are defined and the effectiveness of brief
53 physical activity interventions that could be delivered in a primary care consultation.

54 Therefore, it is timely to examine what is known about these BIs from published systematic
55 reviews. Although we were particularly interested in evidence from BIs delivered in primary
56 care, the purpose of this review was to investigate any BIs that could *potentially* be delivered
57 in the primary care setting. We therefore used an inclusive approach to the available literature
58 and aimed to include reviews of BIs delivered in any setting where the population was similar
59 to that in primary care (i.e. apparently healthy and/or at-risk; not requiring specialised
60 treatment). We conducted a systematic review of reviews to identify: (i) how BIs are defined;
61 (ii) whether interventions defined as brief increased self-reported and objectively measured
62 physical activity; (iii) which factors influenced the effectiveness of BIs; (iv) who BIs were
63 effective for; and (v) whether BIs were feasible and acceptable.

64 **Methods**

65 **Search strategy and selection criteria**

66 We undertook a systematic review that followed the PRISMA guidelines [14] and was based
67 on a protocol [15]. The following databases were searched without date restrictions:

68 CINAHL, Cochrane database of systematic reviews, Database of Abstracts of Reviews of
69 Effects, Health Technology Assessment database, EMBASE, MEDLINE, PsycINFO, Science
70 Citation Index-Expanded and Social Sciences Citation Index (date last searched May 2015).

71 Where possible, searches were limited to those in the English language. The search strategy,
72 tailored for each database (see Additional file 1), was comprised of four filters: physical

73 activity terms (e.g., walking), incremental or reduction terms (e.g., increase), intervention-
74 related terms (e.g., counselling) and review design terms (e.g., systematic). The Scottish
75 Intercollegiate Guidelines Network website [16] and first author's personal collection were
76 also searched (date last searched May 2015).

77 We initially used an inclusive approach in which eligible reviews satisfied the following
78 criteria: (1) published systematic reviews or meta-analyses, determined by title or method, in
79 the English language; (2) inclusion of adults (at least 18 years of age) of any health status,
80 except a) those undergoing rehabilitation to return to, or maintain, normal levels of physical
81 functioning, b) those receiving interventions in secondary or tertiary care (e.g. outpatient care
82 or where treatment involved a specialist), c) those having serious conditions (e.g. cerebral
83 palsy) that require specialist support not typically available in primary care or d) athletes; (3)
84 a primary aim of reviewing interventions promoting lifestyle physical activity, defined as
85 "...self-selected activities, which include all leisure, occupational, or household activities that
86 are at least moderate to vigorous in their intensity and could be planned or unplanned
87 activities that are part of everyday life." [17, p.399]; (4) inclusion of physical activity or
88 sedentary behaviour as an outcome (e.g., objective or self-reported physical activity or sitting
89 time) or proxy measures of physical activity or sedentary behaviour (e.g. exercise capacity,
90 physical fitness, energy expenditure, TV viewing); and (5) inclusion of interventions
91 delivered one-to-one with a face-to-face component. We included reviews irrespective of the
92 design characteristics of included primary studies.

93 We undertook further screening to identify reviews with specific relevance to our research
94 questions. Reviews fell into two groups: 1) brief intervention reviews (BI reviews) with a
95 primary focus on BIs evidenced by title and/or search strategy; and 2) general physical
96 activity intervention reviews (PA reviews) which a) included one or more interventions
97 described as 'brief' in a subgroup analysis or narrative synthesis, or b) reported narrative or

98 quantitative analyses, including moderator analysis, on the basis of contact time between
99 providers and participants (a proxy for BIs).

100 **Screening and data extraction**

101 Following de-duplication one reviewer screened titles for exclusion. Pairs of reviewers used
102 standardised pro formas to screen reviews for eligibility based on abstracts and full texts,
103 respectively. A third reviewer resolved any disagreements. Reviewers were not blind to
104 administrative details of the reviews. Data were extracted about definitions of BIs, references
105 of studies described as brief or very brief, quantitative or narrative analyses of BIs and
106 contact time, effectiveness, factors influencing effectiveness, who BIs were effective for,
107 feasibility, acceptability, and key discussion points and conclusions about BIs related to our
108 research questions. Quality assessment was conducted using the validated 11-item AMSTAR
109 tool [18] for all included reviews. We calculated scores ranging from 0 (low quality) to 11
110 (high quality). A second reviewer double-checked extracted data and ratings, and a third
111 reviewer resolved any disagreements. We retained reviews for data synthesis irrespective of
112 their quality, and conducted a narrative synthesis.

113 **Results**

114 Initial screening identified ninety-eight potentially eligible reviews (Figure 1). Following
115 full-text screening, sixteen reviews met the inclusion criteria and were eligible for data
116 extraction. Three of these reviews focused on BIs (BI reviews) [8,19,20] (see Table 1 for
117 details of the included BI reviews) and thirteen focused on physical activity interventions in
118 general (PA reviews) [21-33] (see Table 2 for summary details of the included PA reviews).
119 Of the three BI reviews, one was a recent NICE evidence review [8] which updated an earlier
120 review [20]. The BI reviews included: nine papers describing eight unique studies (including
121 two cluster randomised controlled trials) [19]; 12 papers describing ten studies (including
122 seven cluster or individual randomised controlled trials and one cost-effectiveness evaluation)

123 [20]; and 22 papers describing 21 studies (including 15 cluster or individual randomised
124 controlled trials) [8] (see Figure 2 for overlap). One BI review also included 46 studies of
125 barriers and facilitators of BI delivery and uptake [8]. All three BI reviews included only BIs
126 delivered in primary care and/or intervention delivery by a primary care practitioner. Quality
127 scores were 4 [20], 5 [19], and 6 [8] on the 11-point AMSTAR scale (Table 1); none reported
128 on status of publications for inclusion, duplicate study selection and extraction, publication
129 bias or conflicts of interest.

130 Of the thirteen included PA reviews, six included one or more interventions described as
131 ‘brief’ in a subgroup analysis or narrative synthesis [23,28,30-33], and seven performed a
132 statistical analysis or narrative synthesis based on contact time [21,22, 24-27, 29] (see Table
133 2). Five of the PA reviews included interventions delivered in any setting [23-27]; four of the
134 PA reviews included only interventions delivered in primary care [28,30,32,33]; three of the
135 PA reviews did not specify a setting as an inclusion criterion [22,29,31]; and one included
136 only interventions delivered in clinical and community settings [21]. Quality scores for the
137 PA reviews ranged from 3 [30,33] to 8 [21,29,32] on the 11-point AMSTAR scale (Table 2).

138 **Definitions of brief interventions**

139 Of the sixteen included reviews, only the three BI reviews provided a priori definitions of
140 BIs, but used the term “brief advice” (Table 3). A BI was defined as having a maximum
141 duration of 30 minutes [8] or consisting of a single core consultation [8,19,20]. Two BI
142 reviews included brief advice plus additional components such as written support and follow-
143 ups [8,20]. These broad and inclusive definitions of BIs resulted in a wide range of included
144 BIs. For example, all three BI reviews included a study by Bull and Jamrozik (1998) [34]
145 which involved a BI consisting of a single 2-3 min session of ‘tailored’ advice, plus a printed
146 pamphlet; whereas two BI reviews [8,20] included a study by Elley et al. (2003) [35] which
147 involved a much more resource-intensive BI consisting of an initial 7-13 minute session of

148 brief advice and a written prescription, plus quarterly newsletters and an additional 3
149 telephone calls of 10-20 min each over 3 months made by an exercise specialist from a local
150 sports foundation. Other BIs included in the three BI reviews consisted of verbal advice with
151 or without materials (e.g., pamphlets, action planners, exercise prescriptions, leisure centre
152 passes), counselling, motivational interviewing and step testing, and included follow-up
153 components such as visits, phone calls and newsletters [36-41].

154 **Effectiveness of brief interventions**

155 All three BI reviews reported that BIs increased self-reported physical activity in the short-
156 term (4-12 weeks) compared with usual care (Table 4). One BI review reported that BIs
157 increased self-reported physical activity in the “long-term” (defined as 12 weeks or more)
158 and that this was possibly due to follow-up sessions [20]. The remaining BI reviews [8,19]
159 concluded that there was a lack of evidence of long-term effectiveness, defined as 4 months
160 or more by one review [19]. No BI review reported objective physical activity as an outcome.
161 Five of the seven PA reviews that performed a statistical analysis or narrative synthesis based
162 on contact time reported a lack of evidence for a relationship between intervention contact
163 time and intervention effectiveness [21,22,24,25,29], two reported a positive relationship
164 [26,27]. Five of the six PA reviews that described one or more interventions as ‘brief’ in a
165 subgroup analysis or narrative synthesis reported some evidence supporting the effectiveness
166 of BIs for increasing physical activity [28,30-33] (Table 2).

167 **Factors influencing the effectiveness of brief interventions**

168 Table 5 summarizes the factors influencing the effectiveness of BIs as reported in the BI
169 reviews. No PA review investigated factors that influenced the effectiveness of BIs. Two of
170 the three BI reviews investigated factors that influenced the effectiveness of BIs [8,20]. One
171 BI review reported inconclusive evidence about the impact of intervention duration of
172 individual sessions on self-reported activity. [8]. Another BI review reported that follow-up

173 sessions might be more important than individual session duration for effectiveness [20].
174 There was mixed evidence for the impact of including written materials, with one BI review
175 reporting that adding written materials did not increase effectiveness [8], and another
176 reporting that a ‘written prescription’ may be a useful addition to BIs [20]. Overall there was
177 insufficient evidence to identify important effects of tailoring of intervention materials, or
178 types of providers, provider training, setting, or theoretical basis [8,20].

179 **Target populations for whom brief interventions are more effective**

180 No PA review investigated population factors that influenced the effectiveness of BIs. Two of
181 the three BI reviews investigated whether population characteristics influenced the
182 effectiveness of BIs [8,20]. One BI review reported inconclusive evidence that BIs are more
183 effective for specific age groups, as although the interventions aimed at older groups seemed
184 more effective, these were also the studies that involved follow-up sessions [20]. The other
185 BI review reported moderate evidence that BIs were less effective in increasing self-reported
186 levels of physical activity among economically disadvantaged populations [8]. Both reviews
187 reported that there was insufficient evidence to determine the impact of gender, ethnicity or
188 baseline activity levels on intervention effectiveness [8,20].

189 **Feasibility and acceptability of brief interventions**

190 Two of the three BI reviews commented on the acceptability and feasibility of BIs. Table 6
191 summarises the findings of the BI review that included 46 studies of barriers and facilitators
192 of BI delivery and uptake [8]. This review found a number of facilitators of practitioner
193 delivery and patient uptake of BIs, including the availability of support and structured
194 protocols for practitioners delivering the BI and the delivery of advice that is preventative
195 rather than treatment-based. Identified barriers to practitioner delivery included such things as
196 lack of provision of high-quality print materials to reinforce the verbal messages of the BI
197 and a lack of time [8]. The other BI review concluded that most interventions could

198 potentially be applied to primary care in the UK with moderate training of health
199 professionals and moderate additional resources (e.g. written materials), but that many BIs
200 were too long (up to 40 minutes) to be included in primary care consultations in the UK [20].
201 Two of the thirteen PA reviews commented on the acceptability and feasibility of BIs. One
202 PA review reported that it was feasible to train a range of health care providers to deliver BIs
203 (with training durations ranging between 30 minutes and four hours), although consistent
204 implementation might be difficult [24]. The other PA review reported that patients
205 consistently expressed a preference for interventions including a written contract or
206 prescription; and that practitioners are restricted by financial and time constraints [30].

207 **Discussion**

208 Only three of the sixteen reviews included in this review provided definitions of BIs (using
209 the term “brief advice”), and only one of these definitions specified a maximum duration for
210 brief advice (of 30 minutes) [8]. Overall, evidence from these 3 BI reviews and 13 general
211 PA reviews can be summarised as:

- 212 (i) BIs can increase self-reported physical activity in the short-term, but there is
213 insufficient evidence about their long-term impact, or their impact on objectively
214 measured physical activity.
- 215 (ii) There was mixed evidence that providing high quality supplements (e.g., written
216 prescriptions) or including follow-up sessions may increase the effectiveness of
217 BIs; and there was insufficient evidence to identify the effects of tailoring of
218 intervention materials, types of providers, provider training, setting, or theoretical
219 basis on BI effectiveness.
- 220 (iii) There was insufficient evidence to determine the impact of age, gender, ethnicity,
221 SES or baseline activity levels on BI effectiveness.

222 (iv) A number of practitioner, patient, intervention, and system factors (such as the
223 quality of written intervention materials and time constraints of the primary care
224 system) influence the feasibility and acceptability of BIs.

225 **Definitions of brief interventions**

226 Our findings demonstrate that there is no agreed definition of BIs and that definitions are
227 broad and inclusive and often include interventions that may not be feasible in primary care.
228 For example, although two BI reviews included BIs of 30 [8] or 40 [20] minutes, their
229 definition of BIs did not specify that interventions that should be deliverable in primary care
230 consultations. Consequently, some BIs included in these two BI reviews were potentially too
231 resource-intensive for delivery in primary care – for example, in addition to the initial brief
232 advice consultation, included BIs involved six follow-up phone calls of three minutes [36], at
233 least three follow-up phone calls of 10-20 minutes [35], up to three additional visits [37-40],
234 or motivational interviewing [41]. We recommend that researchers and policy-makers be
235 aware of this diversity in definitions when interpreting evidence and recommendations about
236 BIs. Furthermore, as all three BI reviews provided definitions that focused on verbal advice,
237 they did not necessarily consider other possible types of BIs, such as the provision of
238 pedometers or action planning, that may be more effective than brief advice or enhance its
239 effect [42,43].

240 **Effectiveness of brief interventions**

241 BIs increased self-reported physical activity in the short-term (4-12 weeks), but evidence for
242 their long-term effectiveness is inconclusive. This is in line with previous reviews of general
243 physical activity interventions [44-46], and may be partly due to varying definitions of short-
244 term across reviews (6 weeks up to 12 months), which would mean that studies with long-
245 term effects may have been categorised differently in the different reviews. There is also a
246 lack of evidence about the effect of BIs on objectively measured physical activity and fitness.

247 This again corroborates evidence from previous reviews [7,47], and reflects the fact that very
248 few studies evaluating BIs have used an objective measure of physical activity.

249 **Factors influencing the effectiveness of brief interventions**

250 In terms of factors influencing the effectiveness of BIs, we found mixed support for the use
251 of supplements such as written prescriptions. It is possible that the varied quality of written
252 materials across studies has contributed to this mixed evidence. Indeed one review
253 recommended that higher quality materials are used when trying to establish whether these
254 increase effectiveness [8]. Collaborative work with patients and practitioners might improve
255 the quality of materials [48].

256 We identified only three reviews that specifically investigated the effectiveness of BIs
257 [8,19,20], of which only one performed meta-analyses to compare BIs with usual care or with
258 more intensive interventions [8]. Consequently, the evidence for the impact of intervention
259 duration is inconclusive, and illustrates a need for more studies comparing BIs of varying
260 durations among themselves and against usual care.

261 The lack of evidence about the impact of tailoring, types of providers, provider training,
262 intervention setting, and theoretical basis on BI effectiveness likely reflects the heterogeneity
263 of BI studies i.e. the variety of methods used to tailor BIs, or the different variables tailoring
264 was based on (e.g. psychosocial, behavioural and demographic variables); the varied types of
265 intervention provider and the quantity and quality of training they received; and the
266 theoretical basis (or lack thereof) of the interventions. Future reviews, as well as future
267 individual studies, should evaluate different methods of tailoring BIs (e.g. tailored pamphlets)
268 and the use of different tailoring variables. Furthermore, the limited evidence about
269 promising behaviour change techniques for use in BIs underlines the need for studies that
270 compare BIs that use different techniques. Finally, the inconclusive evidence for the effects
271 of different types of providers and settings suggests a need for studies that compare the

272 effects of the same BIs delivered by different providers (e.g., nurse, general practitioner) and
273 delivered in different settings (e.g., primary care, community, at participants' homes).

274 **Target populations for whom brief interventions are more effective**

275 Likewise, we found mixed and limited evidence for the impact of targeting BIs at patients
276 with various characteristics, although there was some evidence that BIs might be more
277 effective among patients of higher socio-economic status. Consequently, there is a need for
278 formative research in disadvantaged populations to ensure that BIs are tailored to their needs
279 and preferences. It is well known that disadvantaged population are often difficult to engage
280 in physical activity research [49], however, and future research should also endeavour to
281 reduce this inequity [50], for example by involving these populations in research design and
282 by using approaches which are tailored to these populations.

283 **Feasibility and acceptability of brief interventions**

284 Only two of the three included BI reviews and two of the thirteen included PA reviews
285 commented on the acceptability and feasibility of BIs, allowing only tentative conclusions to
286 be drawn. With regard to the feasibility and acceptability of BIs, practitioners mentioned time
287 constraints as a key barrier [8,20,30]. Although there was insufficient evidence from the
288 included BI reviews to identify important effects of intervention provider on the feasibility
289 and acceptability of BIs, the impact of the type of provider (e.g. general practitioner, nurse,
290 health care assistant, etc.) deserves further investigation, especially in the primary care
291 context where members of staff face different time constraints. The development and
292 evaluation of very brief interventions (VBIs), defined as having a duration of five minutes or
293 less [6] might address this barrier, especially within the context of primary care consultations
294 [20]. Providers can feasibly be trained to deliver BIs within a few hours, but evidence for
295 implementation fidelity is lacking. Although there is mixed evidence for including written
296 materials in BIs to increase their *effectiveness*, evidence from one BI review suggested that

297 adding structured, clear and simple protocols, high quality written materials, and system-level
298 support to BIs may encourage their delivery by providers [8]. Furthermore, BIs that promote
299 physical activity as a preventative measure, rather than as treatment for a perceived medical
300 condition, might be more acceptable to participants. In view of these findings, we suggest
301 that policies should highlight that physical activity promotion is part of the core role of
302 primary care practitioners and that BIs are a preventative measure that can benefit all inactive
303 patients, not just those with a diagnosed medical condition or other at-risk groups.

304 **Limitations**

305 It is possible that relevant reviews may have been missed, given the lack of consistency
306 across PA reviews in describing interventions as brief, and the use of contact time as a proxy
307 for BIs. Furthermore, our search strategy was limited to electronic databases and the first
308 author's collection. However, this is unlikely since we took an inclusive approach to
309 incorporating PA reviews and they reported very limited evidence. Our findings should be
310 interpreted with caution due to the varying quality of the reviews and the included primary
311 studies.

312 **Implications for practice and policy**

313 Given these findings, policy-makers, commissioners and practitioners should be aware that
314 evidence and recommendations about BIs are partly based on interventions that are too long
315 for primary care consultations [51]. We recommend that researchers distinguish brief
316 interventions (BIs) and very brief interventions (VBIs), as done in some NICE guidance [6],
317 and that VBIs are defined as interventions that can be delivered within a single five-minute
318 session. We also recommend that researchers consider types of BIs other than brief advice,
319 for example those that use pedometers or include behaviour change techniques such as action
320 planning.

321 **Conclusions**

322 Our review indicates uncertainty about the effectiveness, feasibility and acceptability of BIs
323 that could be delivered in a primary care consultation. We have also identified a need for
324 studies to investigate intervention effects on objectively measured and self-reported physical
325 activity in the long term. Importantly, current definitions of BIs include interventions that are
326 too long for primary care consultations. Practitioners, commissioners and policy-makers
327 should be aware of this when interpreting evidence about BIs, and future research should
328 develop and evaluate *very* brief interventions (of five minutes or less) which may be more
329 feasible to deliver in a routine consultation than BIs and may prove to be cost-effective,
330 scalable interventions.

331 **Conflict of interest statement**

332 WH has done consultancy work for AbbVie Ltd. The other authors declare that they have no
333 conflicts of interest.

334 **Authors' contributions**

335 LL, DM, SS, and WH contributed to review design. LL and SP executed the search strategies,
336 screened initial search results, extracted data from included studies, undertook narrative
337 synthesis, drafted the manuscript, and are guarantors of the study. LL, SP, WH, KM, MB and
338 SS assessed studies for inclusion. WH, DM, KM, SP, and MB double-checked the data
339 extraction. LL, SP, WH and SS interpreted the findings. All authors contributed to the
340 manuscript, and read and approved the final manuscript.

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Table 1: Characteristics of Brief Intervention reviews included in the systematic review of reviews

Study	Type of review	Aim	Inclusion/exclusion criteria	Key outcomes	AMSTAR Quality Score	N studies (N participants)	Period searched
Campbell et al. 2012 [8]	Systematic review and Meta-analysis	To investigate the effectiveness of, and the barriers and facilitators for, brief advice interventions in primary care to promote physical activity in adults	Intervention: Brief advice (verbal advice, discussion, negotiation or encouragement, with or without written or other support or follow-up) to promote physical activity, or local infrastructure and systems that facilitate the delivery of brief advice in primary care settings Design: None specified Population: Adults 19 and over Setting: GP surgery, health centre or other primary care setting, or delivered by primary care professionals in other settings	Physical activity, cardio-respiratory fitness, mental health outcomes. Barriers and facilitators to implementation of brief advice physical activity interventions	6	21 studies: 16RCTs; 5nRCTs (13,493) 46 barriers and facilitators studies (15,156)	1990 to 2012
Lawlor and Hanratty 2001 [19]	Systematic review	To determine the effect of advice given in routine primary care consultations on levels of physical activity	Intervention: Advice (verbal/written/other forms) given within a routine consultation with the aim of increase physical activity Design: Controlled research design (randomized or non-randomized) with a control group that did not receive advice to increase physical activity Population: None specified Setting: Primary care	Physical activity	5	8 studies: 2 RCTs; 6 nRCTs (5,102)	1966 to Dec 2000
NICE 2006 [20]	Systematic review	To examine the effectiveness of brief interventions in primary care to increase physical activity in adults	Intervention: Brief intervention to increase physical activity Design: Controlled research design (with a control or comparison group), with measures at baseline and from 6 weeks post intervention Population: Adult population Setting: Primary care	Self-reported or objective physical activity or physical fitness outcomes	4	10 studies: 7 RCTs; 3 nRCTs (6,898)	1990 to June 2005

Abbreviations: RCT = Randomised Controlled Trial, nRCT = non-randomized controlled trial, PA = Physical activity, BI = Brief intervention

Table 2: Summary details of the thirteen Physical Activity reviews included in the systematic review of reviews

Study	Type of Review	Inclusion/Exclusion Criteria	AMSTAR Quality Score	N	Method of comparison	Key outcomes/conclusions
Avery 2012 [21]	Systematic review and Meta-analysis	Intervention: Behavioural interventions targeting free-living PA and exercise Design: RCT Population: Adults 18yrs or older with type 2 diabetes Setting: Clinical and community settings Outcome: Change in HbA1c	8	17 RCTs	Moderator analyses based on contact time (number of contacts)	No significant effect of number of contacts on effect sizes for HbA1c: Interventions of greater intensity (median ≥ 14 contacts), were not associated with clinically significant improvement in HbA1c.
Chase 2015 [22]	Meta-analysis	Intervention: PA interventions Design: None specified Population: Community-dwelling older adults 65yrs and older Setting: None specified Outcome: Subjective or objective PA, sufficient data to calculate effect sizes.	6	46 two-group treatment vs control intervention studies 33 single group pre-posttest intervention studies	Moderator analyses based on contact time (number of intervention sessions, session duration in minutes, and total intervention duration in minutes)	No significant effect of number of intervention sessions, session duration, or total intervention duration on PA effect sizes.
Cleland 2015 [23]	Systematic review and Meta-analysis	Intervention: Any intervention focused on increasing PA Design: RCTs and nRCTS Population: Community-dwelling, socio-economically disadvantaged women aged 19-64yrs Setting: Any setting Outcome: Change in PA or PA-related outcome (e.g. cardiorespiratory fitness)	7	11 RCTs 8 nRCTs	Narrative summary: Includes interventions described as 'brief'	One RCT out of the 19 included studies reported an intervention described as brief: <ul style="list-style-type: none"> Albright et al. (2005) compared G₁, a home-based phone and mail intervention which included “<i>brief, structured PA telephone counselling (10-15min)</i>” with a control G₀ (a home-based mail intervention). SMD -0.13 (95% CI -.59-0.33) in favour of control group.
Conn et al. 2008 [24]	Meta-analysis	Intervention: Patient education interventions to increase PA Design: Multiple designs Population: Chronically ill participants > 18yrs old Setting: Any setting Outcome: PA behaviour, sufficient data to calculate effect sizes.	5	213 samples from 163 reports	Moderator analysis based on contact time (in minutes)	No significant effect of contact time on effect sizes for physical activity.

Study	Type of Review	Inclusion/Exclusion Criteria	AMSTAR Quality Score	N	Method of comparison	Key outcomes/conclusions
Conn et al. 2011 [25]	Meta-analysis	Intervention: Interventions to increase PA Design: Multiple designs Population: Healthy adults Setting: Any setting Outcome: PA behaviour	5	358 reports	Moderator analysis based on contact time (in minutes)	No significant effect of contact time on effect sizes for physical activity.
Conn et al. 2002 [26]	Meta-analysis	Intervention: Interventions to increase PA Design: Multiple designs Population: Adults aged 60yrs or older Setting: Any setting Outcome: Overall PA or episodic exercise behaviour, sufficient data to calculate effect sizes.	6	43 studies	Moderator analysis based on contact time (in minutes)	Significant relationship between contact time and physical activity effect size: studies with greater levels of contact time had larger effect sizes ($d^* = .44 \pm .13$, $k = 14$) than studies with relatively low levels of contact time ($d = .19 \pm .12$, $k = 14$). * d =effect size weighed by sample size and controlling for design features.
Conn et al. 2009 [27]	Meta-analysis	Intervention: Interventions to increase PA Design: Multiple designs Population: Diagnosed with cardiovascular disease, at least 18yrs of age. Setting: Any setting Outcome: PA behaviour, sufficient data to calculate effect sizes.	5	100 samples from 79 reports	Moderator analysis based on contact time (in minutes)	Significant relationship between contact time and physical activity effect size: the amount of contact time between subjects and interventionists was related positively to PA outcomes.
Eakin et al. 2000 [28]	Narrative Review	Intervention: Interventions to increase PA Design: RCT or quasi-experimental study with a comparison group Population: None specified. Setting: Primary care Outcome: At least one measure of PA	6	9 RCTs 6 quasi-experimental studies	Narrative summary: Includes interventions described as 'brief'	Brief durations of 3-10minutes associated with significant physical activity increases in the short-term.
Hobbs 2013 [29]	Systematic review and Meta-analysis	Intervention: Interventions to promote long-term PA change Design: RCTs Population: Healthy participants or 'at risk' of chronic disease; mean/median age of 55-70yrs. Setting: None specified Outcome: Objective or self-report PA ≥ 12 months after randomization	8	21 RCTs	Sub-group analysis based on contact time (number of contacts)	No statistically significant difference in intervention effect between interventions with ≥ 11 contacts and those with < 11 contacts.

Study	Type of Review	Inclusion/Exclusion Criteria	AMSTAR Quality Score	N	Method of comparison	Key outcomes/conclusions
Neidrick 2012 [30]	Narrative Review	Intervention: Interventions to increase PA Design: None specified Population: Older adults, aged 50yrs or older. Setting: Primary care Outcome: Adherence to PA	3	11 studies (8RCTs; one qualitative study)	Narrative summary: Includes interventions described as 'brief'	Brief advice was effective at increasing physical activity in two of six studies reporting interventions with a single initial visit lasting 3–15 min. <ul style="list-style-type: none"> • Goldstein et al. (1999): No sig. effect. • Pfeiffer et al. (2003): Sig. increase in PA. • Petrella et al. (2003): Sig. increase in PA. • Pinto et al. (2005): No sig. effect. • Marki et al. (2006): No sig. effect. • Armit et al. (2009): No sig. effect.
Ogilvie et al. 2007 [31]	Systematic review	Intervention: Interventions to increase walking Design: RCTs, or controlled before and after experimental or observational studies Population: None specified Setting: None specified Outcome: Objective or self-report measure of walking at both baseline and follow-up	6	48 studies (19 RCTs, and 29 nRCTs)	Narrative summary: Includes interventions described as 'brief'	Brief advice was effective at increasing walking in two of six studies (5 RCTs): <ul style="list-style-type: none"> • Purath et al. (2004): Sig. increase in walking. • Calfas et al. (1996): Sig. increase in walking. • Kerse et al. (1999): No sig. effect. • Halbert A et al. (2000): No sig. effect. • Halbert B et al. (2001): No sig. effect. • Norris et al. (2000): No sig. effect.
Orrow 2012 [32]	Systematic review and Meta-analysis	Intervention: Interventions to increase PA or fitness Design: RCT Population: Sedentary adults aged 16yrs or older over Setting: Primary care Outcome: PA or fitness \geq 12 months after randomization	8	15 RCTs	Narrative summary: Includes interventions described as 'brief'	Larger intervention effects on self-reported PA in studies (six studies*) where control participants received no intervention than where they received a comparator intervention (seven studies*). The authors propose that this suggests that a brief single contact intervention can be as effective as more intensive approaches. * Individual studies not identified
Smith 2004 [33]	Narrative Review	Intervention: Interventions to increase PA Design: RCT or quasi-experimental Population: None specified Setting: Primary care Outcome: PA	3	16 studies (15 RCTs)	Narrative summary: Includes interventions described as 'brief'	Brief and intensive interventions* significantly increased activity in the short term. * Individual studies not identified

Abbreviations: RCT = Randomised Controlled Trial, nRCT = non-randomized controlled trial, PA = Physical activity

Table 3: Definitions of Brief Interventions provided by the Brief Intervention reviews included in the systematic review of reviews

Study	Definition
Campbell et al. 2012 [8]	<p><i>“Less than 30 minutes in duration, or delivered in one session (allowing for research follow-up only as additional contact)”.</i> (p 45)</p> <p><i>“[...] verbal advice, discussion, negotiation or encouragement, with or without written or other support or follow-up. It could be opportunistic and can typically take from less than a minute to up to 20 minutes. It can vary from basic advice to a more extended, individually-focused discussion.”</i> (p 51)</p> <p><i>“[...] can be accompanied by provision of support materials (such as printed information, websites, text messaging etc) as additional aids to the brief advice; can involve followup at single or multiple points after the intervention; can be preceded by an assessment; can involve support and followup but these are additional aspects of brief advice and the intervention (“brief advice”) should be capable of being delivered in the core brief advice session.”</i> (p 79)</p>
Lawlor and Hanratty 2001 [19]	<p><i>“Advice (defined as verbal/written/other forms of advice) given within the confines of a routine consultation in a primary care setting with the aim of increasing levels of physical activity.”</i> (p 220)</p> <p>This definition of brief advice did not include <i>“[...] dedicated health promotion clinics, referral to exercise facilities, supervised training sessions, lengthy motivational interviews or a combination of these.”</i> (p219)</p>
NICE 2006 [20]	<p><i>“Any brief intervention involving verbal advice, encouragement, negotiation or discussion with the overall aim of increasing physical activity delivered in a primary care setting by a health or exercise professional, with or without written support or follow-up”.</i> (pp12-13)</p> <p><i>“Studies were included if the key element of the intervention was a single initial consultation delivered in a primary care setting (no specific time limit was set for the length of this consultation).”</i> (p 13)</p>

Table 4: Brief Intervention effectiveness according to the Brief Intervention reviews included in the systematic review of reviews

Study	Comparisons	Method of comparison N studies	Outcome	Follow-up time	Results
Campbell et al. 2012 [8]	Brief advice to promote PA	Narrative synthesis: 15 effectiveness studies (10 RCTs; 5 nRCTs)	Self-reported physical activity	4-6weeks to 12 months	Narrative synthesis: Six studies (inc. 5RCTs) found a significant positive effect of brief advice in promoting physical activity; Seven studies (inc. 4 RCTs) found a non-significant benefit of brief advice over usual care; Two studies found no difference between brief advice and usual care.
	vs				
	Usual care	Meta-analysis (continuous PA data): 8 effectiveness studies (6 RCTs; 2 nRCTs)			
		Meta-analysis (dichotomous PA data): 9 effectiveness studies (7 RCTs; 2 nRCTs)	Meta-analysis (dichotomous PA data): The relative risk of meeting recommended physical activity levels was 1.30 (95%CI: 1.12 to 1.50; I2 66%) in favour of brief advice.		
Lawlor and Hanratty 2001 [19]	Brief physical activity advice	Narrative synthesis 8 studies: 2 RCTs; 6 nRCTs (5,102)	Self-reported physical activity	Short-term: <8weeks	Short-term: 4 of 6 studies reporting short-term results found PA advice to be effective at increasing physical activity.
	vs			Long-term: >=4months	Long-term: 1 of 4 studies reporting long-term results found PA advice to be effective at increasing physical activity. One of the RCTs found null results at both short and long-term follow-up; the other only assessed long-term outcomes and found null effects at both 4 and 12 months.
	Control (not given advice to increase activity levels)				

Study	Comparisons	Method of comparison N studies	Outcome	Follow-up time	Results
NICE 2006 [20]	Brief interventions (BIs) for PA vs Control	Narrative synthesis 10 studies: 7 RCTs; 3 nRCTs (6,898)	Self-reported physical activity	Short-term: 6-12weeks Longer-term: >12weeks Very long - term: >=1year	Evidence from 10 studies suggests that brief interventions in primary care to increase physical activity can have short, longer- term or very long- term effects: Short-term: 3 of 6 controlled trials (3 of 4 RCTs) found Brief PA advice to be effective at increasing physical activity. Longer-term: 3 of 7 controlled trials (2 of 4 RCTs) found Brief PA advice to be effective at increasing physical activity. Very long-term: 3 of 7 controlled trials (3 of 6 RCTs) found Brief PA advice to be effective at increasing physical activity.

Abbreviations: RCT = Randomised Controlled Trial, nRCT = non-randomized controlled trial, PA = Physical activity, BI = Brief intervention

Table 5: Factors Influencing the Effectiveness of Brief Interventions

Study	Method of Comparison	Summary of findings
Campbell et al. 2012 [8]	Narrative synthesis and Descriptive summary of studies	<ul style="list-style-type: none"> • Intervention duration: Weak evidence from nine studies (six RCT studies and three nRCTs) provides inconclusive evidence regarding the effectiveness of intervention of different durations. • Written materials: Moderate evidence from four studies (three RCTs and one nRCT) suggests that there is no additional benefit in combining brief advice with written materials. The authors note that the lack of statistical significance may reflect the small number of studies and considerable heterogeneity and suggest that caution is needed in interpretation of this finding. • There was insufficient evidence to identify important effects from: <ul style="list-style-type: none"> - Types of provider - Provider training - Setting - Theoretical basis of the intervention /behavior change techniques
Lawlor and Hanratty 2001 [19]	N/A	None reported.
NICE 2006 [20]	Narrative synthesis and Descriptive summary of studies	<ul style="list-style-type: none"> • Follow-up sessions: Follow-up sessions after the initial consultation may be important in achieving improvement in physical activity outcomes over a very long time frame (12 months). Follow-up over an appropriate time period appears to be more important than the length of individual sessions • Written prescriptions and/or step testing: A ‘written prescription’ outlining physical activity goals and/or step testing during the consultation may be a useful adjunct to verbal advice to increase physical activity. The authors note that it is difficult to separate the relative contribution of these elements of the intervention from the impact of follow-up sessions. • There was insufficient evidence to identify important effects from: <ul style="list-style-type: none"> - Tailoring of intervention material to individuals - Types of provider - Setting

Abbreviations: RCT = Randomised Controlled Trial, nRCT = non-randomized controlled trial, PA = Physical activity, BI = Brief intervention

Table 6: Summary of barriers and facilitators of Brief Intervention delivery and uptake identified by Campbell et al.

2012 [8]

Facilitators of practitioner delivery of brief interventions	Facilitators of patient uptake of brief interventions
<p><i>Practitioner-related factors:</i></p> <ul style="list-style-type: none"> • Positive views about the health benefits of physical activity, and effectiveness of brief advice. • Perception that physical activity promotion is part of their role. • Knowledge of physical activity and confidence in delivering brief interventions and promoting physical activity. • Practitioners who are more physically active. • Perception that a patient has certain characteristics. • Perceived likelihood of patient uptake of advice. <p><i>Intervention-related factors:</i></p> <ul style="list-style-type: none"> • Structured protocols with clear and simple messages and process. • Insufficient evidence for use of technology to increase BI delivery. <p><i>System/structural factors:</i></p> <ul style="list-style-type: none"> • Availability of support and specialist staff, knowledge of downstream structures, and presence of structural support. 	<p><i>Intervention-related factors:</i></p> <ul style="list-style-type: none"> • Advice is preventative (rather than treatment-based). <p><i>Practitioner characteristics:</i></p> <ul style="list-style-type: none"> • Appearance/dress, ease of availability, perceived intelligence compared to other general practitioners. <p><i>Patient characteristics:</i></p> <ul style="list-style-type: none"> • Higher education and income levels. • Already physically active. • Better recall and understanding of advice. • Awareness of physical activity recommendations. • Older patients who feel they are being listened to. • Offer of incentives (e.g. financial or cash equivalents) to act on advice. • More receptive of treatment-based advice when ready to change or have a relevant condition.
Barriers to practitioner delivery of brief interventions	
<p><i>Intervention-related factors:</i></p> <ul style="list-style-type: none"> • Perceived lack of provision of high quality print materials to reinforce verbal messages. • Perceived lack of provision of financial incentives. • Perceived lack of provision of other support resources (e.g., knowledge of downstream structures and structural support). <p><i>System/structural factors:</i></p> <ul style="list-style-type: none"> • Lack of time. 	

Figure 1: PRISMA flow diagram of articles excluded and included in the systematic review of systematic reviews and meta-analyses.

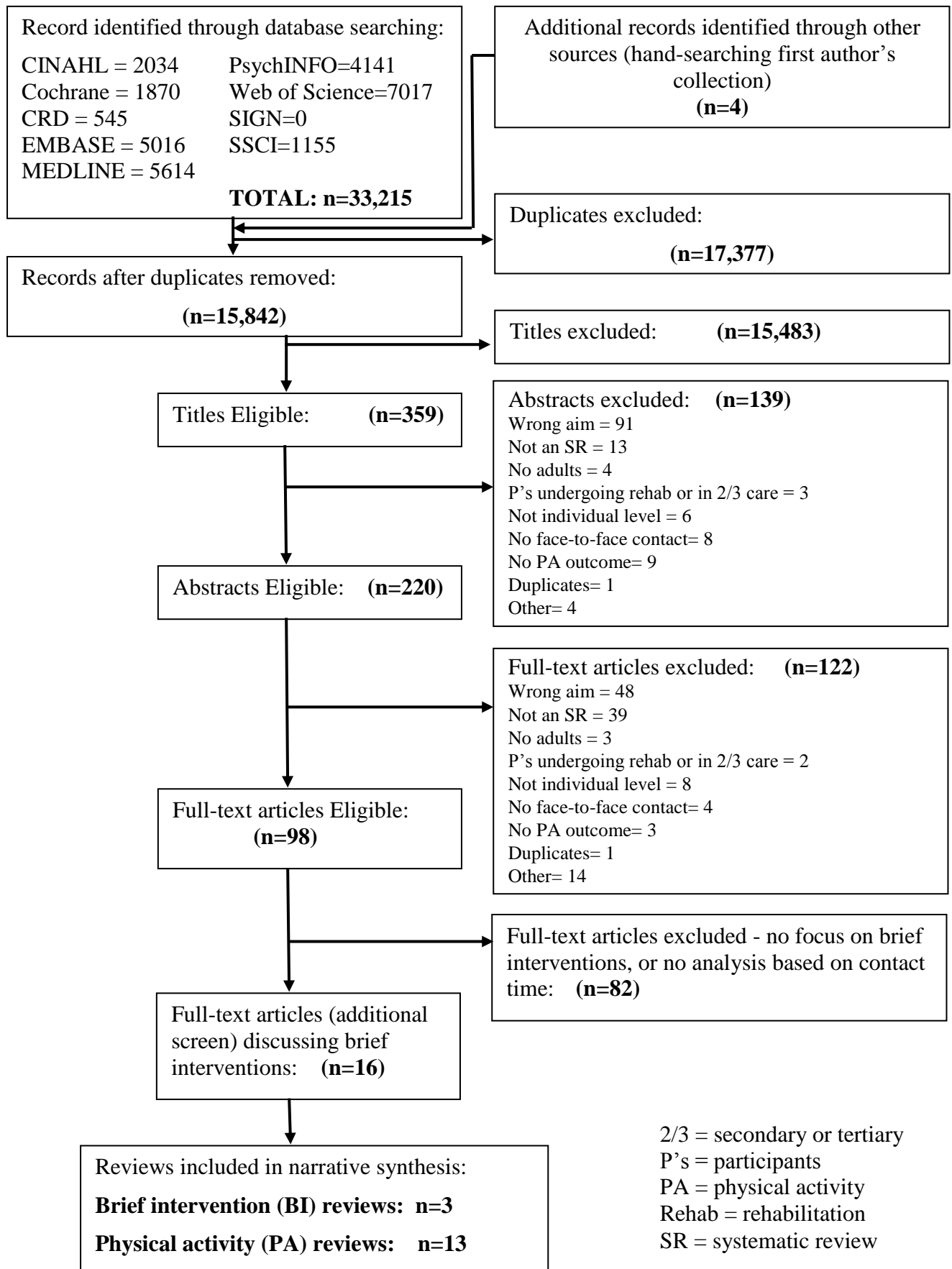
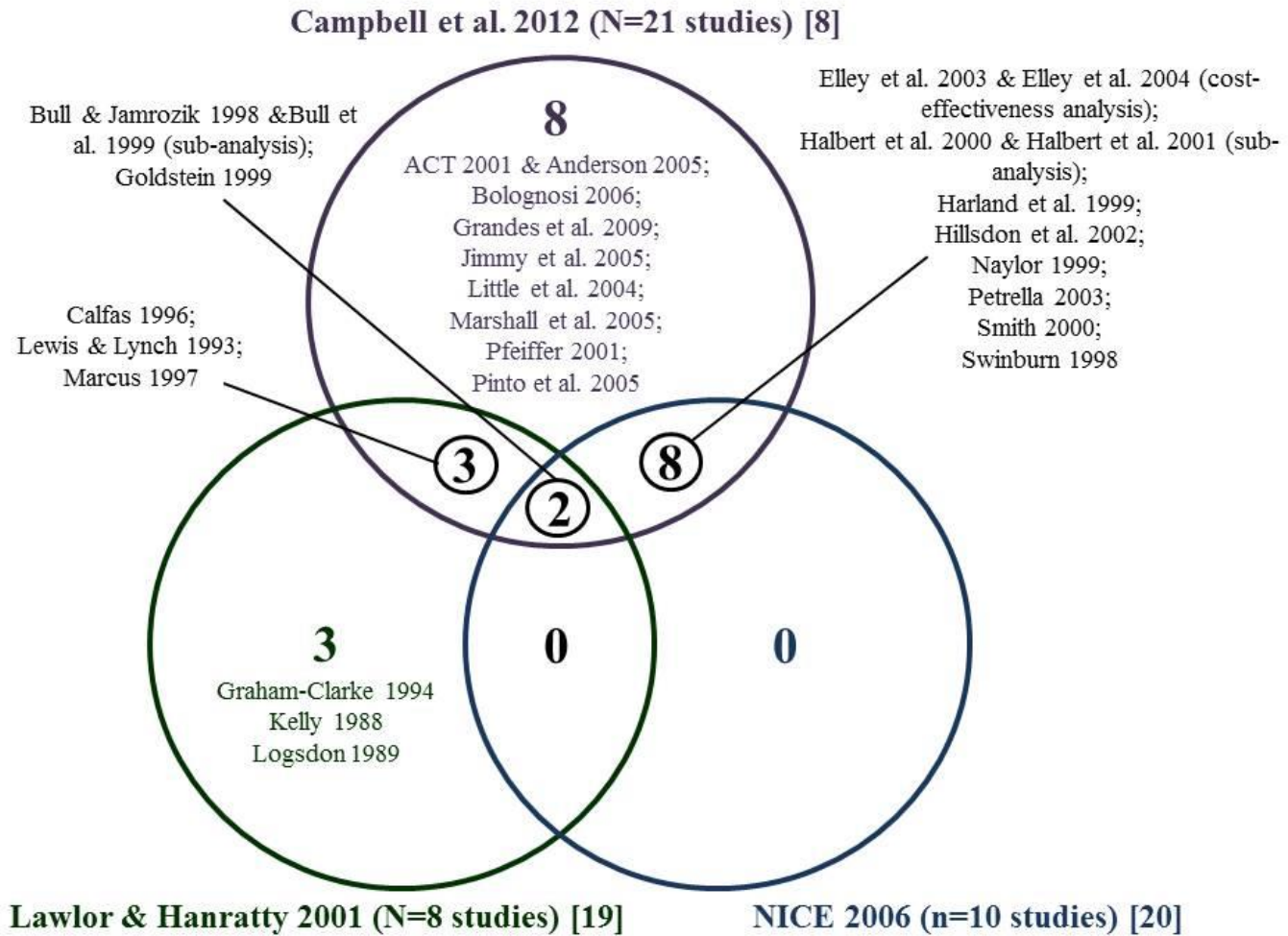


Figure 2: Venn diagram of overlap of effectiveness studies between Brief Intervention (BI) reviews included in the systematic review of reviews



Additional File 1: Search strategy

Search terms for electronic databases:

The following search strategy was used for electronic searches, MEDLINE WoK format:

*= a wildcard for any number of characters

NEAR/5 = for the first and 2nd word in any order, within 5 words.

“” = a phrase, terms are directly adjacent.

MH:exp= Physical exertion

MH:exp= Physical Fitness

MH:exp= Physical Education and Training

MH:exp= Sports

MH:exp= Dancing

MH:exp=Exercise therapy

TS=physical*NEAR/5(fit* OR train* OR activ* OR endur* OR exert* OR educat*)

TS=exercis*

TS=danc*

TS=sport*

TS=walk*

TS=bicycl*

TS= (lifestyle* OR life-style*) NEAR/5 activ*

TS= (lifestyle* OR life-style*) NEAR/5 physical*

MH:exp= Exercise

TS=inactiv*

TS=sedentary NEAR/5 (lifestyle* OR life-style* OR population* OR occupation* OR behav*)

#1 or #2 or #3 or #4 or #5 or #6 or #7 or #8 or #9 or #10 or #11 or #12 or #13 or #14 or #15 or #16 or #17

TS=increas*

TS=promot*

TS=improv*

TS=prevent*

TS=reduc*

#19 or #20 or #21 or #22 or #23

TS=intervention*

TS=(brief OR minimal)NEAR/5 intervention*

TS= Health NEAR/5 (promot* OR behav*)

TS= Prevent* NEAR/5 medicine

MH:exp= Health Promotion

TS=behav* NEAR/5 (chang* OR modif*)

TS= (lifestyle* OR life-style*) NEAR/5 chang*

MH:exp= Health Behavior

MH:exp= Preventive Medicine

TS=advis* OR advice

MH:exp= Counseling

TS=counsel*

TS=prescri*

TS=(“motivational interview*” OR “motivational counseling” OR “motivational counselling” OR “motivational intervention”)

TS=educat*

TS=program*

TS=scheme*
#25 or #26 or #27 or #28 or #29 or #30 or #31 or #32 or #33 or #34 or #35 or #36 or #37 or #38
or #39 or #40 or #41
TS=MEDLINE
TS=systematic AND TS=review
DT=meta analysis
SO=Cochrane database of systematic reviews online
TS=search
#43 or #44 or #45 or #46 or #47
#18 and #24 and #42 and #48 and Language=(English)

NB: Lemmatization was on in WoK databases. MeSH terms were only used in MEDLINE databases.

The physical activity filter (#18) was devised using the filter from an earlier Cochrane review of physical activity interventions. [52] This revised version updates old MeSH terms such as exertion (now Physical Exertion) and incorporates new terms, both MeSH and text, to improve sensitivity.

The study design filter (#48) was developed by the hedges team [53] and represents the filter with the highest specificity while also having a high level of sensitivity for capturing systematic reviews, in MEDLINE. The Hedges team demonstrate a high quality development process using a large number of articles for both development and validation. The MEDLINE filter was translated to all the other literature databases apart from EMBASE and PsycINFO. It was not applied in the Cochrane Library or CRD platforms as these databases contain only systematic reviews. If a term from the study design filter was not represented in a database then it was omitted from the strategy e.g. SCI-EX and CINAHL do not report meta analysis as a type of document that can be searched for.

EMBASE and PsychINFO were searched using the following highly specific and sensitive study design filters (displayed in Ovid format) developed specifically for these databases by the Hedges team (filters were chosen on the following criteria: the specificity filter with the highest sensitivity):

: = a wildcard for any number of characters.

EMBASE [54]

meta-analysis.tw
systematic review.tw
MEDLINE.tw
#1 or #2 or #3

PsychINFO [55]

meta-analysis.tw
search: .tw
effectiveness.tw
#1 or #2 or #3

NB: Despite the Hedges team developing a study filter for CINAHL [56] this filter did not prove sensitive enough for the current review purposes and therefore was not used.

References for search strategy:

- 52 Foster C, Hillsdon M, Thorogood M. Interventions for promoting physical activity (Review). *Cochrane Database Syst Rev* Published Online First: 2005. doi:10.1002/14651858.CD003180.pub2
- 53 Montori VM, Wilczynski NL, Morgan D, Haynes RB. Optimal search strategies for retrieving systematic reviews from Medline: analytical survey. *BMJ* 2005;330:68. doi:10.1136/bmj.38336.804167.47
- 54 Wilczynski NL, Haynes RB. EMBASE search strategies achieved high sensitivity and specificity for retrieving methodologically sound systematic reviews. *J Clin Epidemiol* 2007;60:29–33. doi:10.1016/j.jclinepi.2006.04.001
- 55 Eady A, Wilczynski N, Haynes RB. PsycINFO search strategies identified methodologically sound therapy studies and review articles for use by clinicians and researchers. *J Clin Epidemiol* 2008;61:34–40. doi:10.1016/j.jclinepi.2006.09.016
- 56 Wong SSL, Wilczynski NL, Haynes RB. Optimal CINAHL search strategies for identifying therapy studies and review articles. *J Nurs Scholarsh* 2006;38:194–9. <http://www.ncbi.nlm.nih.gov/pubmed/16773925>