

1 **The effectiveness of interventions that support women, girls, and**
2 **people who menstruate to participate in physical activity: a rapid**
3 **overview of reviews**

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28 **Abstract**

29 **Background:** Adults (age 18-64 years) are recommended 150-300 minutes of moderate-to-
30 vigorous or 75-150 minutes of vigorous-intensity physical activity per week. Irrespective, the
31 number of women not meeting recommended physical activity is 5% higher than men globally.
32 Women, girls and people who menstruate face multiple barriers to participating in physical
33 activity, including gender bias, low perceived exercise competence, and insufficient support
34 from peers and/or family. Moreover, menstruation is often reported as a barrier. Numerous
35 interventions have been proposed to increase physical activity participation of women and
36 girls, while little is known about interventions for people who menstruate. Therefore, the aim
37 of this rapid overview of reviews was to investigate the effectiveness of interventions that
38 support women, girls, and people who menstruate to participate in physical activity.
39 Additionally, this review examined whether any of these interventions incorporated managing
40 physical activity participation throughout the menstrual cycle.

41 **Methods:** Bibliographic databases (MEDLINE, Emcare, and AMED on OVID platform;
42 CINAHL and SPORTDiscus on EBSCO; Epistemonikos, and Cochrane Database) and grey
43 literature were searched in March 2024. Title/abstract screening was conducted by one
44 reviewer and 20% of records checked by a second. Full-texts screening was performed by
45 two reviewers. Data extraction and critical appraisal (using JBI systematic review checklist)
46 were conducted by one reviewer with another checking accuracy. Findings were summarised
47 narratively.

48 **Results:** Fifteen systematic reviews across 16 reports (published between 2008-2024) met
49 the inclusion criteria. The population included young and adolescent girls (n=9), adult women
50 (n=3), mothers and daughters (n=2), and mixed population (n=1). A wide range of
51 interventions were identified which were educational, environmental or multicomponent. None
52 of the included systematic reviews described interventions focusing on managing physical
53 activity participation throughout the menstrual cycle. Most reviews found mixed effectiveness
54 in increasing physical activity participation, leading to inconclusive results.

55 **Conclusion:** There is a need for further research to better support women, girls, and people
56 who menstruate to participate in physical activity, with particular focus on addressing barriers
57 related to the menstrual cycle. The findings can inform workplace, educational and other
58 relevant physical activity recommendations for women, girls and people who menstruate.

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60

61 **Keywords (3 to 10):** physical activity, exercise, sport, menstruation, menstrual cycle,
62 women's health, children, adolescents, rapid review, evidence synthesis

63

64 **Background**

65 Insufficient physical activity is a significant risk factor for non-communicable diseases
66 alongside having a negative impact on mental health and quality of life [1]. Hence, it is
67 important that people maintain adequate physical activity levels throughout their lifetimes. The
68 World Health Organization (WHO) provides evidence-based recommendations on required
69 activity levels for children and adolescents (5-17 years), adults (18-64 years), older adults (65
70 years and older), pregnant and postpartum women, adults with chronic conditions, and for
71 disabled children, adolescents and adults [2]. Children and adolescents should perform
72 moderate- to vigorous-intensity physical activity (MVPA) at least 60 minutes per day, and
73 vigorous-intensity aerobic and strengthening exercises at least three times a week [2]. Adults
74 between the age of 18 and 64 years are recommended either 150 to 300 minutes of MVPA or
75 75 to 150 minutes of vigorous-intensity physical activity per week [2]. However, the prevalence
76 of insufficient physical activity (less than 150 min/week moderate-intensity, or 75 min/week
77 vigorous-intensity exercise, or any combination of these) is 5% higher among women than in
78 men globally [1]. In the United Kingdom (UK), while the Department of Health & Social Care
79 [3] adopted PA guidelines similar to the WHO, women (16 years and older) were also less
80 likely to be physically active (61%) compared to men (65.6%) [4]. A similar trend also exists in

81 Wales, where women were more likely to report 'no activity' (18%) compared to all adults
82 (16%) [5].

83

84 The lower level of physical activity participation of women is particularly important, as evidence
85 suggests that women experience more ill health and impairments throughout the life course
86 [6]. As the benefits of being physically active are well documented [2], it is important to
87 understand how to support women to participate in physical activity. Since the decline in
88 physical activity often starts in puberty [7-9], it is also important to understand adolescent girls'
89 experiences and investigate what could support them to be physically active during their
90 formative years to help them become active adults [8].

91

92 Several barriers to the physical activity participation of women and girls have been
93 documented in the literature. Adolescent girls experience gender bias, low perceived exercise
94 skills and competence, lack of support from peers and/or family to be physically active, and
95 have limited time and competing priorities [10, 11]. Women between the ages of 18 and 87
96 years often reported barriers, such as body image and societal beauty standards, family
97 duties, lack of social support, religious and cultural norms, inadequate sport facilities and
98 environment, and safety issues [12]. Transgender men and non-binary individuals, referred to
99 as people who menstruate from this point forward [13], can face barriers related to
100 discrimination, the physical environment, for example changing rooms, and fear of being found
101 out [14]. Physiological differences between sexes can also act as a barrier, for example,
102 menstruation and symptoms associated with periods are often reported as factors that reduce
103 physical activity among adults and adolescents [15-17]. In the UK, a recent survey exploring
104 adolescent girls' physical activity behaviour found that 84% reported reduced interest in sport
105 and physical activity following menarche and 23% felt embarrassed to participate in exercise
106 during their periods [7].

107

108 These barriers have been recognised worldwide, and in recent years, there has been
109 increased policy focus on getting women, girls, and people who menstruate active, with
110 recommendations being made to overcome inhibiting factors. The House of Commons [18],
111 UK, and the Scottish Parliament [19] made recommendations, such as improved education
112 regarding the menstrual cycle and change in physical education kit to address barriers
113 affecting physical activity participation of adolescent girls. The Welsh Government set out
114 actions to reduce physical inactivity among women, girls and people who menstruate [20]. The
115 Office on Women's Health, USA, has dedicated pages to promoting physical activity with
116 information provided on staying safe and the importance of keeping active during menstruation
117 [21]. In Australia, the 'National Women's Health Strategy 2020-2030' prioritised the promotion
118 of physical activity, with recommendations made for tailored interventions, and improving
119 healthcare professionals' exercise literacy [22]. While these policy initiatives offer some
120 potential solutions for increasing physical activity participation among women, girls, and
121 people who menstruate, it is important that implemented interventions are supported by
122 research.

123

124 Numerous interventions have been evaluated throughout the years to increase the physical
125 activity participation of women and girls. School- or community-based interventions have been
126 investigated for young and adolescent girls [23], while workplace interventions have been
127 suggested for adult women [24, 25]. Meanwhile, little is known about interventions for people
128 who menstruate. Therefore, the aim of this rapid review was to investigate the effectiveness
129 of interventions that support women, girls, and people who menstruate to participate in
130 physical activity, mainly leisure-domain physical activity, including exercise and sport. The
131 focus is leisure-domain physical activity because it has stronger association with improved
132 mental and physical health compared to other domains, such as work or household [26, 27].
133 However, participation in leisure-domain physical activity is 3.1% lower in women than in men
134 globally [28].

135

136 Preliminary searches identified multiple systematic reviews focusing on interventions that aim
137 to support physical activity participation of women, girls, and people who menstruate [29].
138 Thus, systematic reviews were included in this review, to create a rapid overview of reviews.
139 Additionally, as menstruation and the menstrual cycle can pose a significant barrier to physical
140 activity participation of women, girls, and people who menstruate, this rapid overview of
141 reviews also examined whether the included systematic reviews contained interventions that
142 could help manage physical activity participation throughout the menstrual cycle.

143

144 **Methods**

145 Rapid overview of reviews is an established evidence synthesis methodology, commonly used
146 in policy making and rapid research, when limited time is available [30-32]. Overviews of
147 reviews can also help reduce research waste by using information from already existing
148 systematic reviews [33]. This rapid overview of reviews was based on Cochrane rapid review
149 guidance and the synthesis of systematic review evidence was informed by JBI umbrella
150 review methodology [33, 34]. A protocol detailing the methods was developed prior to the start
151 of this rapid overview of reviews, and registered on Open Science Framework (OSF) [35]. The
152 conduct of this review was reported according to the Preferred Reporting Items for Systematic
153 reviews and Meta-Analyses (PRISMA) 2020 [36] and the Reporting Items for Overviews of
154 Reviews (PRIOR) [37].

155

156 ***Eligibility criteria***

157 The Population, Intervention, Comparator, Outcome (PICO) framework was used to inform
158 the eligibility criteria (Table 1).

159

160

161

162 **Table 1: Eligibility Criteria**

163

	Inclusion criteria	Exclusion criteria
Population	<p>Women, girls, and people who menstruate from menarche^a up to menopause^b</p> <p>Women, girls, and people who menstruate with menstruation disturbances and associated conditions</p>	<p>Girls prior to menarche</p> <p>Menopausal and post-menopausal women</p> <p>Women, girls, and people who menstruate participating and competing in sports at an elite level</p> <p>Pregnancy</p> <p>Postpartum women^c</p> <p>Women, girls, and people who menstruate with a chronic health condition (e.g. cancer, diabetes, cardiovascular disease, etc.) or obesity, smoking, and poor nutrition</p>
Intervention / exposure	<p>Interventions that support women, girls, people who menstruate to participate in leisure-domain physical activity^d / exercise^e / sport^f</p> <p>Interventions that manage leisure-domain physical activity^d / exercise^e / sport^f participation throughout the menstrual cycle</p>	<p>Interventions focusing on behaviour change of people with a chronic health condition (e.g. cancer, diabetes, cardiovascular disease, etc.) or obesity, poor nutrition, and smoking (e.g. weight management interventions, smoking cessation)</p> <p>Exercise-based prehabilitation / rehabilitation for surgical interventions or treatments for health conditions</p> <p>Enhanced Recovery After Surgery (ERAS)</p>
Comparator	Any	
Outcome	<p>Participation</p> <p>Attendance</p> <p>Leisure-domain physical activity / exercise / sport behaviour</p> <p>Leisure-domain physical activity / exercise / sport frequency, intensity, or duration</p>	
Setting / Context	Any	
Study design	<p>Quantitative systematic reviews</p> <p>Mixed methods systematic reviews using segregated approach to synthesize the findings</p>	<p>Primary studies</p> <p>Narrative or non-systematic reviews</p> <p>Scoping reviews</p> <p>Qualitative systematic reviews</p> <p>Mixed methods systematic reviews using an integrated approach to synthesize the findings</p>
Language of publication	English	Languages other than English

Publication date	2008 - Current	Reviews published prior to 2008
Publication type	Published and preprint, grey literature	
Other factors <i>Any other key points to note</i>	No geographical limitations	

164

165 **Definitions:**

166 ^a Menarche: “The start of menstrual periods in adolescence” [38]. “This is usually between age 8 and
167 17” [39].

168 ^b Menopause: “Menopause is a biological stage in a woman’s life when menstruation stops permanently
169 due to the loss of ovarian follicular activity. It occurs with the final menstrual period and is usually
170 diagnosed clinically after 12 months of amenorrhoea. In the UK, the mean age of natural menopause
171 is 51 years, although this can vary between different ethnic groups” [40].

172 ^c Postpartum: “Postpartum refers to a period of time after the end of pregnancy. The postpartum period
173 is commonly defined as up to six weeks following the end of pregnancy, with the late postpartum period
174 from six weeks up to one year after the end of pregnancy” [3].

175 ^d Leisure-domain physical activity: “Physical activity performed by an individual that is not required as
176 an essential activity of daily living and is performed at the discretion of the individual. Such activities
177 include sports participation, exercise conditioning or training, and recreational activities such as going
178 for a walk, dancing, and gardening” [2].

179 ^e Exercise: “A subcategory of physical activity that is planned, structured, repetitive, and purposeful in
180 the sense that the improvement or maintenance of one or more components of physical fitness is the
181 objective. “Exercise” and “exercise training” frequently are used interchangeably and generally refer to
182 physical activity performed during leisure time with the primary purpose of improving or maintaining
183 physical fitness, physical performance, or health” [2]

184 ^f Sport: “Sport covers a range of activities performed within a set of rules and undertaken as part of
185 leisure or competition. Sporting activities involve physical activity carried out by teams or individuals
186 and may be supported by an institutional framework, such as a sporting agency” [2]

187

188 **Searching**

189 A comprehensive search of bibliographic databases was conducted for English language
190 publications from 2008 to March 2024. The date limit of 2008 was applied, as an evidence
191 review by NICE [23] focusing on PA promotion for adolescent girls was published that year,
192 which was a comprehensive exploration of previously published randomised controlled trials.

193 The following bibliographic databases were searched: Medline, Emcare, and AMED on OVID
194 platform; CINAHL and SPORTDiscus on EBSCO; Epistemonikos; and Cochrane Database of
195 Systematic Reviews. The search strategy was developed by an experienced information
196 specialist (EG) and tailored for each information source (see additional file 1). The websites
197 of key third sector and government organisations were also searched (see additional file 2).
198 Forward and backward citation searching was completed using Web of Science and relevant
199 studies were added to the review.

200

201 **Screening**

202 All citations retrieved from the database searches were imported into EndNote™ (Thomson
203 Reuters, CA, USA) and duplicates were removed. Following deduplication, the remaining
204 citations were imported to Rayyan™, where two reviewers (JC, AS) dual screened
205 approximately 20% of citations using the information provided in the title and abstract. The
206 rest of the citations were screened by a single reviewer (JC). Any conflicts in the title and
207 abstract screening were resolved by a third reviewer (EG). For citations that appeared to meet
208 the inclusion criteria, or in cases in which a definite decision could not be made based on the
209 title and abstract alone, the full texts were retrieved. The full texts were screened for inclusion
210 by two reviewers (JC, EG, JH, MK, MM, AS) and any disagreements were resolved by a third
211 reviewer (JC, EG). Systematic reviews that contained a wider population range than the
212 inclusion criteria, for example a review that included studies with young and post-menopausal
213 women, were included if the majority (75%) of the review population met the inclusion criteria
214 [41].

215

216 ***Assessment of methodological quality***

217 Eligible systematic reviews were critically appraised using the JBI critical appraisal checklist
218 for systematic reviews and research syntheses [33]. Methodological quality assessment was
219 conducted by one reviewer (JC, DE, EG, JH, MK, MM, AS) and checked by a second (DE,
220 MK, MM) and any disagreements were resolved by a third researcher (JC, DE). All included
221 systematic reviews regardless of the results of their methodological quality, underwent data
222 extraction and synthesis.

223

224 ***Data extraction***

225 Data were extracted directly into a data extraction table by one reviewer (JC, DE, EG, JH, MK,
226 MM, AS) and checked by another (JC, DE). The data extracted included specific details about
227 the included systematic reviews (purpose of the review; number, publication date, research
228 design and quality rating of included studies; Grading of Recommendations, Assessment,

229 Development and Evaluation (GRADE); populations; interventions (type, length, setting and
230 country); and outcomes of significance to the review questions and objectives). Data extraction
231 process was piloted on one report to see whether the data extraction table was fit for purpose.

232

233 To investigate whether any of the included systematic reviews contained interventions that
234 aimed to support physical activity participation throughout the menstrual cycle, full-text
235 documents, included studies tables, and additional materials were thoroughly examined. If
236 information was provided on any interventions focusing on managing the menstrual cycle, it
237 was extracted. Additionally, titles of all included studies within the systematic reviews were
238 tabulated and examined for any mention of menstruation, period or menstrual cycle.

239

240 ***Synthesis***

241 The data extracted from selected reviews was tabulated and reported narratively as a series
242 of thematic summaries [42]. As this work was a rapid overview of reviews, it is possible that
243 identified systematic reviews include the same primary research studies. This phenomenon is
244 called overlap, which could lead to overestimation of results [43]. To determine the degree of
245 overlap, the corrected covered area was calculated [43]. Based on the corrected covered area,
246 less than 5% overlap is a slight overlap, 6-10% is a moderate overlap, 11-15% is a high overlap
247 and >15% is a very high overlap [43].

248

249 ***Assessment of body of evidence***

250 To determine the certainty in the evidence, existing Grading of Recommendations
251 Assessment, Development and Evaluation (GRADE) results were extracted from the included
252 systematic reviews [44]. For systematic reviews where GRADE assessment had not been
253 completed, the GRADE assessment checklist developed by Meader et al. [45] was used to try
254 to determine the certainty in the evidence [46].

255

256 **Results**

257 ***Flow of studies through the review***

258 The flow of citations through each stage of the review process is displayed in a PRISMA
259 flowchart [36] and can be found in Figure 1. The database searches identified 1752 records
260 and after duplicates were removed 1040 records underwent title and abstract screening.
261 Following this process, the full-texts of 34 reports were screened against the inclusion criteria.
262 An additional 29 reports were identified from grey literature searching and of these 13 full-
263 texts were screened against the inclusion criteria. Fifteen systematic reviews published across
264 16 reports were included in this review. The full details of reports excluded at full text screening
265 can be found in additional file 3.

266

267 *Insert Figure 1 around here*

268

269 ***Characteristics of included reviews***

270 The characteristics of the included reviews can be found in Table 2 and additional file 4 and
271 are also described narratively below.

272

273 *Insert Table 2 around here*

274

275 The included systematic reviews were published between 2008 and 2024. Nine systematic
276 reviews were conducted with young and adolescent girls and interventions were delivered in
277 a variety of settings, including schools (extracurricular / after school activities), communities
278 including clubs and teams, primary care services, at participants' home, or online [23, 47-54].
279 Three systematic reviews focused on adult women, with interventions delivered in the
280 community or workplace [24, 25, 55]. Two systematic reviews summarised interventions for
281 mothers and daughters, which were conducted in settings, such as the community, after
282 school clubs, home or online [56, 57]. One systematic review included studies conducted with

283 adolescents or adult women [58]. None of the included systematic reviews contained
 284 information about interventions for people who menstruate. Information about the ethnicity of
 285 study participants was only reported across two of the included systematic reviews [49, 54],
 286 with both including African American and Latinx populations.

287

288 The majority of studies within the included systematic reviews were conducted in the USA [23-
 289 25, 48-50, 52-57]. Other countries where studies within the systematic reviews were
 290 conducted included Australia [23, 24, 48-50, 52-58], UK [23, 24, 47-53, 58], Iran [25, 49, 52,
 291 53, 55, 56], and several European countries [23, 25, 48, 52, 53, 58].

292

293 There were a wide variety of outcomes reported which included participation in team sport
 294 [47], participation in physical activity [48, 55], attendance at PE within school [51], PA
 295 behaviours [49, 53], movement behaviour [58], changes in physical activity levels [49, 57] or
 296 outcomes [23, 24, 50, 52, 54, 56, 57]. These outcomes were often used interchangeably
 297 across the systematic reviews to describe a range of outcome measures and units of
 298 measurement focusing on physical activity, for example; specific minutes per week of MVPA,
 299 mean daily MVPA, Metabolic Equivalent of Task (MET) minutes per week, METs per week
 300 Mean steps/day, Moderate steps/day and weekly leisure activity score.

301

302 ***Methodological quality***

303 The details of the critical appraisal scores for each included systematic review can be found
 304 in Table 3.

305 **Table 3: JBI critical appraisal scores for systematic reviews and research syntheses**

Study	JBI Appraisal items											Score
	1	2	3	4	5	6	7	8	9	10	11	
Allison et al. 2017 [47]	Y	Y	N	Y	N	U	U	Y	n/a	Y	Y	6
Amiri Farahani et al. 2015 [55]	Y	Y	U	N	U	Y	Y	Y	n/a	Y	Y	7
Barnes et al. 2018 [56]	Y	Y	N	U	U	Y	Y	Y	n/a	Y	Y	7
Biddle et al. 2014 [48, 59]	Y	Y	U	U	Y	Y	U	Y	Y	N	Y	7
Brennan et al. 2021 [57]	Y	Y	N	U	Y	Y	Y	Y	n/a	Y	Y	8

Camacho-Minano et al. 2011 [49]	Y	Y	U	U	N	U	Y	Y	n/a	Y	Y	6
Houle et al. 2020 [50]	Y	Y	U	U	N	Y	Y	N	n/a	Y	Y	6
Kelly et al. 2024 [51]	Y	Y	N	Y	Y	U	U	Y	n/a	Y	Y	7
Madden et al. 2020 [25]	Y	Y	Y	U	Y	N	Y	Y	n/a	Y	Y	8
Matheson et al. 2023 [58]	Y	Y	N	Y	Y	Y	Y	U	Y	Y	Y	9
NICE 2008 [23]	Y	Y	Y	U	Y	Y	U	Y	n/a	Y	Y	8
Owen et al. 2017 [52]	Y	Y	N	U	Y	U	Y	Y	Y	Y	Y	8
Pearson et al. 2015 [53]	Y	Y	N	U	Y	Y	U	Y	Y	N	Y	7
Reed et al. 2017 [24]	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	11
Voskuil et al. 2017 [54]	Y	Y	Y	U	Y	U	U	Y	n/a	Y	Y	7

306

307 **Key:** Y – Yes; N – No; U – Unclear; n/a – not applicable

308

309 1. Is the review question clearly and explicitly stated?

310 2. Were the inclusion criteria appropriate for the review question?

311 3. Was the search strategy appropriate?

312 4. Were the sources and resources used to search for studies adequate?

313 5. Were the criteria for appraising studies appropriate?

314 6. Was critical appraisal conducted by two or more reviewers independently?

315 7. Were there methods to minimize errors in data extraction?

316 8. Were the methods used to combine studies appropriate?

317 9. Was the likelihood of publication bias assessed?

318 10. Were recommendations for policy and/or practice supported by the reported data?

319 11. Were the specific directives for new research appropriate?

320

321 There are 11 items on the JBI critical appraisal checklist for systematic reviews and only one

322 systematic review fulfilled all 11 criteria [24]. Only four of the reviews were assessed as having

323 conducted an adequate search strategy including the use of subject headings or MESH terms

324 as part of the search [23-25, 54]. Additionally, while all systematic reviews searched more than

325 two bibliographic databases, only three reviews included a search for grey literature in the

326 subject area [24, 51, 58]. Five systematic reviews did not use appropriate criteria for

327 appraising studies as they developed their own appraisal tools or used questions from a range

328 of pre-existing appraisal checklists without validating or piloting the new tool [47, 49, 50, 55,

329 56]. It was not always reported if the critical appraisal was performed by two or more reviewers

330 [47, 49, 51, 52, 54] or if measures were taken to minimise errors in data extraction [47, 48, 51,

331 53, 54]. It was felt that 13 out of the 15 reviews used appropriate methods to combine studies.

332 With regards to the data analysis only five of the reviews reported a meta-analysis [24, 48, 52,

333 53, 58]. The five systematic reviews that performed a meta-analysis assessed publication bias.

334 Three reported small or negligible evidence of publication bias [48, 53, 58], while two found

335 high probability [24, 52].

336

337 Regarding the designs of included studies within the systematic reviews, one systematic
338 review did not report the type of primary research study included [51]. One systematic review
339 only included cross-sectional and quasi-experimental studies [47]. Two systematic reviews
340 only contained randomised controlled trials [54, 58], while the rest of the systematic reviews
341 included a mixture of randomised and non-randomised studies (quasi-experimental, controlled
342 trials, pre-post designs, among others) [23-25, 48-50, 52, 53, 55-58]. Based on the original
343 author's assessment, quality of the included primary research studies within the systematic
344 reviews varied, with over half of them rated as poor quality or having high or moderate risk of
345 bias. Further detail of the quality of included primary studies is extracted in additional file 4.

346

347 **Overlap**

348 The included systematic reviews contained 288 primary research reports, of which 222 were
349 unique. Corrected covered area was 2.1%, indicating a slight overlap across all systematic
350 reviews [43]. However, following pairwise comparison between systematic reviews, very high
351 overlap (>15%) was detected between five pairs, high (11-15%) between two pairs, moderate
352 (6-10) between six pairs, and slight (0-5%) between six pairs. Overlap was detected between
353 reviews focusing on similar populations, for example mothers and daughters, but none of the
354 reviews completely overlapped. Pairwise overlap is depicted in Figure 2.

355

356 *Insert Figure 2 around here*

357

358 **Effectiveness of interventions for young and adolescent girls**

359 Results across the nine systematic reviews which focused on young and adolescent girls
360 found mixed effectiveness of interventions that support physical activity participation. None of
361 the reviews focusing on young and adolescent girls described interventions focusing on
362 managing physical activity participation throughout the menstrual cycle.

363

364 Six of the systematic reviews used narrative synthesis to summarise the results of primary
365 research studies and three undertook meta-analysis. Those that used narrative synthesis
366 found either mixed [23, 47, 49, 54] or no effect [50, 51]. No effect meant that all included
367 primary studies failed to demonstrate measurable change in physical activity participation
368 either at post-intervention or at follow-up. However, the systematic reviews showing no effect
369 contained a very small number of primary studies, ranging from one to four. Mixed effect meant
370 that some of the primary studies included in the systematic reviews showed a positive change
371 in physical activity participation, while others failed to show an effect.

372

373 Regarding intervention types, one of the systematic reviews showing no effect focused on
374 extra-curricular physical activity programmes, including physical activity only (dance) or
375 multicomponent interventions (group discussions, motivational elements, text messaging,
376 newsletters) [50]. The other review focused specifically on sporting role model interventions,
377 for which the one included peer-reviewed publication found no effect [51]. This review has also
378 identified 15 interventions from the grey literature, although most had unavailable or
379 unpublished programme evaluations, so effectiveness could not be inferred [51].

380

381 Out of the systematic reviews with narrative synthesis reporting mixed results, one focused
382 on team sport participation and the interventions included partnership working, grant funding,
383 and multicomponent approaches (containing a mixture of staff training, action planning, grant
384 funding, partnership working, resource provision, how-to guide, gender-specific research
385 insights, and merchandise) [47]. Two reviews categorised interventions as single- (including
386 educational) and/or multicomponent interventions, although it was unclear what the authors
387 understood by single- and multicomponent [49, 54]. Interventions in these two systematic
388 reviews often included a wide variety of components, such as various exercises, behavioural
389 counselling, family involvement, health education, written material, self-monitoring, and
390 environmental and policy change among others. One systematic review categorised
391 interventions as counselling, mediated (delivered via a medium such as computer, phone or

392 printed materials), educational, or a combination of these [23]. All three intervention types or
393 their combinations showed mixed effect, with the majority of mediated and counselling
394 interventions demonstrating no effect [23].

395

396 The three systematic reviews that conducted meta-analysis found a significant small overall
397 effect, although statistical heterogeneity was high, potentially due to the combination of
398 different intervention types and delivery [48, 52, 53, 59]. Additionally, Owen et al. [52] identified
399 an outlier study, and following its removal no significant effect was detected and heterogeneity
400 substantially reduced. All three reviews conducted sub-group analyses based on intervention
401 types, with Biddle et al. [48, 59] and Pearson et al. [53] categorising studies as educational,
402 environmental and multicomponent (combination of educational and environmental).
403 However, it was unclear how educational and environmental interventions were defined, and
404 these also contained a wide selection of different elements, such as specialist led PE, after-
405 school or curriculum programme, behaviour modification lessons, and skill building, among
406 others, adding to further clinical and statistical heterogeneity. Subgroup analyses in Owen et
407 al. [52] were conducted based on two categories, single and multicomponent interventions.
408 Similarly to the other two systematic reviews, these categories were not clearly defined, and
409 multicomponent interventions contained a wide selection of elements, such as environmental
410 adaptations, modified physical education lessons, educational and counselling sessions,
411 extra-curricular physical activity, among others.

412

413 Results of the subgroup analyses shows that all three reviews found significant small effects
414 for multicomponent interventions [48, 52, 53, 59], although two reviews still had significantly
415 high heterogeneity [48, 53, 59]. Biddle et al. [48, 59] focused specifically on pre-adolescent
416 girls, and reported a significant small effect for educational interventions, although statistical
417 heterogeneity was high in this subgroup analysis. No significant effect was detected for single
418 component interventions [52], and educational and environmental interventions [53] in
419 adolescent girls.

420

421 ***Effectiveness of interventions for adult women***

422 Three systematic reviews focused on interventions to support the physical activity participation
423 of adult women [24, 25, 55], and none of these reported interventions on managing physical
424 activity participation throughout the menstrual cycle. Two of these combined studies using
425 narrative synthesis and one used a meta-analysis. The two systematic reviews reporting their
426 findings using narrative synthesis found mixed effectiveness of interventions [25, 55]. These
427 two systematic reviews included primary studies focusing on community-based
428 multicomponent interventions [55], and workplace programmes categorised as exercise,
429 interrupted sitting, and multicomponent interventions [25]. Community-based multicomponent
430 interventions comprised of varied elements, such as social support, goal setting, self-
431 monitoring, cultural facilitators, problem-solving training, media messages and economic
432 incentives [55]. Multicomponent workplace programmes included elements, such as
433 education, peer support, incentives, counselling, cognitive restructuring, problem solving and
434 overcoming barriers, among others [25]. Madden et al. [25] did not provide a breakdown of
435 whether exercise, interrupted sitting, or multicomponent interventions were more effective,
436 although the authors did report that interventions that had technology as their main
437 component, such as Nintendo Wii™ or treadmill, showed no effect on increasing PA outcomes.

438

439 The systematic review with meta-analysis of workplace interventions found differing results
440 based on the unit of measurement [24]. Separate meta-analysis was performed for minutes
441 per week of MVPA, METs per week, and MET min/week, and results suggests that studies
442 that measured physical activity via minutes per week of MVPA or METs per week detected no
443 significant effect for workplace interventions. On the contrary, when measured in MET
444 min/week, significant increase in physical activity was observed, although only a small number
445 of studies (n=4) reported this unit of measurement. Statistical heterogeneity was high in all
446 three meta-analyses. Regarding intervention types, Reed et al. [24] categorised workplace
447 programmes, as single and multi-intervention strategies, the elements of which included

448 counselling, messages and emails for feedback, personal partner, team-goal setting, self-
449 monitoring, educational sessions and reduction of perceived barriers, among others. However,
450 no subgroup analysis was conducted based on intervention type (single or multi).

451

452 ***Effectiveness of interventions for mixed population (young and adolescent girls and***
453 ***women)***

454 One systematic review with a meta-analysis reported no effect on movement behaviour
455 following body image or movement-based interventions for young and adolescent girls or
456 women [58]. Statistical heterogeneity was low, but the results were based on a small number
457 of studies (n=4). The interventions could further be categorised as unimodal and multimodal.
458 Hatha yoga was provided as part of a unimodal intervention, while multimodal interventions
459 focused on physical activity, strength-based approaches, or healthy body image [58]. The
460 systematic review did not mention interventions focusing on managing physical activity
461 participation throughout the menstrual cycle, and it was unclear whether the included studies
462 contained both male and female participants, or females only.

463

464 ***Effectiveness of mother and daughter interventions***

465 Results from two systematic reviews focusing on mother and daughter interventions indicate
466 mixed effectiveness [56, 57]. The results of primary studies were synthesised narratively, and
467 neither of the reviews conducted meta-analysis. Positive effects of the interventions were
468 mainly within group (pre- and post-intervention) in both systematic reviews, with only a few
469 studies showing significant between-study (group-by-time) effect [56, 57]. The investigated
470 interventions were varied and included physical activity components, such as dance, fitness,
471 interactive games, group walking, and material components, for example newsletters,
472 booklets, certificates, DVDs, stickers, jump ropes, balls, weights, pedometers, and logbooks.
473 Barnes et al. [56] concluded that multicomponent interventions and those that allowed mothers
474 and daughters to participate together may lead to better physical activity participation. Brennan
475 et al. [57] focused on behaviour change techniques and found that goal setting and information

476 on health consequences were more promising to improve physical activity participation
477 compared to others included in the systematic review. Regarding intervention components
478 focusing on managing physical activity participation throughout the menstrual cycle, neither of
479 the reviews mentioned or described such components.

480

481 ***Theoretical approach underpinning the interventions***

482 Out of the 15 included systematic reviews only 10 reported whether the original studies used
483 any theories, such as behaviour change or learning, to develop the interventions [23, 25, 48,
484 49, 52-55, 57, 58]. Six of these systematic reviews focused on young and adolescent girls [23,
485 48, 49, 52-54], two on adult women [25, 55], and one each on mothers and daughters and
486 mixed population [57, 58]. A wide variety of theories or models were reported in these
487 systematic reviews, but the most common ones were social cognitive theory, social ecological
488 model, and the transtheoretical model. Theories used are detailed in additional file 5. Three
489 systematic reviews with meta-analysis conducted subgroup analysis based on whether a
490 theory was used for intervention development [48, 52, 53]. Results from two of these
491 systematic reviews found that interventions for adolescent girls with a theoretical approach
492 were more effective than atheoretical [52, 53]. However, the systematic review focusing on
493 pre-adolescents found that atheoretical interventions were more effective than those with a
494 theoretical approach [48].

495

496 ***Certainty in the evidence***

497 Only one systematic review focusing on adult women receiving workplace interventions
498 conducted GRADE assessment, and the overall certainty in the evidence base was found very
499 low [24]. Due to the majority of publications reporting findings narratively and the reviews with
500 meta-analysis not reporting detailed risk of bias assessment, it was not possible to determine
501 GRADE for the rest of the findings.

502

503

504 **Discussion**

505 The aim of this rapid overview of reviews was to investigate the effectiveness of interventions
506 that could support women, girls, and people who menstruate to participate in physical activity,
507 and the majority of the included systematic reviews indicate an overall mixed effect regardless
508 of the target population. While these mixed results are mainly based on narrative reviews,
509 where statistical pooling was not possible, the findings from systematic reviews with meta-
510 analysis also indicate mixed effect. While significant small effects were detected for
511 interventions designed for pre-adolescent and adolescents [48, 53, 59], in one review no
512 statistically significant positive effect was detected after the removal of an outlier [52].
513 Subgroup analysis also indicates that single component interventions, educational, and
514 environmental interventions may not increase physical activity participation significantly.

515

516 These results are similar to those observed in the wider literature not specifically focused on
517 adolescent girls. Multiple systematic reviews exist that suggest that school-based
518 interventions, such as educational interventions, do not increase physical activity participation
519 significantly in the wider population including adolescent boys [60-62]. Additionally, there is no
520 difference between the results of adolescent girls and boys [61, 62]. However, Schulze et al.
521 [62] concluded that there was a need for sex/gender to be considered when developing or
522 choosing intervention content and materials and measurement instruments. This is particularly
523 important as this rapid overview of reviews also found that none of the interventions described
524 in the included systematic reviews mentioned managing physical activity participation
525 throughout the menstrual cycle, which should be a specific sex/gender consideration.

526

527 Recent reports suggest that young and adolescent girls' interest in sports and physical activity
528 reduces with menarche [7, 9, 17]. Moreover, a recent systematic review focusing on women,
529 girls and people who menstruate identified multiple barriers to physical activity in association
530 with the menstrual cycle. These included societal taboo, fear and anxiety related to being

531 “found out”, physical symptoms, and beliefs related to physical activity which often resulted in
532 avoiding participation [63]. This also highlights the need for improving knowledge and
533 resources around physical activity and the menstrual cycle. Moreover, there is a lack of
534 evidence-based guidelines worldwide regarding continuing to be physically active during the
535 menstrual cycle [63], and the findings of this rapid overview of reviews support this. The lack
536 of mention regarding the menstrual cycle in 15 systematic reviews specifically focusing on
537 girls and women, indicates a gap in the PA promotion literature. This is supported by a recent
538 report that only identified two primary research studies and an organisational report focusing
539 on managing physical activity throughout the menstrual cycle [29]. This lack of evidence is
540 significant, as insufficient physical activity is a risk factor for non-communicable diseases[1],
541 whilst evidence suggests that exercise may be an effective strategy for managing
542 premenstrual syndrome [64], and dysmenorrhea [65]. Future research should focus on
543 developing and evaluating interventions that address barriers related to the menstrual cycle.
544 Additionally, policymakers will need to consider guidance that could help reduce societal taboo
545 around the menstrual cycle and menstruation.

546

547 While menstruation and the menstrual cycle can have a significant impact on young and
548 adolescent girls’ PA participation, other factors can also act as a barrier. There is a significant
549 evidence-base suggesting that lack of family and peer support, time limitations, gender bias,
550 body image, and perceived competence can also act as barriers [10, 11]. Therefore,
551 approaches that target multiple inhibiting factors may be necessary. Recommendations that
552 have been made in the literature include, addressing gender norms in the curriculum, training
553 for teachers and professionals, and environmental changes [11]. While environmental and
554 single component approaches did not seem to be effective individually [48, 52, 53, 59], as
555 supported by the wider evidence-base [66], multicomponent interventions were found more
556 effective across the reviews. This supports that multiple factors may need to be targeted for
557 young and adolescent girls to be physically active.

558

559 Regarding adult women, similar mixed effectiveness of interventions aiming to improve PA
560 participation was identified as for young and adolescent girls. Multimodal and individualised
561 interventions seemed to be more effective than unimodal interventions lacking tailoring [25].
562 Tailoring and a multicomponent approach is crucial as adult women face diverse barriers to
563 PA, some of which may be similar to those experienced by young and adolescent girls', such
564 as gender bias, body image, lack of family and peer support, and time [12, 67]. However, other
565 barriers may be specific to adults, such as family and domestic duties [12, 67]. Additionally,
566 adult women also experience menstruation and the menstrual cycle as barriers, which is not
567 considered in any of the included systematic reviews in this rapid overview of reviews [16].
568 Future research should focus on multicomponent interventions tailored to the needs of adult
569 women, particularly considering the menstrual cycle.

570

571 From the point of view of quality of the evidence, the systematic review with meta-analysis
572 focusing on adult women in the workplace found different results with different units of
573 measurement used (Minutes per week MVPA, MET min/week) [24]. As separate analysis was
574 conducted for separate units of measurement, it is possible that interventions in the different
575 subgroups may have been significantly different. Additionally, research from the wider
576 evidence base suggests that using various analytical methods and units of measurement may
577 detect change in physical activity participation differently [68-70]. Hence, there is a need for
578 more research using uniform and reliable data collection and analytical methods that are
579 sensitive to detect changes in specific populations, inclusive of women, girls, and people who
580 menstruate.

581

582 Explanation for mixed effect across the 15 systematic reviews may relate to interventions and
583 components often not being defined, and frequently being grouped based on the delivery
584 setting, for example school or community. This potentially led to the high clinical and statistical
585 heterogeneity and difficulty in combining data in a meta-analysis. Although not specifically
586 investigated for this rapid overview of reviews, primary studies across the reviews also differed

587 in delivery method, theoretical approach, profession of instructors, duration, and intensity,
588 leading to further heterogeneity across the studies. Moreover, review authors reported high or
589 moderate risk of bias in the majority of included studies, which could lead to varying results
590 and a lack of certainty in the evidence. Only one systematic review conducted GRADE
591 assessment, which found very low certainty in the evidence for workplace interventions for
592 adult women [24]. Future research will need to develop robust study designs and define and
593 describe interventions for replicability and generalisability.

594

595 ***Strength and limitations of the review***

596 While established rapid review guidance was followed for this review, it still has some
597 limitations. Even though a comprehensive search strategy was developed across multiple
598 databases, it is possible that relevant reviews may have been missed due to focusing
599 searches on terms related to girls, women, female, and menstruation. However, forward and
600 backward citation searching were completed and a thorough grey literature search across
601 multiple organisational and government website was conducted, ensuring that as many
602 relevant systematic reviews were identified as possible.

603

604 The advantage of overviews of reviews is that they provide a breadth of evidence that would
605 not be possible to cover in a single systematic or rapid review. However, a possible limitation
606 of this approach is that review of the individual primary research studies is not conducted. This
607 means that it is possible that details of interventions and the populations may have been
608 missed. However, included studies tables within the systematic reviews and additional
609 materials were thoroughly checked, and titles of primary research studies were screened to
610 ensure that no significant information was missed.

611

612 While there was only a slight overlap across all 15 systematic reviews, very high pairwise
613 overlap existed between reviews focusing on mother and daughter interventions, and some of

614 the publications focusing on adolescent girls. This could potentially cause some
615 overestimation in the breadth of the evidence.

616

617 Only two systematic reviews reported including ethnic minorities, and none of the publications
618 mentioned people who menstruate but do not identify as a girl or a woman. As these
619 populations often face specific barriers, such cultural differences or stigma, their needs and
620 interventions that could support them to participate in physical activity should be investigated.

621

622 **Conclusions**

623 A substantial systematic review evidence base focusing on interventions aiming to support
624 physical activity participation for women and girls exists, although findings are mixed and the
625 certainty in the evidence is often very low. Additionally, these women and girls specific
626 systematic reviews do not consider interventions which are sex/gender specific including
627 management of the menstrual cycle during physical activity. High quality research is needed
628 to identify interventions that could help girls, women, and people who menstruate be physically
629 active, with consideration to barriers related to the menstrual cycle. Additionally, policymakers
630 will need to consider guidance that could help ease the societal taboo around menstruation.

631

632

633 **List of abbreviations**

634 GRADE - Grading of Recommendations, Assessment, Development and Evaluation

635 PRISMA - Preferred Reporting Items for Systematic reviews and Meta-Analyses

636 MVPA – Moderate to vigorous physical activity

637 MET – Metabolic Equivalent of Task

638 PA – Physical activity

639 PE – Physical education

640

641 **Declarations**

642

643 **Ethics approval and consent to participate**

644 Not applicable

645

646 **Consent for publication**

647 Not applicable

648

649 **Availability of data and materials**

650 All data analysed during this rapid overview of reviews are included in this published article
651 and its supplementary information files. The search strategy is included within the additional
652 files, but has also been shared on searchRxiv. The links to the search strategy can be found
653 below:

654 MEDLINE <https://doi.org/10.1079/searchRxiv.2024.00673>

655 AMED <https://doi.org/10.1079/searchRxiv.2024.00674>

656 CINAHL <https://doi.org/10.1079/searchRxiv.2024.00675>

657 Cochrane <https://www.cabidigitallibrary.org/doi/10.1079/searchRxiv.2024.00676>

658 Emcare <https://doi.org/10.1079/searchRxiv.2024.00677>

659 Epistemonikos <https://doi.org/10.1079/searchRxiv.2024.00678>

660 SportDiscus <https://doi.org/10.1079/searchRxiv.2024.00679>

661

662 **Competing interests**

663 The authors declare that they have no competing interests.

664

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670

671 **Authors' contributions**

672 JC developed the protocol, and wrote the first draft of the manuscript. EG, JH developed the
673 search strategy and conducted the literature searches. JC, DE, EG, JH, MK, MM, and AS
674 screened records and reports, extracted and quality appraised the data. NB, AC, AE, SM
675 provided topic expertise, while RL acted as a methodological expert. All authors read and
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677

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682

683 **Additional material**

684 Additional file 1.docx: Search strategies

685 Comprehensive search strategies across all the included databases

686

687 Additional file 2.docx: Websites of key third sector and government organisations

688 A table detailing the websites of key third sector and government organisations

689

690 Additional file 3.docx: List of excluded reports

691 Table of reports excluded on full text screening with the reason for exclusion

692

693 Additional file 4.docx: Data extraction

694 Data extraction table containing the characteristics and findings of included systematic
695 reviews

696

697 Additional file 5.docx: Table of interventions and behaviour change theories

698 A table containing components and underpinning behaviour change theories of interventions

699 included in the systematic reviews

700

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Table 2: Included systematic review characteristics

Citation Number of included studies	Participants Age	Type of interventions: definition/description	Outcome	Impact	GRADE
Young and adolescents girls					
Allison et al. 2017 [47] n=4	Girls 11–25	Partnership working (n=1) Grant funding (n=1) Multicomponent (n=2)	Team sport participation	Mixed (no inferential statistics provided)	NR
Biddle et al. 2014 ^m [48, 59] n=22	Preadolescents 5-12	Educational (n=9) Environmental (n=4) Multicomponent (n=9)	PA participation	<p><u>Overall effect</u> Significant small effect (k=22, g=0.314, 95% CI (0.112, 0.516), p<0.001) Heterogeneity: (Q_T=346.37, p<0.001, τ²=0.199, I²=93.94)</p> <p><u>Educational</u> Significant small effect (k=9, g=0.414, 95% CI (0.070, 0.759), p<0.01) Heterogeneity (τ²=0.067, I²=82.43)</p> <p><u>Environmental</u> No significant effect (k=4, g= -0.301, 95% CI (-0.795, 0.194), p>0.01) Heterogeneity (τ²=1.174, I²=98.11)</p> <p><u>Multicomponent</u> Significant small effect (k=9, g=0.503, 95% CI (0.172, 0.833), p<0.01) Heterogeneity (τ²=0.174, I²=93.17)</p>	NR
Camacho-Minano et al. 2011 [49] n=21 studies across 29 reports	Young and adolescent girls 5-18	Educational and multicomponent but interventions are not formally grouped	PA levels/ PA behaviour	Mixed (Positive effect (n=10/21))	NR
Houle et al. 2020 [50] n=17 (4 reported on PA outcomes and are extracted)	Adolescent girls 11 – 17	Extra-curricular physical activity programs PA programme (n=2) Multi-approach programme (n=2)	Mean daily MVPA minutes	No effect	NR

Kelly et al. 2024 [51] Peer reviewed paper (n=1) Grey literature (n=15)	Peer reviewed paper: Adolescents 11-16 Grey literature: Not reported	Peer reviewed paper: an elite sports role model visited the schools Grey literature: Sport role model encounters. One off encounters (n=10), multiple encounters (n=5, 2 with minimal interaction)	PE attendance	No effect (Peer-reviewed paper) Unavailable/unpublished evaluations (grey literature)	NR
NICE 2008 [23] n=12 (13 intervention arms)	Adolescent girls 11-18	Counselling (n=1) Mediated (n=4) Mediated & Counselling (n=2) Education (n=4) PA self-monitoring (n=1) Education & Mediated (n=1)	PA outcomes	<u>Mediated interventions</u> Mixed (Positive effect (n=2/6)) <u>Counselling interventions</u> Mixed (Positive effect (n=1/3)) <u>Educational interventions</u> Mixed (Positive effect (n=3/5))	NR
Owen et al. 2017 ^m [52] n=20	Adolescent girls 11-17	Multicomponent (n=10) Single component interventions (n=10)	PA outcomes	<u>Overall effect</u> Significant small effect (k=17, g=0.37, 95% CI (0.0008, 0.73), p<0.05) Heterogeneity: (Q = 80.12, p < 0.001; I ² = 94.91%) <u>Overall effect (without outlier)</u> No significant effect (k=16, g=0.07, 95% CI (-0.002, 0.14), p=0.05) Heterogeneity: (Q= 23.98, p>0.05; I ² = 0.01%) <u>Single component intervention</u> No significant effect (k=9, g=0.02, 95% CI (-0.09, 0.14), p>0.05) Heterogeneity: (Q = 11.83, p>0.05; I ² = 0.00%) <u>Multicomponent intervention</u> Small significant effect (k=7, g=0.09, 95% CI (0.006, 0.18), p<0.05) Heterogeneity: (Q = 11.30, p>0.05; I ² = 0.02%)	NR

Pearson et al. 2015 ^m [53] n=34 studies (independent samples) across 45 reports	Adolescent girls 12-18	Educational (n=21) Environmental (n=4) Multicomponent (n=9)	PA behaviours	<u>Overall effect</u> Significant small effect (k=35 ^b , g=0.350, 95% (0.12, 0.58), p <0.001) Heterogeneity: (Q _T =1436.90, τ ² =0.421, I ² =98%) <u>Educational</u> No significant effect (k=21, g=0.225, 95% CI (-0.060, 0.509), p>0.01) Heterogeneity (τ ² =0.105, I ² =89.21) <u>Environmental</u> No significant effect (k=4, g=0.372, 95% CI (-0.301, 1.046), p>0.01) Heterogeneity (τ ² =0.130, I ² =71.60) <u>Multicomponent</u> Significant small to moderate effect (k=9, g=0.618, 95% CI (0.197, 1.039), p<0.01) Heterogeneity (τ ² =0.827, I ² =99.18)	NR
Voskuil et al. 2017 [54] n=15 (5 reported on PA outcomes and are extracted)	Adolescent girls 8-12	Multicomponent (n=5)	PA outcomes	Mixed (positive effect (n=1/5))	NR
Adult women					
Amiri Farahani et al. 2015 [55] n=9	Women 18-65	Community-based multicomponent (n=9)	PA participation	Mixed (Positive effect (n=7/9) (statistical significance n=4))	NR
Madden et al. 2020 [25] n=20 studies across 23 reports	Working women 33.2±7.8 and 48.77±9.27	Workplace interventions Exercise (n=5) Interrupted sitting (n=1) Multicomponent (n=14)	PA outcomes (Mean steps/day, Moderate steps/day, Weekly Leisure Activity Score, MVPA accelerometer, Total accelerometer counts, Workday sit time, Workday average sit time)	Mixed (at least one positive effect (n=12/17))	NR

			(hours), Workday sit-to-stand transitions, MET mins/week, VO ₂ peak, VO ₂ max)		
Reed et al. 2017 ^m [24] n=24	Working-Age Women 17-51 (83%)	Workplace interventions Single intervention strategy (n=3) Multi intervention strategy (n=21)	Minutes per week of MVPA METs per week <i>MET min/week</i>	Minutes per week of MVPA (n=12) No significant effect (SMD=0.38; 95% CI, (-0.15, 0.92), p=0.16) Heterogeneity: (I ² =97%, p<0.00001) METs per week (n=3) No significant effect (SMD=0.11; 95% CI (-0.48, 0.71), p=0.71) Heterogeneity: (I ² =86%, p<0.00001) MET min/week (n=4) Significant effect (SMD=2.07, 95% CI (1.44, 2.69), p<0.00001) Heterogeneity: (I ² =97%, p<0.00001)	Very low
Mixed (both young and adolescent girls and adult women)					
Matheson et al. 2023 [58] n=31 (4 reported on Movement behaviour outcomes and are extracted)	Girls and women 0-17 >35	Body image or movement-based interventions Unimodal (n=1) Multimodal (n=3)	Movement behaviour	<u>Overall effect</u> No effect (k=4, d+=0.036, 95% CI (-0.088, 0.161), 95% PI (-0.237, 0.310), p>0.001) Heterogeneity (I ² =0.0%)	NR
Mothers and daughters					
Barnes et al. 2018 [56] n=14 studies across 16 reports	Mothers and daughters 8-19 (daughters) 32-45.2 (mothers mean age)	Community-based intervention for mothers and daughters that targeted physical activity, fitness, nutrition, or adiposity	PA outcomes	<u>Mothers:</u> Mixed (significant positive group-by-time effect (n=3/7)) <u>Daughters:</u> Mixed (significant positive group-by-time effect (n=1/8))	NR
Brennan et al. 2021 [57] n=11 (14 intervention arms)	Mothers and daughters 7-17 (daughters) 28-50 (mothers)	Described as mother and daughter interventions (no further detail reported)	PA levels	<u>Mothers:</u> Mixed (positive effect within group (n=8/11) (statistical significance n=6)) <u>Daughters:</u> Mixed (positive effect within group (n=10/13) (statistical significance n=8))	NR

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Key: CI - confidence interval; GRADE - Grading of Recommendations, Assessment, Development, and Evaluations; MET - Metabolic Equivalent of Task; MVPA - Moderate- to vigorous-physical activity; NICE - The National Institute for Health and Care Excellence; NR – not reported; PA – physical activity; PE – physical education; SMD - standardised mean difference; k - number of effect sizes; g = effect size (Hedges' g); d+ = sample weighted average effect size

^mmeta-analysis