

1 **What Effect do Goal Setting Interventions have on Physical Activity and Psychological**
2 **Outcomes in Insufficiently Active Adults? A Systematic Review and Meta-analysis**

3 Manuscript type: Review

4
5 Katie R. Garstang

6 Nottingham Trent University

7 Patricia C. Jackman

8 University of Lincoln

9 Laura C. Healy

10 Nottingham Trent University

11 Simon B. Cooper

12 Nottingham Trent University

13 Daniele Magistro

14 Nottingham Trent University

15
16 Katie Garstang, Daniele Magistro, Laura C. Healy, and Simon B. Cooper, Sport, Health and
17 Performance Enhancement (SHAPE) Research Group, School of Science & Technology,
18 Nottingham Trent University, UK. Patricia C. Jackman, School of Sport and Exercise Science,
19 University of Lincoln, Lincoln, UK.

20 Please address all correspondence to: Katie Garstang, Department of Sport Science, School of
21 Science and Technology, Nottingham Trent University, Clifton Campus, Clifton Lane,
22 Nottingham, NG11 8NS, UK. email: katie.garstang2020@my.ntu.ac.uk

23 Date of submission: 06.07.2023

24 Manuscript word count: 7,460 (including abstract and references)

25

26

Abstract

Background: Goal setting is commonly used for promoting physical activity (PA) among insufficiently active individuals. Previous reviews have analysed the effects of goal setting on PA, but the purpose of this systematic review was to examine the concurrent effects of goal setting on PA *and* psychological outcomes in insufficiently active individuals to support interventions aiming to produce sustained PA behaviour change.

Methods: In this review (PROSPERO: CRD42021243970), we identified 13 studies with 1208 insufficiently active adults that reported the effects of goal-setting interventions (range 3-24 weeks) on both PA and psychological outcomes (e.g., self-efficacy, motivation, affect). We used meta-analysis and narrative synthesis to analyse these effects.

Results: All goals used in the included studies were specific goals. Setting specific goals had a large, positive effect on PA (g [SMD] = 1.11 [$p < .001$], 95% CI 0.74-1.47), but only a small, positive effect on the combined psychological outcomes (g [SMD] = 0.25 [$p < .001$], 95% CI 0.10-0.40). Moderator analyses revealed that interventions that did not reward participants had a significantly greater effect on PA than interventions that did provide rewards ($g = 1.30$ vs. 0.60 respectively, $p \leq .003$). No other significant moderators were found.

Conclusion: Our review offers initial insight into the long-term effects of specific goals on PA *and* psychological outcomes in insufficiently active adults. Further research that examines the PA and psychological effects of goal-setting interventions and investigates a wider range of goal types could develop a stronger evidence base to inform intervention for insufficiently active individuals.

Keywords

Exercise, sedentary behaviour, motivation

Abstract word count: 250

1 **What Effects do Goal-Setting Interventions have on Physical Activity and Psychological** 2 **Outcomes in Insufficiently Active Adults? A Systematic Review and Meta-Analysis**

3 The physical, mental and social benefits of physical activity (PA; any bodily movement
4 that substantially increases energy expenditure¹) are widely documented.² Nevertheless,
5 prevalence data indicates that one-third of adults globally are not meeting the World Health
6 Organisation's (WHO) PA guidelines of ≥ 150 minutes of moderate-vigorous PA per week,^{3,4}
7 with some even labelling this issue a 'global pandemic'.⁵ If levels of physical inactivity remain
8 unchanged, it is predicted that 499.2 million new cases of preventable non-communicable
9 diseases will occur by 2030.⁶ Consequently, the development and implementation of behaviour
10 change strategies that help to address physical inactivity would be valuable to PA providers,
11 healthcare organisations, exercise practitioners, and researchers.

12 Goal setting is one of the most frequently used strategies for promoting PA behaviours,
13 particularly among those who are less active.^{7,8} A goal is defined as the objective of one's actions
14 directed towards a desired achievement or end state^{9,10}. Under the right conditions, a goal can
15 influence an individual's motivations and behaviours,¹¹ such as increasing PA. A meta-analysis
16 of 52 interventions ($N = 5912$), of mostly insufficiently active adults, indicated that goal setting
17 can have a significant, moderate effect on PA in adults ($d = 0.55$, 95% CI = 0.43-0.67).¹²
18 However, contrary to previous goal-setting theory-based research (e.g., Locke & Latham,
19 2002¹³) and the widespread use of specific goals in PA interventions, specific goals ($d = 0.589$,
20 $p < .001$), both in absolute (e.g., "to walk 10,000 steps per day") and relative (e.g., "to be 20%
21 more active compared to baseline") forms, did not produce significantly different levels of PA
22 compared to nonspecific goals (e.g., "to be more active" - $d = 0.511$, $p < .001$).¹²

23 Although the review by McEwan et al.¹² established that goal setting had a positive effect
24 on PA behaviour, researchers have also assessed the effects of goal setting on a range of
25 psychological outcomes in insufficiently active adults. For instance, evidence has emerged on
26 the effects of goal setting in PA on self-efficacy,¹⁴ motivation,¹⁵ and quality of life.¹⁶ Given that

1 psychological responses in PA (e.g., affective response) can predict long-term PA engagement
2 (e.g., Rhodes & Kates¹⁷) and that goal setting can elicit different psychological responses in
3 active compared to insufficiently active adults,¹⁸ a synthesis of evidence on the effects of goal
4 setting on PA *and* psychological outcomes in insufficiently active adults is warranted. By doing
5 so, this could provide a more complete picture of the impact of goal-setting interventions, which
6 could help to inform future PA interventions that involve goal setting.

7 Although McEwan et al.¹² found no evidence of a significant difference between goals
8 that differed in specificity (i.e., specific vs. vague goals), differences between specific and non-
9 specific goals have been found in recent studies involving exercising tasks. Specifically, findings
10 from a series of lab-based walking studies have suggested that the types of goal used within
11 interventions may influence psychological outcomes.¹⁸⁻²⁰ Despite initial experimental evidence
12 suggesting that qualitatively different goals may elicit distinct psychological responses, even in
13 the absence of any significant differences in performance, the effects of different goal types on
14 psychological outcomes in interventions over longer timeframes have yet to be synthesised. By
15 synthesising the effects of goals on psychological outcomes in PA interventions in insufficiently
16 active adults and analysing the moderating effect of goal type, better understanding of the longer-
17 term effects of different goal types on PA levels could be provided.

18 The aim of this systematic review and meta-analysis was to identify, synthesise, and
19 appraise literature on the effects of goal-setting interventions on PA and psychological outcomes
20 in insufficiently active adults. Through addressing these aims, the current review builds upon
21 previous literature (e.g., McEwan et al.¹²) by examining the effects of goals on PA *and*
22 psychological outcomes in PA interventions specifically in insufficiently active adults. By doing
23 so, the findings could offer a more comprehensive understanding of the effects of goal setting
24 interventions in PA. In turn, this could help to inform the development of goal-setting
25 recommendations for insufficiently active adults.

26

Methods

1 **Protocol and Pre-registration**

2 This systematic review was pre-registered (PROSPERO: CRD42021243970) and
3 reported in accordance with the Preferred Reporting Items for Systematic-Reviews and Meta-
4 Analysis (PRISMA) guidelines²¹ and the APA's Meta-Analysis Reporting Methods (MARS).
5 The narrative synthesis is reported following the Synthesis Without Meta-Analysis (SWiM)
6 guidelines²² (supplementary material).

7 **Eligibility Criteria**

8 Eligibility criteria were set in line with the PICO framework (Population, Intervention,
9 Comparison, and Outcome). Studies were included if they: (a) used goal setting as the primary
10 intervention to promote PA, which could have been in relation to outcomes (e.g., to spend less
11 time sitting in the day), events (e.g., to complete a 5 km run), or processes (e.g., to increase PA
12 levels¹⁹); (b) recruited sedentary (i.e. MET value < 2²³) or insufficiently active (< 150 minutes
13 of moderate-to-vigorous activity per week³) adults aged between 18 and 64 years old; (c)
14 examined the effects of the intervention on at least one PA measure and at least one psychological
15 outcome; (d) included a control or baseline measure; (e) measured the effects of the intervention
16 over a minimum of a 1-week period; (f) reported original empirical data; and (g) were published
17 as a full text in the English language. We defined a goal as “the objective or aim of an individual's
18 actions”.^{9(p126)} Where insufficiently active adults were combined with ineligible participants
19 (e.g., sufficiently active adults, children), a study was only included if data for eligible
20 participants were presented separately and could be extracted.

21 **Search Strategy**

22 Electronic database searches were conducted on three occasions from March 2021 to the
23 final search conducted in February 2023. Five electronic databases were searched: Academic
24 Search Complete; APA PsycINFO; MEDLINE; PubMed; and SPORTDiscus. Table 1 lists the
25 search terms and fields used for each search block (see supplementary material for full search
26 information for each database). To ensure that studies including step-count instructions that did

1 not explicitly refer to the term “goal” were identified, we included the term “step*” in block 1.
2 In relation to block 4, we chose to focus on broad psychological terms rather than specific
3 constructs due to the exploratory nature of this element of the review. In addition to the electronic
4 database searches, manual searches were undertaken of the reference lists of five reviews that
5 focused on goal setting or improving PA .^{8,12,24-26} All returned records were exported to Zotero
6 6.0. Duplicates were manually removed before articles were screened independently by the first
7 and fifth authors. The records were screened first at title level, before being screened at the
8 abstract level, and with the full-text screening constituting the third and final stage. After each
9 stage of screening, the first and fifth authors met to discuss their decisions, resolve discrepancies,
10 and, in the case of articles excluded at full text, agree reasons for exclusion (see supplementary
11 material for list of excluded texts and reasons). The inter-rater reliability coefficient indicated
12 “almost perfect” agreement on screening decisions ($\kappa = .93$).

13 [INSERT TABLE 1]

14 **Data Analysis**

15 *Data Extraction*

16 The following contextual information were extracted by the first author: design; sample;
17 goal; PA measure; psychological variable measure; and number of effect sizes calculated. The
18 authors of 16 studies were contacted for further information as insufficient data were presented
19 in the original articles to satisfy the requirements of a meta-analysis. Six authors replied and
20 provided the necessary data to be included. Two further studies were included, but only some of
21 the variables could be used in the analysis. No replies were received for the remaining eight
22 studies, leading to the exclusion of these articles. The fifth author reviewed and verified all
23 extracted data.

24 *Risk of Bias*

25 Risk of bias was conducted by the first author and assessed using the Cochrane Risk-of-
26 Bias Tool for Randomised Trials (RoB ²²⁷) and the Risk of Bias in Non-Randomised Studies –

1 of Interventions (ROBINS-I²⁸). The risk of bias determined by the first author for each study was
2 reviewed by the fifth author and agreement was reached (see supplementary material).

3 *GRADE Assessment*

4 The Grading of Recommendations, Assessment, Development, and Evaluation levels of
5 certainty framework (GRADE²⁹) was employed to assess the certainty of the evidence included
6 in the review (see supplementary material). The first author assessed GRADE using
7 GRADEpro,³⁰ with additional guidance on level and considerations for each sub-group provided
8 using the checklist proposed by Meader et al.³¹

9 *Meta-analysis*

10 A quantitative aggregate data synthesis was conducted with Review Manager (RevMan)
11 version 5.4 software (The Cochrane Collaboration, 2020), using a random effects meta-analysis,
12 with standard mean difference (SMD) effect sizes ($g \leq 0.2$ – small effect, $0.2 < g \leq 0.5$ – moderate
13 effect, $g \geq 0.8$ – large effect³²), and 95% confidence intervals (CI). Heterogeneity of studies was
14 assessed from visual inspection of forest plots and assessment of the I^2 statistic, where an I^2
15 statistic of 50% or greater indicated a substantial grade of heterogeneity.³³ Additionally,
16 publication bias was reduced by including grey literature,³⁴ although no grey literature met the
17 eligibility criteria. Due to the low number of included studies and diverse range of outcomes and
18 scales presented, moderator analyses could not be undertaken for all intended subgroups
19 (PROSPERO: CRD42021243970). Guided by groupings in the moderator analysis of a previous
20 review¹², the following subgroups were analysed: study characteristics (mode of intervention,
21 PA intensity, PA measure, and follow-up); sample characteristics (sex); goals (goal type and
22 time frame of goal); and additional behaviour change techniques (reward and educational
23 component). Effect size (Standard Mean Difference), standard error, 95% CI, Z-value, and Q -
24 value with p -value were calculated for each of the 11 moderators for PA. Where possible, PA
25 subgroup analyses were conducted. Due to the high level of heterogeneity in the psychological
26 outcomes assessed and measures used, a narrative synthesis approach was used to analyse

1 evidence concerning the effects of goals on psychological outcomes. Effect sizes and standard
2 mean differences (g) were computed to enable comparison across studies. Scores for variables
3 that were negatively framed (e.g., lower scores for negative affect, anxiety, or depression are
4 regarded as more positive outcomes) were reversed to ensure the overall effect-size direction
5 was consistent.

6 **Results**

7 4,834 records were identified through our searches (Figure 1). Of the 122 articles
8 screened at full-text level, 13 were included in the final review. The most common reason for
9 exclusion was that baseline activity levels of the samples were not reported ($n = 17$; see
10 supplementary material).

11 **Contextual Information**

12 The 13 included studies included RCT ($k = 10$) and non-randomised trials ($k = 3$), with
13 intervention durations ranging from three to 24 weeks. Table 2 provides an overview of study
14 characteristics. In total, 1,208 participants took part in the included studies (studies with mixed
15 gender samples $n = 11$; studies with female-only samples $n = 2$). All participants were deemed
16 not to be meeting WHO³ PA guidelines (mixed inactivity levels: $k = 1$; insufficiently active: $k =$
17 2; low active: $k = 1$; inactive: $k = 3$; sedentary: $k = 6$). Based on the contents of the goals, the
18 experimental conditions in all studies used specific, specific-relative (i.e., goals set relative to an
19 individual's current PA levels, e.g., 3,000 steps above baseline; $k = 5$) or specific-absolute (goals
20 set in relation to an absolute level of PA, e.g., 30-minutes of activity ≥ 5 days a week; $k = 8$)
21 goals. No study compared specific-relative to specific-absolute goals. No other goal types were
22 employed in any of the reviewed studies. A range of PA measures (steps $k = 10$; minutes of PA
23 $k = 1$; recall [any form of participant perceived PA] $k = 3$) and psychological outcomes (self-
24 efficacy $k = 10$; quality of life $k = 3$; enjoyment $k = 2$; anxiety-depression $k = 1$; motivation $k =$
25 1; mood $k = 1$; well-being $k = 1$) were utilised.

26 [INSERT FIGURE 1]

1 Moderator analyses were carried out for four subgroups, each with multiple potential
2 moderating variables to account for any potential influencing factors (Table 3; supplementary
3 material).

4 *Study Characteristics*

5 No significant difference ($p = .24$) was found between interventions that used remote (g
6 $= 0.81$, $p = .006$, GRADE: low) and multiple ($g = 1.21$, $p < .001$; GRADE: low) methods of
7 delivery. The effects of goals did not differ significantly depending on the intensity of PA (i.e.,
8 moderate or not specified), with both presenting large, positive effects on PA ($g \geq 1.06$, $p \leq .001$;
9 GRADE: very low and low, respectively). There were no significant differences for the effects
10 of goals based on the measure of PA ($p = .97$), with significant effects found when PA was
11 assessed using objective means (i.e., via pedometer; $g = 1.12$, $p < .001$; GRADE: moderate) and
12 self-report methods (i.e., through questionnaires; $g = 1.10$, $p = .008$; GRADE: very low). Follow-
13 up periods were reported at 12 weeks ($k = 1$), 24 weeks ($k = 1$), and 48 weeks ($k = 4$), with seven
14 studies not including follow-up information. There was no significant difference in physical
15 activity ($p = .66$) between studies with ($g = 0.98$, $p < .001$) and without ($g = 1.15$, $p < .001$)
16 follow up measures. The GRADE certainty of evidence was low and moderate, respectively.

17 *Sample Characteristics*

18 Of the 13 included studies, 11 studies measured specific-goal effects on PA behaviour in
19 mixed-gender samples, and two reported the effect for female-only samples. Both reported large
20 effects ($g \geq 1.05$), yet no significant difference was found between groups ($p = .87$) and there
21 was high heterogeneity within each subgroup (Female-only: $Q = 5.50$, $df = 1$ [$p = .02$], $I^2 = 82\%$;
22 GRADE: low; Mixed gender: $Q = 147.38$, $df = 11$ [$p < .001$], $I^2 = 93\%$; GRADE: very low).

23 *Goal Content*

24 Specific-absolute ($g = 1.29$, $p < .001$) and specific-relative goals ($g = 0.81$, $p < .001$) and
25 the timeframe of the goal (i.e., set daily or weekly), had a large, positive effect on PA ($g \geq 0.89$,

1 $p < .001$), but no significant differences were revealed between these comparator groups. The
2 certainty of evidence for both was graded as moderate-to-very low based on the GRADE criteria.

3 [INSERT TABLE 3]

4 *Intervention Related Behaviour Change Techniques*

5 Four studies provided a monetary reward or a gift to participants for taking part. Studies
6 with no reward had a significantly greater effect on PA ($g = 1.30, p < .001$) versus studies that
7 rewarded participants ($g = 0.60, p = .003$), although the quality of evidence was judged to be
8 very low and low, respectively. When educational components (e.g., information leaflets) were
9 included in studies, the effect on PA was positive ($g = 0.97; p < .001$; GRADE: low), yet the
10 effect was not significantly different when an educational component was not used ($g = 1.37, p$
11 $< .002$; GRADE: low).

12 **Psychological Outcomes**

13 The overall effect of goal-setting interventions for PA in insufficiently active adults on
14 the presented psychological variables was small-to-moderate (g : [SMD = 0.25, 95% CI 0.10-
15 0.40]; Figure 3). Notably, some outcomes (e.g., self-efficacy) were negatively affected by
16 specific goals. However, using the GRADE assessment criteria, the quality of evidence was rated
17 as very low, with the primary concern being the inconsistency of evidence. Due to the wide range
18 of psychological variables assessed (i.e., 8 outcomes), high heterogeneity ($Q = 138.67, df = 24,$
19 $p = .001, I^2 = 83\%$), low number of studies assessing outcomes, and lack of consistency in
20 measurement tools, it was not possible to conduct subgroup analyses for psychological
21 outcomes. The following sub-sections present our narrative synthesis of findings. Where
22 possible, the differences between specific-absolute and specific-relative goals have been stated.

23 [INSERT FIGURE 3]

24 *Self-efficacy*

25 Self-efficacy was measured using multiple scales across three domains: exercise self-
26 efficacy (i.e., belief in one's abilities to take part in regular exercise⁵⁹); barrier self-efficacy (i.e.,

1 one's belief in own abilities to cope with barriers⁶⁰); and overall self-efficacy (i.e., self-
2 perception of one's abilities and belief to complete a task⁶¹). Four studies assessed 'exercise self-
3 efficacy' or self-efficacy for PA, with one study reporting a positive, moderate effect of specific
4 goals ($g = 0.51$ – Lewis et al.⁴³), and three reporting negligible, non-significant effects ($g = 0.08$
5 – Chae et al.³⁶; $g = -0.11$ – Rovniak et al.⁵²; $g = -0.10$ – Stovitz et al.¹⁴). Barrier self-efficacy also
6 produced mixed results; Monroe et al.⁴⁹ reported a moderate, negative effect of specific-relative
7 goals on barrier self-efficacy ($g = -0.30$), thus suggesting participants felt less capable of coping
8 with barriers, whereas Steeves et al.⁵⁵ reported a large, positive effect of specific-absolute goals
9 on barrier self-efficacy ($g = 0.58$). Self-efficacy was measured more generally by the remaining
10 four studies, although there was no consistency in the measurement tool employed. Overall, the
11 results were mixed, with two studies reporting positive effects of specific-absolute goals ($g =$
12 2.22 – Dallow & Anderson³⁸; $g = 0.59$ – Mansi et al.⁴⁴) and two others displaying negligible
13 effects (specific-relative: $g = -0.01$ – Miragall et al.⁴⁷; specific-absolute: $g = -0.20$ – Prestwich et
14 al.¹⁵). Based on the synthesised evidence, it is difficult to offer a firm conclusion on the overall
15 effect of specific goals on self-efficacy in PA interventions for insufficiently active adults.

16 *Psychological Wellbeing and Mental Health*

17 This category encompassed three studies that examined the effects of goals on indicators
18 of psychological wellbeing and mental health. Overall, due to the heterogeneity of measures and
19 variables assessed, it was difficult to draw any firm conclusions. Yuenyongchaiwat⁵⁷ and
20 Vetrovsky et al.¹⁶ both reported moderate-to-large, positive effect on psychological well-being
21 ($g = 0.58$) and mental health ($g = 0.48$) when a specific goal was pursued. However, specific
22 goals produced negligible changes in general quality of life ($g = 0.07$ – Fitzsimons et al.⁴⁰) and
23 in mental health subscale scores in a single study ($g = 0.16$ – Mansi et al.⁴⁴). Finally, Vetrovsky
24 et al.¹⁶ found that a specific-absolute goal produced large reduction in anxiety ($g = 0.80$) and a
25 large reduction in depression ($g = 0.87$) in a 12-week intervention in a mixed-gender sample.

26 *Enjoyment and Affect*

1 Two studies examined enjoyment (Miragall et al.⁴⁷; Rovniak et al.⁵²), albeit using
2 different measurement tools. Overall, enjoyment in PA resulted moderately improved following
3 12 weeks of using a specific-absolute ($g = 0.39$ – Rovniak et al.⁵²) and 3 weeks of using a
4 specific-relative goal ($g = 0.59$ – Miragall et al.⁴⁷). Fitzsimons et al.⁴⁰ used the Positive and
5 Negative Affect Schedule (PANAS⁴²) as a measure of mood and reported a small change in
6 positive and negative subscales as a result of setting a specific-relative goal for PA ($g = 0.19$ and
7 $g = 0.05$, respectively).

8 *Motivation*

9 Only one study assessed participants' motivation when setting specific goals for PA.¹⁵
10 Prestwich et al.¹⁵ used the BREQ-2⁵¹ to assess five types of motivation regulations for exercise
11 (external, introjected, identified, intrinsic, and amotivation) and found that setting a specific goal
12 of walking more than 10,000 steps per day resulted in negligible differences in the five
13 motivation subscales ($g \leq 0.18$).

14 **Discussion**

15 This systematic review and meta-analysis aimed to identify, synthesise, and appraise
16 published evidence on the effects of goal setting interventions on PA and psychological
17 outcomes in insufficiently active adults. Only 13 studies met inclusion criteria, thus suggesting
18 that a relatively small number of goal-setting studies on PA in insufficiently active adults
19 considered the effects of goal-setting on both PA *and* psychological outcomes concurrently.
20 Such a trend is somewhat surprising given how important psychological outcomes can be for
21 long-term PA engagement (e.g., Rhodes & Kates¹⁷). Nevertheless, this systematic review and
22 meta-analysis provides important findings related to goal-setting interventions lasting 3-24
23 weeks in insufficiently active adults. First, specific, relative and absolute, goals were effective
24 for increasing PA compared to no goal or a baseline; second, not rewarding or incentivising
25 participants appeared to be more beneficial for PA than providing rewards; third, specific-

1 relative and specific-absolute goals had small, non-significant, effects on psychological
2 outcomes.

3 **Physical activity outcomes**

4 Specific goals were found to have a large, positive effect on PA. This effect was greater
5 than that found by McEwan et al.¹² and reinforces the utility of goal setting for increasing PA in
6 insufficiently active adults. A comparison of the effects of specific goals to other goal types was
7 not possible as only specific goals were used, although a comparison of specific-relative and
8 specific-absolute goals was possible. While our findings might suggest specific-absolute goals
9 should be recommended for insufficiently active adults to increase PA, our meta-analytical
10 evidence supports previous work (McEwan et al.¹²) in suggesting that there is a paucity of
11 evidence to demonstrate that these goals are better than other goal types. That is, based on our
12 moderator analyses, we can only conclude at this point that specific goals are better than no goals
13 at all for PA outcomes and maintained PA behaviour when pursued by insufficiently active
14 adults, but it remains unknown as to how they compare to other, non-specific goal types.
15 Although the use of non-specific goals (e.g., open) have been suggested for insufficiently active
16 individuals,^{25,62} no longer-term intervention has examined the effects of non-specific goals on
17 both PA and psychological outcomes. Future research using a range of goal types within
18 interventions for insufficiently active adults may yield more insight on the impact that goal type
19 can have on both PA and psychological outcomes.

20 Although not significantly different, results of the present meta-analysis indicated that
21 specific-absolute goals had larger effects on PA in comparison to specific-relative goals. As
22 absolute goals, and most commonly daily step-count, had a greater effect on PA, this somewhat
23 contradicts previous work which argued that health behaviour change interventions are most
24 effective when individualised.⁶³ The popularity of daily step-count as a PA measure is
25 understandable due to its high validity and reliability, cost-effectiveness, and ease of
26 implementation, with evidence suggesting that 6000-8000 steps per day is associated with lower

1 mortality risk.⁶⁴ However, daily step count alone cannot be used to assess the attainment of
2 WHO⁴ guidelines, which are published in minutes of activity per day. Based on these findings,
3 we suggest that future PA guidelines could incorporate step goals into their recommendations
4 (e.g., minimum 30-minutes of brisk walking of 3-4000 steps per week⁶⁵), with the aim to increase
5 acceptability of guidelines.

6 In contrast to McEwan et al.¹², who found that daily or combined daily-and-weekly goals
7 work best in populations of mixed-activity level (i.e., active and insufficiently active groups),
8 the current review found that insufficiently active populations benefited from either daily or
9 weekly goals for PA, with no significant difference revealed between these goal timeframes. It
10 should be noted, however, that the effect was greater for those pursuing daily goals. The findings
11 therefore support McEwan and colleagues' suggestion that recommendations for PA-promotion
12 guidance should not only advise people to set weekly goals for PA, but to also set daily PA goals.
13 Nevertheless, further research is warranted given that the findings presented in the current review
14 are drawn from a smaller sample than the previous review¹² of goal setting in PA.

15 Feedback and reward are two variables deemed important for successful goal setting.⁶⁶
16 Moderator analysis indicated that all but one study utilised feedback and the effect on PA was
17 significantly greater when no reward was provided in comparison to studies that provided
18 rewards, of which most were monetary. This finding suggests that rewards were not required in
19 the included goal-setting interventions to improve PA. Although somewhat speculative, a
20 possible explanation is that the financial rewards offered may not have been viewed, or accepted,
21 as a sufficient reward by some participants. Alternatively, it is also possible that the rewards may
22 have undermined autonomous motivation for PA,⁶⁷ resulting in lower commitment to the goal
23 and, as a result, less goal progress.⁶⁸ When providing rewards, accounting for personality and
24 behavioural characteristics may aid the use of rewards as a moderator for goal achievement.⁶⁹
25 The moderator analyses also found educational components did not significantly moderate the
26 effect of the goal-setting interventions on PA. However, knowing the benefits of PA could incite

1 autonomous motives to be physically active, which are more effective at predicting health
2 behaviours,⁷⁰ such as PA adherence. In addition, current activity level may inform the type of
3 goal most beneficial for increasing activity, so that the most effective strategy for long term PA
4 engagement is utilised.²⁵

5 **Psychological outcomes**

6 Although specific goals had a large, positive effect on PA, only small effects were found
7 for the combined psychological outcomes. The psychological outcomes were assessed through
8 a variety of measures, resulting in high heterogeneity and preventing a statistical synthesis of
9 findings for specific variables. Self-efficacy was the most widely examined psychological
10 outcome, yet the effects of the specific goals used varied widely. This variation could be a result
11 of the duration of the intervention as they ranged 3 – 24 weeks with the longer, 24-week
12 interventions reporting moderate-large improvements in self-efficacy,^{38,43,55} compared to the
13 shorter interventions. Given the important role of self-efficacy for PA,⁷¹ further research on goal
14 setting and self-efficacy in PA is warranted, including in relation to the effects of goal setting on
15 multiple types of self-efficacy depending on the stage of a goal-setting intervention (e.g.,
16 initiation and maintenance⁷²).

17 As goal setting is a strategy for increasing motivation,¹¹ it was surprising that the one
18 study reporting motivation¹⁵ reported negligible, non-significant effects of specific goals on five
19 types of motivation. Future studies should compare the level of motivation that could be provided
20 from different goal types to explore the relationship between goal content and motivation further.
21 Enjoyment of PA can facilitate continued participation and adherence,⁷³ and the two studies that
22 examined the effects of specific goals on enjoyment (Miragall et al.⁴⁷; Rovniak et al.⁵²) showed
23 moderate increases in enjoyment. As enjoyment could result in maintained behaviours,⁷³ there
24 is tentative evidence suggesting that specific goals produce greater enjoyment of PA over time
25 versus no goal. However, based on the small amount and low quality of evidence available,

1 further research that examines the effects of specific goals and other goal types on enjoyment,
2 as well as other affective outcomes (e.g., affective response), is needed.

3 Overall, the findings of this review show that specific goals may bring about changes in
4 PA, yet minimal changes in psychological outcomes. This is both concerning, given the high use
5 of specific goals within the papers reviewed and popularity of these goal types more generally,
6 and important, because if individuals using goals to enhance PA have a positive psychological
7 experience, there may be benefits for adherence to interventions and long-term behaviour
8 change. Therefore, this review provides the impetus for future research to compare how other
9 goal types (e.g., nonspecific goals) impact on psychological outcomes such as self-efficacy,
10 motivation, wellbeing, and enjoyment. Such lines of inquiry would offer a more holistic
11 understanding of the effects of goal setting for PA behaviour change in insufficiently active
12 adults.

13 **Strengths and Limitations**

14 This review has made a valuable contribution to knowledge of goal setting for
15 insufficiently active adults and has several strengths. To the best of our knowledge, this review
16 is the first to synthesise the literature on goal setting for PA and psychological outcomes
17 specifically in a population of insufficiently active adults. While it could be claimed this limits
18 the generalisability of the findings, we consider this to be a strength as there have been calls to
19 shift away from one-size-fits-all approaches to goal setting in PA (e.g., McEwan et al.¹²; Swann
20 & Rosenbaum⁶²; Swann et al.²⁰). Therefore, the focussed nature of the review on insufficiently
21 active populations means our findings may be useful to inform future practice, recommendations,
22 and research by highlighting the benefits, or lack thereof, for specific-goal-setting interventions
23 for PA and psychological outcomes specifically within this population. Additionally, by
24 examining both PA and psychological outcomes concurrently, our review extends the current
25 literature and may be useful in highlighting ways in which future research can promote both
26 initial engagement in PA interventions *and* long-term PA adherence.

GOAL SETTING FOR INSUFFICIENTLY ACTIVE ADULTS

- 1 effects of specific and other goal types on PA and psychological outcomes to be compared over
- 2 time.
- 3

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26

Acknowledgements

There are no funders associated with this project. No funding was awarded to complete this study.

The research in this manuscript was conducted as a part of the doctoral studies of the first author, supervised by the other authors, who is a funded student through a doctoral studentship from Nottingham Trent University.

Funding Source/Trial Registration

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26

The research in this manuscript was conducted as a part of the doctoral studies of the first author, supervised by the other authors, and funded through a doctoral studentship from Nottingham Trent University.

This review was pre-registered at <https://www.crd.york.ac.uk/prospero/> (PROSPERO: CRD42021243970) and follows the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) and the recommendations made by the APA's Meta-Analysis Reporting Methods (MARS).

References

- 1
2 1. Caspersen CJ, Powell KE, Christenson GM. Physical activity, exercise, and physical fitness:
3 Definitions and distinctions for health-related research. *Public Health Rep.* 1985;100(2):126-131.
- 4 2. Cekin R. Psychological benefits of regular physical activity: Evidence from emerging adults.
5 *Univers J Educ Res.* 2015;3(10):710-717. <https://doi.org/10.13189/ujer.2015.031008>
- 6 3. WHO guidelines on physical activity and sedentary behaviour. who.int/ Published November 25,
7 2020. Accessed June, 2021. <https://www.who.int/publications/i/item/9789240015128>
- 8 4. Guthold R, Stevens GA, Riley LM, Bull FC. Worldwide trends in insufficient physical activity
9 from 2001 to 2016: A pooled analysis of 358 population-based surveys with 1.9 million
10 participants. *Lancet Glob Health.* 2018;6(10):e1077-e1086. [https://doi.org/10.1016/S2214-](https://doi.org/10.1016/S2214-109X(18)30357-7)
11 [109X\(18\)30357-7](https://doi.org/10.1016/S2214-109X(18)30357-7)
- 12 5. Flint E, Cummins S, Sacker A. Associations between active commuting, body fat, and body mass
13 index: Population based, cross sectional study in the United Kingdom. *BMJ.* 2014;349:1-9.
14 <https://doi.org/10.1136/bmj.g4887>
- 15 6. Santos AC, Willumsen J, Meheus F, Ilbawi A, Bull FC. The cost of inaction on physical inactivity
16 to public health-care systems: A population-attributable fraction analysis. *Lancet Glob Health.*
17 2023;11(1):e32-e39. [https://doi.org/10.1016/S2214-109X\(22\)00464-8](https://doi.org/10.1016/S2214-109X(22)00464-8)
- 18 7. Howlett N, Schulz J, Trivedi D, Troop N, Chater A. Determinants of weekly sitting time: Construct
19 validation of an initial COM-B model and comparison of its predictive validity with the theory of
20 planned behaviour. *Psychol Health.* 2021;36(1):96-114.
21 <https://doi.org/10.1080/08870446.2020.1763994>
- 22 8. Howlett N, Trivedi D, Troop NA, Chater AM. Are physical activity interventions for healthy
23 inactive adults effective in promoting behavior change and maintenance, and which behavior
24 change techniques are effective? A systematic review and meta-analysis. *Transl Behav Med.*
25 2019;9(1):147-157. <https://doi.org/10.1093/tbm/iby010>
- 26 9. Locke EA, Shaw KN, Saari LM, Latham GP. Goal setting and task performance: 1969–1980.
27 *Psychol Bull.* 1981;90(1):125. <https://doi.org/10.1037/0033-2909.90.1.125>

- 1 10. Lee TW, Locke EA, Latham GP. Goal setting theory and job performance. In Pervin L, ed. *Goal*
2 *concepts in personality and social psychology*. Hillsdale. 1989.
- 3 11. Lunenburg FC. Goal-setting theory of motivation. *International journal of management, business,*
4 *and administration*. 2011;15(1):1-6.
- 5 12. McEwan D, Harden SM, Zumbo BD, et al. The effectiveness of multi-component goal setting
6 interventions for changing physical activity behaviour: A systematic review and meta-analysis.
7 *HPR*. 2016;10(1):67-88. <https://doi.org/10.1080/17437199.2015.1104258>
- 8 13. Locke EA, Latham, GP. Building a practically useful theory of goal setting and task motivation: A
9 35-year odyssey. *Am. Psychol*. 2002;57(9):705-717. <https://doi.org/10.1037/0003-066X.57.9.705>
- 10 14. Stovitz SD, VanWormer JJ, Center BA, Bremer KL. Pedometers as a means to increase ambulatory
11 activity for patients seen at a family medicine clinic. *JABFM*. 2005;18(5):335-343.
12 <https://doi.org/10.3122/jabfm.18.5.335>
- 13 15. Prestwich A, Conner M, Morris B, Finlayson G, Sykes-Muskett B, Hurling R. Do web-based
14 competitions promote physical activity? Randomized controlled trial. *PSE*. 2017;29:1-9.
15 <https://doi.org/10.1016/j.psychsport.2016.11.003>
- 16 16. Vetrovsky T, Cupka J, Dudek M, et al. Mental health and quality of life benefits of a pedometer-
17 based walking intervention delivered in a primary care setting. *Acta Gymnica*. 2017;47(3):138-143.
18 <https://doi.org/10.5507/ag.2017.017>
- 19 17. Rhodes RE, Kates A. Can the affective response to exercise predict future motives and physical
20 activity behavior? A systematic review of published evidence. *Ann Behav Med*. 2015;49(5):715-
21 731. <https://doi.org/10.1007/s12160-015-9704-5>
- 22 18. Hawkins RM, Crust L, Swann C, Jackman PC. The effects of goal types on psychological outcomes
23 in active and insufficiently active adults in a walking task: Further evidence for open goals. *PSE*.
24 2020;48:101661. <https://doi.org/10.1016/j.psychsport.2020.101661>
- 25 19. Swann C, Hooper A, Schweickle MJ, et al. Comparing the effects of goal types in a walking session
26 with healthy adults: Preliminary evidence for open goals in physical activity. *PSE*. 2020;47:101475.
27 <https://doi.org/10.1016/j.psychsport.2019.01.003>

- 1 20. Swann C, Schweickle MJ, Peoples GE, Goddard SG, Stevens C, Vella SA. The potential benefits of
2 nonspecific goals in physical activity promotion: Comparing open, do-your-best, and as-well-as-
3 possible goals in a walking task. *J Appl Sport Psychol*. 2022;34(2):384-408.
4 <https://doi.org/10.1080/10413200.2020.1815100>
- 5 21. Page MJ, McKenzie JE, Bossuyt PM, et al. The PRISMA 2020 statement: An updated guideline for
6 reporting systematic reviews. *BMJ*. 2021;372(71):1-9. <https://doi.org/10.1136/bmj.n71>
- 7 22. Campbell M, McKenzie JE, Sowden A. et al. Synthesis without meta-analysis (SWiM) in
8 systematic reviews: Reporting guideline. *BMJ*. 2020;368:1-6. <https://doi.org/10.1136/bmj.l6890>
- 9 23. Salmon J, Owen N, Crawford D, Bauman A, Sallis JF. Physical activity and sedentary behavior: A
10 population-based study of barriers, enjoyment, and preference. *Health psychol*. 2003;22(2):178.
11 <https://doi.org/10.1037//0278-6133.22.2.178>
- 12 24. Allen MS, Walter EE, Swann C. Sedentary behaviour and risk of anxiety: A systematic review and
13 meta-analysis. *J Affect Disord*. 2019;242:5-13. <https://doi.org/10.1016/j.jad.2018.08.081>
- 14 25. Swann C, Rosenbaum S, Lawrence A, Vella SA, McEwan D, Ekkekakis P. Updating goal-setting
15 theory in physical activity promotion: A critical conceptual review. *Health Psychol Rev*.
16 2021;15(1):34-50. <https://doi.org/10.1080/17437199.2019.1706616>
- 17 26. Whatnall MC, Sharkey T, Hutchesson MJ, et al. Effectiveness of interventions and behaviour
18 change techniques for improving physical activity in young adults: A systematic review and meta-
19 analysis. *J Sports Sci*. 2021;39(15):1754-1771. <https://doi.org/10.1080/02640414.2021.1898107>
- 20 27. Sterne JAC, Savović J, Page MJ, et al. RoB 2: A revised tool for assessing risk of bias in
21 randomised trials. *BMJ*. 2019;366:1-8. <https://doi.org/10.1136/bmj.l4898>
- 22 28. Sterne JAC, Hernán MA, Reeves BC, et al. ROBINS-I: A tool for assessing risk of bias in non-
23 randomised studies of interventions. *BMJ*. 2016;355:1-7. <https://doi.org/10.1136/bmj.i4919>
- 24 29. Guyatt GH, Oxman AD, Vist GE. et al. GRADE: An emerging consensus on rating quality of
25 evidence and strength of recommendations. *BMJ*. 2008;336(7650):924-926.
26 <https://doi.org/10.1136/bmj.39489.470347.AD>
- 27 30. GRADEpro GDT. GRADEpro Guideline Development Tool [Software]. McMaster University
28 2021. Developed by Evidence Prime Inc. *Accessed April*. 2021;19.

- 1 31. Meader N, King K, Llewellyn A, et al. A checklist designed to aid consistency and reproducibility
2 of GRADE assessments: Development and pilot validation. *Syst Rev.* 2014;3(1):1-9.
3 <https://doi.org/10.1186/2046-4053-3-82>
- 4 32. Hedges LV. Distribution theory for Glass's estimator of effect size and related estimators. *J Educ*
5 *Stat.* 1981;6(2):107-128. <https://doi.org/10.3102/10769986006002107>
- 6 33. Deeks JJ, Higgins JP, Altman DG, Cochrane Statistical Methods Group. Analysing data and
7 undertaking meta-analyses. *Cochrane handbook for systematic reviews of interventions.* John Wiley
8 & Sons, Ltd. 2019:241-284. <https://doi.org/10.1002/9781119536604.ch10>
- 9 34. Hopewell S, Clarke M, Mallett S. Grey literature and systematic reviews. In Rothstein HR, Sutton
10 AJ, Borenstein M, eds. *Publication bias in meta-analysis: Prevention, assessment and adjustments.*
11 John Wiley & Sons, Ltd. 2005:48-72.
- 12 35. Thomas S, Reading J, Shephard RJ. Revision of the physical activity readiness questionnaire (PAR-
13 Q). *Canadian Journal of Sport Sciences.* 1992;17(4); 338-345.
- 14 36. Chae D, Kim S, Park Y, Hwang Y. The effects of an academic–workplace partnership intervention
15 to promote physical activity in sedentary office workers. *Workplace Health Saf.* 2015;63(6):259-
16 266. <https://doi.org/10.1177/2165079915579576>
- 17 37. Bandura A. *Self-Efficacy: The Exercise of Control.* Freeman; 1997.
- 18 38. Dallow CB, Anderson J. Using self-efficacy and a transtheoretical model to develop a physical
19 activity intervention for obese women. *Am J Health Promot.* 2003;17(6):373-381.
20 <https://doi.org/10.4278/0890-1171-17.6.373>
- 21 39. Marcus BH, Selby VC, Niaura RS, Rossi JS. Self-efficacy and the stages of exercise behavior
22 change. *Res Q Exerc Sport.* 1992;63(1):60-66. <https://doi.org/10.1080/02701367.1992.10607557>
- 23 40. Fitzsimons CF, Baker G, Gray SR, Nimmo MA, Mutrie N. Does physical activity counselling
24 enhance the effects of a pedometer-based intervention over the long-term: 12-month findings from
25 the Walking for Wellbeing in the west study. *BMC Public Health.* 2012;12:1-12.
26 <https://doi.org/10.1186/1471-2458-12-206>
- 27 41. Group TE. EuroQol-a new facility for the measurement of health-related quality of life. *Health*
28 *Policy.* 1990;16(3):199-208. [https://doi.org/10.1016/0168-8510\(90\)90421-9](https://doi.org/10.1016/0168-8510(90)90421-9)

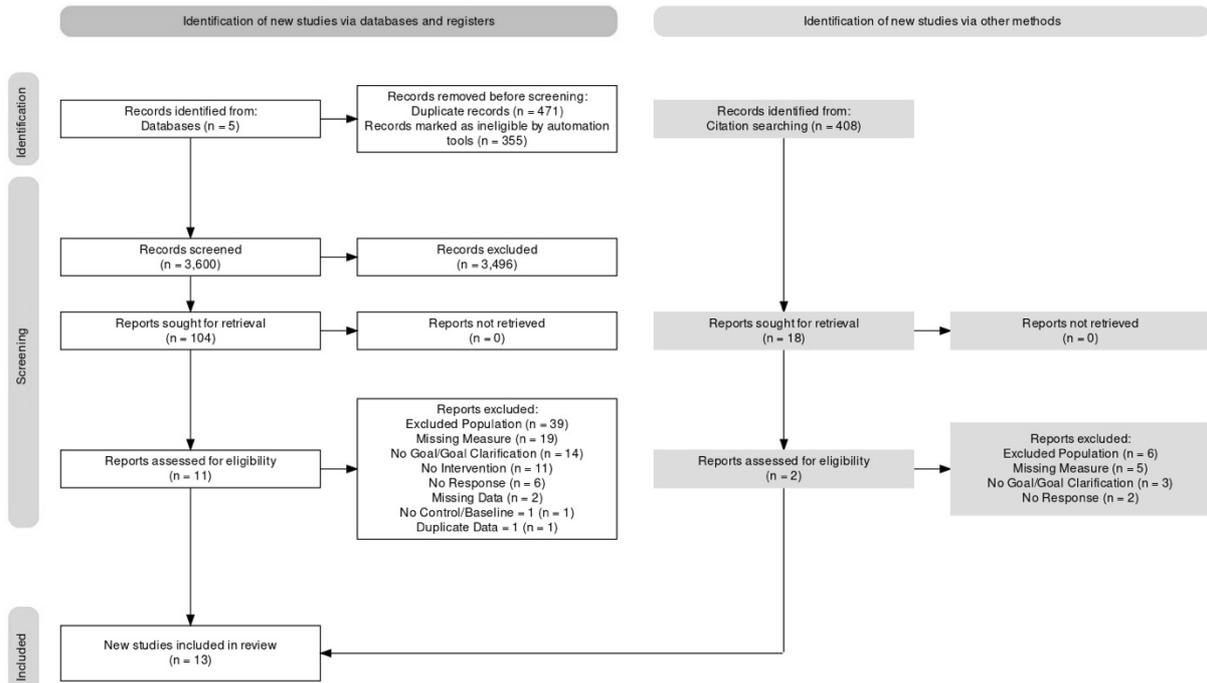
- 1 42. Watson D, Clark LA, Tellegen A. Development and validation of brief measures of positive and
2 negative affect: The PANAS scales. *J Pers Soc Psychol*. 1988;54(6):1063-1070.
3 <https://doi.org/10.1037/0022-3514.54.6.1063>
- 4 43. Lewis BA, Williams DM, Martinson BC, Dunsiger S, Marcus BH. Healthy for life: A randomized
5 trial examining physical activity outcomes and psychosocial mediators. *Ann Behav Med*.
6 2013;45(2):203-212. <https://doi.org/10.1007/s12160-012-9439-5>
- 7 44. Mansi S, Milosavljevic S, Tumilty S, Hendrick P, Higgs C, Baxter DG. Investigating the effect of a
8 3-month workplace-based pedometer-driven walking programme on health-related quality of life in
9 meat processing workers: A feasibility study within a randomized controlled trial. *BMC public*
10 *health*. 2015;15(1):1-12. <https://doi.org/10.1186/s12889-015-1736-z>
- 11 45. Craig CL, Marshall AL, Sjöström M. et al. International physical activity questionnaire: 12-country
12 reliability and validity. *Med Sci Sports Exerc*. 2003;35(8):1381-1395.
13 <https://doi.org/10.1249/01.MSS.0000078924.61453.FB>
- 14 46. Ware Jr JE, Sherbourne CD. The MOS 36-item short-form health survey (SF-36): I. Conceptual
15 framework and item selection. *Med Care*. 1992;30(6):473-483. [https://doi.org/10.1097/00005650-](https://doi.org/10.1097/00005650-199206000-00002)
16 [199206000-00002](https://doi.org/10.1097/00005650-199206000-00002)
- 17 47. Miragall M, Domínguez-Rodríguez A, Navarro J, Cebolla A, Baños RM. Increasing physical
18 activity through an Internet-based motivational intervention supported by pedometers in a sample of
19 sedentary students: A randomised controlled trial. *Psychol Health*. 2018;33(4):465-482.
20 <https://doi.org/10.1080/08870446.2017.1368511>
- 21 48. Kendzierski D, DeCarlo KJ. Physical activity enjoyment scale: Two validation studies. *JSEP*.
22 1991;13(1):50-64. <https://doi.org/10.1123/jsep.13.1.50>
- 23 49. Monroe CM, Bassett Jr DR, Fitzhugh EC, Raynor HA, Thompson DL. Effect of adding online
24 social support tools to an adult walking program: A pilot randomized controlled trial. *Health*
25 *Promot Pract*. 2017;18(1):84-92. <https://doi.org/10.1177/1524839915626674>
- 26 50. McAuley E. The role of efficacy cognitions in the prediction of exercise behavior in middle-aged
27 adults. *J Behav Med*. 1992;15(1):65-88. <https://doi.org/10.1007/BF00848378>

- 1 51. Markland D, Tobin V. A modification to the behavioural regulation in exercise questionnaire to
2 include an assessment of amotivation. *JSEP*. 2004;26(2):191-196.
3 <https://doi.org/10.1123/jsep.26.2.191>
- 4 52. Rovniak LS, Hovell MF, Wojcik JR, Winett RA, Martinez-Donate AP. Enhancing theoretical
5 fidelity: An e-mail—based walking program demonstration. *Am J Health Promot*. 2005;20(2):85-
6 95. <https://doi.org/10.4278/0890-1171-20.2.85>
- 7 53. Centers for Disease Control and Prevention. National Health Interview Survey. Public Health
8 Service, National Center for Health Statistics. 1990.
- 9 54. Sallis JF, Pinski RB, Grossman RM, Patterson TL, Nader PR. The development of self-efficacy
10 scales for health-related diet and exercise behaviors. *Health Educ Res*. 1988;3(3):283-292.
11 <https://doi.org/10.1093/her/3.3.283>
- 12 55. Steeves JA, Bassett DR, Fitzhugh EC, Raynor H, Cho C, Thompson DL. Physical activity with and
13 without TV viewing: Effects on enjoyment of physical activity and TV, exercise self-efficacy, and
14 barriers to being active in overweight adults. *JPAH*. 2016;13(4):385-391.
15 <https://doi.org/10.1123/jpah.2015-0108>
- 16 56. Zigmond AS, Snaith RP. The hospital anxiety and depression scale. *Acta Psychiatr Scand Suppl*.
17 1983;67(6):361-370. <https://doi.org/10.1111/j.1600-0447.1983.tb09716.x>
- 18 57. Yuenyongchaiwat K. Effects of 10,000 steps a day on physical and mental health in overweight
19 participants in a community setting: A preliminary study. *BJPT*. 2016;20(4):367-373.
20 <https://doi.org/10.1590/bjpt-rbf.2014.0160>
- 21 58. Curran SL, Andrykowski MA, Studts JL. Short form of the profile of mood states (POMS-SF):
22 Psychometric information. *Psychol Assess*. 1995;7(1):80-83. [https://doi.org/10.1037/1040-
23 3590.7.1.80](https://doi.org/10.1037/1040-3590.7.1.80)
- 24 59. Everett B, Salamonson Y, Davidson PM. Bandura's exercise self-efficacy scale: Validation in an
25 Australian cardiac rehabilitation setting. *Int J Nurs Stud*. 2009;46(6):824-829.
26 <https://doi.org/10.1016/j.ijnurstu.2009.01.016>

- 1 60. Cramp AG, Bray SR. A prospective examination of exercise and barrier self-efficacy to engage in
2 leisure-time physical activity during pregnancy. *Ann Behav Med.* 2009;37(3):325-334.
3 <https://doi.org/10.1007/s12160-009-9102-y>
- 4 61. Bandura A. *Social Foundations of Thought and Action: A Social-Cognitive View.* Prentice-Hall;
5 1986.
- 6 62. Swann C, Rosenbaum S. Do we need to reconsider best practice in goal setting for physical activity
7 promotion? *Br J Sports Med.* 2018;52(8):485-486. <https://doi.org/10.1136/bjsports-2017-098186>
- 8 63. Kahn EB, Ramsey LT, Brownson RC, et al. The effectiveness of interventions to increase physical
9 activity: A systematic review. *Am J Prev Med.* 2002;22(4):73-107. [https://doi.org/10.1016/S0749-](https://doi.org/10.1016/S0749-3797(02)00434-8)
10 [3797\(02\)00434-8](https://doi.org/10.1016/S0749-3797(02)00434-8)
- 11 64. Paluch AE, Bajpai S, Bassett DR, et al. Daily steps and all-cause mortality: A meta-analysis of 15
12 international cohorts. *Lancet Public Health.* 2022;7(3):e219-e228. [https://doi.org/10.1016/S2468-](https://doi.org/10.1016/S2468-2667(21)00302-9)
13 [2667\(21\)00302-9](https://doi.org/10.1016/S2468-2667(21)00302-9)
- 14 65. Tudor-Locke C, Craig CL, Brown WJ, Clemes SA, De Cocker K, Giles-Corti B, Hatano Y, Inoue
15 S, Matsudo SM, Mutrie N, Opper JM. How many steps/day are enough? For adults. *IJBNPA.*
16 2011;8(1):1-7. <https://doi.org/10.1186/1479-5868-8-79>
- 17 66. Latham GP, Locke EA. Self-regulation through goal setting. *Organ Behav Hum Decis Process.*
18 1991;50(2):212-247. [https://doi.org/10.1016/0749-5978\(91\)90021-K](https://doi.org/10.1016/0749-5978(91)90021-K)
- 19 67. Ryan RM, Deci EL. Self-determination theory and the facilitation of intrinsic motivation, social
20 development, and well-being. *Am Psychol.* 2000;55(1):68-78. [https://doi.org/10.1037/0003-](https://doi.org/10.1037/0003-066X.55.1.68)
21 [066X.55.1.68](https://doi.org/10.1037/0003-066X.55.1.68)
- 22 68. Klein HJ, Wesson MJ, Hollenbeck JR, Alge BJ. Goal commitment and the goal-setting process:
23 Conceptual clarification and empirical synthesis. *J Appl Psychol.* 1999;84(6):885-896.
24 <https://doi.org/10.1037/0021-9010.84.6.885>
- 25 69. Munson SA, Consolvo S. Exploring goal-setting, rewards, self-monitoring, and sharing to motivate
26 physical activity. In: *2012 6th International Conference on Pervasive Computing Technologies for*
27 *Healthcare (Pervasivehealth) and Workshops.* IEEE; 2012:25-32.
28 <https://doi.org/10.4108/icst.pervasivehealth.2012.248691>

- 1 70. Hagger MS, Hardcastle SJ, Chater A, Mallett C, Pal S, Chatzisarantis NLD. Autonomous and
2 controlled motivational regulations for multiple health-related behaviors: Between-and within-
3 participants analyses. *Health Psychol Behav Med.* 2014;2(1):565-601.
4 <https://doi.org/10.1080/21642850.2014.912945>
- 5 71. Ashford S, Edmunds J, French DP. What is the best way to change self-efficacy to promote lifestyle
6 and recreational physical activity? A systematic review with meta-analysis. *Br J Health Psychol.*
7 2010;15(2):265-288. <https://doi.org/10.1348/135910709X461752>
- 8 72. Conner M. Initiation and maintenance of health behaviors. *Appl Psychol.* 2008;57(1):42-50.
9 <https://doi.org/10.1111/j.1464-0597.2007.00321.x>
- 10 73. Wankel LM. The importance of enjoyment to adherence and psychological benefits from physical
11 activity. *Int J Sport Psychol.* 1993;24(2):151-169.
- 12 74. Mental health. Who.int/ Published June 17, 2022. Accessed July 2022. [https://www.who.int/news-](https://www.who.int/news-room/fact-sheets/detail/mental-health-strengthening-our-response)
13 [room/fact-sheets/detail/mental-health-strengthening-our-response](https://www.who.int/news-room/fact-sheets/detail/mental-health-strengthening-our-response)

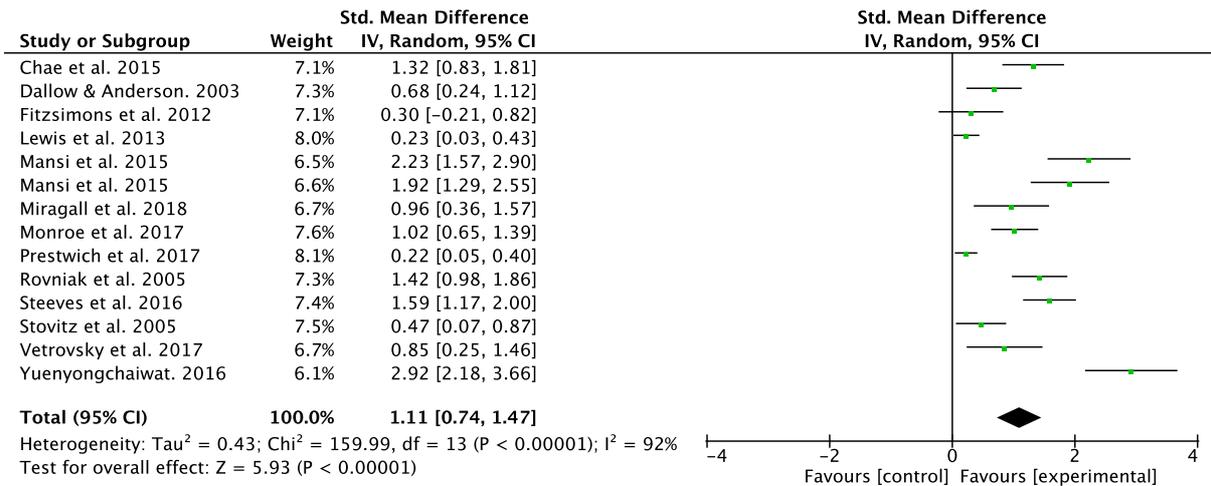
1 **Figure 1.** Literature search PRISMA flow diagram.



2

3

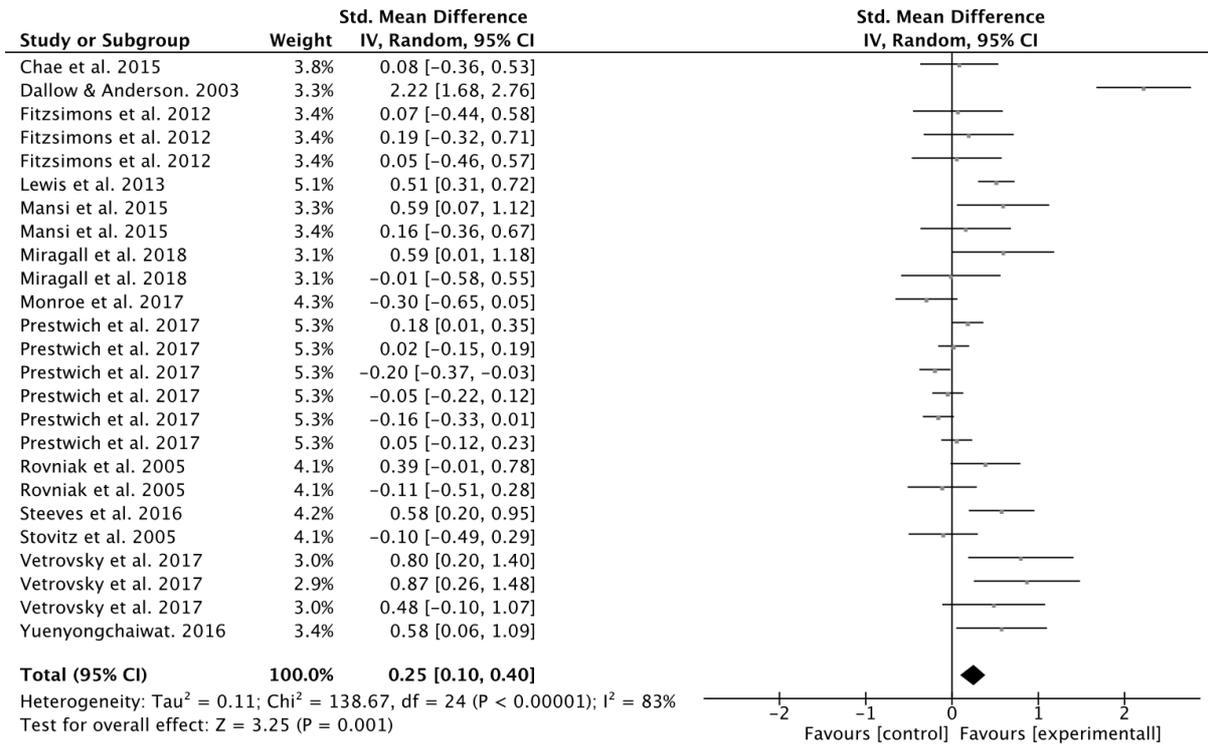
1 **Figure 2.** Overall effect size of included studies on physical activity.



2

3

1 **Figure 3.** Overall effect size of included studies on psychological variables.



2

1 **Table 1.** *Search terms used to identify relevant research.*

| Block | Search Terms | Search Field |
|-------|---|----------------|
| 1 | goal* OR step* | Title/Abstract |
| 2 | “phys* activ*” OR exer* OR fitness OR activ* OR walk* OR “phys* train*” | Full Text |
| 3 | “seden* adult*” OR “seden* older* adult*” OR “inactiv* adult*” OR “inactiv* older* adult*” OR “seden* individual*” OR “inactiv* individual*” OR “insufficient* activ* adult*” OR “insufficient* activ* older* adult*” OR “insufficient* activ* individual*” | Full Text |
| 4 | psych* OR wellbeing OR well-being OR “well being” OR “mental health” | Full Text |

2 (*) were used to broaden the search and to retrieve all variations of the word.

3 (“”) were used to search multiple words as one phrase.

4

5

1 **Table 2.** *Summary of included studies.*

| Study | Design | Sample | Specific goal | Physical activity measure | Psychological variable measure | Number of effect sizes (ES) calculated | Overall RoB judgment |
|-----------------------------------|--|---|---|--|---|---|----------------------|
| Chae et al. ³⁶ | 8-week intervention | Sedentary male and female office workers ($N = 39$, $M_{age}: 39.31 \pm 8.46$) | Relative: + 3,000 steps above baseline everyday | Pedometer step count | Exercise Self-Efficacy: Exercise Self-Efficacy scale (EXES; Bandura ³⁷) | 2 ES: differences between baseline and 8-weeks post-intervention of steps and exercise self-efficacy | Moderate |
| Dallow and Anderson ³⁸ | 24-week RCT (2 experimental conditions) | Sedentary obese females ($N = 58$, $M_{age}: 46.7$) | Absolute: 30-minutes of moderate-vigorous activity ≥ 4 days/week | Physical Activity Readiness Questionnaire (PAR-Q ³⁵) | Self-Efficacy ³⁹ | 3 ES: differences between combined experimental conditions at baseline and 24-weeks post-intervention of daily energy expenditure and self-efficacy, and baseline and 48-weeks post-intervention daily energy expenditure | High |
| Fitzsimons et al. ⁴⁰ | 12-week randomised trial (1 experimental condition, 1 control) | Low active Scottish male and female adults ($N = 59$, $M_{age}: 49.2 \pm 8.8$) | Relative: + 3,000 steps above baseline, ≥ 5 days/week | Pedometer step count | Quality of Life: Euroqol (EQ-5D ⁴¹) Mood: Positive and Negative Affect Schedule (PANAS ⁴²) | 5 ES: differences between group 1 and group 2 at 12-weeks post-intervention of steps, EQ-5D, PANAS (+ve), and PANAS (-ve), and group 1 baseline and 48-weeks post-intervention steps | High |
| Lewis et al. ⁴³ | 6-month RCT (1 experimental condition, 1 control) | Sedentary male and female adults ($N = 386$, $M_{age}: 42.65$) | Absolute: 30-minutes of moderate activity ≥ 5 days/week | Diary & Interview: Minutes of Physical Activity | Self-Efficacy: Self-Efficacy for Physical Activity ³⁹ | 3 ES: differences between experimental and control conditions at 6-months of minutes of PA and self- | Some concern |

| | | | | | | |
|--------------------------------|---|---|--|---|---|--|
| Mansi et al. ⁴⁴ | 12-week RCT (1 experimental condition, 1 control) | Insufficiently active male and female adults in New Zealand ($N = 58$, Experimental: $M_{age}: 43 \pm 14.9$; Control: $M_{age}: 40 \pm 12.2$) | Absolute: Increase steps by 5% each week until 10,000 steps a day is reached | Pedometer step count 7-day recall: International Physical Activity Questionnaire Short-Form (IPAQ-SF ⁴⁵) | Quality of Life: Short Form 36 Version 2 Mental Component Score (SF-36 MCS ⁴⁶) Self-Efficacy | efficacy, and at 12-months of PA 6 ES: differences between experimental and control conditions at 12-weeks of steps, IPAQ, self-efficacy, and MCS of SF-36, and at 24-weeks of steps and IPAQ |
| Miragall et al. ⁴⁷ | 3-week RCT (2 experimental conditions, 1 control) | Sedentary or low active male and female students ($N = 71$, $M_{age}: 22.18 \pm 3.71$) | Relative: Individually set daily step count | Pedometer step count | Enjoyment: Physical Activity Enjoyment Scale – Short Version (sPACES ⁴⁸) Self-Efficacy: Self-Efficacy Questionnaire (SEQ ³⁸) | 4 ES: difference between IMI+Ped condition and control of steps, enjoyment, and self-efficacy, and at 12-weeks post intervention of steps |
| Monroe et al. ⁴⁹ | 12-week RCT (1 experimental condition, 1 control) | Insufficiently active male and female adults ($N = 63$, $M_{age}: 48.2 \pm 10.40$) | Relative: + 3,000 steps above baseline, ≥ 5 days/week | Pedometer step count | Self-Efficacy: Barrier Self-Efficacy Scale ⁵⁰ | 2 ES: differences between combined experimental condition at 12-weeks and baseline of step and barrier self-efficacy |
| Prestwich et al. ¹⁵ | 4-week RCT (2 experimental conditions, 1 control) | Physically inactive male and female adults ($N = 263$, Competition: $M_{age}: 23.94 \pm 9.16$; Self-monitoring: $M_{age}: 21.98 \pm 5.97$; | Absolute: $\geq 10,000$ steps day | Pedometer step count | Motivation: Behavioural Regulation in Exercise Questionnaire (BREQ-2 ⁵¹) Self-Efficacy | 7 ES: differences between combined experimental condition and baseline of step, self-efficacy, and the five subscales of (BREQ-2) motivation |

| | | | | | | |
|------------------------------|--|---|---|---|--|---|
| Rovniak et al. ⁵² | 12-week RCT (2 experimental conditions) | Control: M _{age} : 23.09 ± 6.96) Sedentary females (N = 50, M _{age} : 40.21 ± 9.14) | Absolute: Walk for 30-minutes, 3 x times/week | Self-reported walking: National Health Interview Survey ⁵³) | Self-Efficacy for Exercise Behaviour Scale ⁵⁴ Physical Activity Enjoyment Scale (PACES ⁴⁸) | 4 ES: differences between High combined experimental condition and baseline of minutes walked, self-efficacy for exercise, and PA enjoyment, and 1-year post intervention of minutes walked |
| Steeves et al. ⁵⁵ | 6-month randomised trial (2 experimental conditions) | Sedentary overweight male and female adults (N = 58, M _{age} : 53.8 ± 6.8; TV: M _{age} : 50.2 ± 9.8) | Absolute: All: increase to at least 150-minutes PA per week 1: walk briskly during TV commercials for ≥90 minutes a day, ≥5 days per week 2: walk briskly for ≥30-minutes, ≥5 days per week | Pedometer step count | Self-Efficacy: Barriers Specific Self-Efficacy Scale ⁵⁰ | 2 ES: differences between High combined experimental condition and baseline of step and barrier self-efficacy |
| Stovitz et al. ¹⁴ | 9-week RCT (1 experimental condition, 1 control) | Inactive male and female patients (N = 94, Intervention: M _{age} : 38 ± 12.4; Control: M _{age} : 44.3 ± 13.8) | Relative: Intervention: increase daily average step count by 400 steps each week | Pedometer step count | Self-Efficacy: Exercise Self-Efficacy ³⁹ | 2 ES: differences between High experimental condition post-intervention and baseline of step and exercise self-efficacy |

| | | | | | | |
|--------------------------------|---|--|---|----------------------|--|--|
| Vetrovsky et al. ¹⁶ | 12-week intervention (2 experimental conditions) | Physically inactive male and female adult patients ($N = 23$, $M_{age}: 41 \pm 10$) | Control: walk an extra 10% more steps each week Absolute: Gradually increase daily steps to 10,000 steps per day | Pedometer step count | Quality of Life: Short Form 36 (SF-36 mental health scale ⁴⁶) Anxiety & Depression: 14-item Hospital Anxiety and Depression scale (HADS ⁵⁶) Psychological well-being: Profile of Mood States (POMS ⁵⁸) | 4 ES: differences between experimental condition post-intervention and baseline of steps, anxiety, depression, and mental health 2 ES: differences between experimental condition post-intervention and baseline of step and psychological well-being |
| Yuenyong-chaiwat ⁵⁷ | 12-week intervention (1 experimental condition with baseline) | Sedentary overweight male and female individual's ($N = 30$, $M_{age}: 49.67 \pm 6.51$) | Absolute: Walk $\geq 10,000$ steps per day | Pedometer step count | | |

- 1 PA = physical activity
- 2 +ve = positive
- 3 -ve = negative

1 **Table 3.** Moderator analysis for physical activity outcomes (overall effect on physical activity; $g = 1.11$).

| Moderator | k | Effect size (SE) | 95% CI | Z-value | p-value | Q value (df), p-value | GRADE Rating |
|-------------------------------|----|---------------------|-----------|---------|---------|-----------------------|--------------|
| <i>Study characteristics</i> | | | | | | | |
| Mode of intervention | | | | | | 1.40 (1), $p = .24$ | |
| Remote | 4 | 0.81 (0.30) | 0.23-1.39 | 2.75 | .006 | | Low |
| Multiple methods | 9 | 1.21 (0.17) | 0.88-1.54 | 7.26 | < .001 | | Low |
| PA intensity | | | | | | 0.07 (1), $p = .79$ | |
| Moderate | 6 | 1.17 (0.31) | 0.57-1.77 | 3.81 | < .001 | | Very low |
| Not specified | 7 | 1.06 (0.27) | 0.52-1.59 | 3.87 | < .001 | | Low |
| PA measure | | | | | | 0.00 (1), $p = .97$ | |
| Technology (pedometer) | 10 | 1.12 (0.24) | 0.66-1.59 | 4.71 | < .001 | | Moderate |
| Self-report | 4 | 1.10 (0.41) | 0.29-1.91 | 2.67 | .008 | | Very low |
| Follow-up | | | | | | 0.19 (1), $p = .66$ | |
| Yes | 6 | 0.98 (0.26) | 0.47-1.50 | 3.73 | < .001 | | Low |
| No | 7 | 1.15 (0.29) | 0.58-1.73 | 3.94 | < .001 | | Moderate |
| <i>Sample characteristics</i> | | | | | | | |
| Sex | | | | | | 0.03 (1), $p = .87$ | |
| Female | 2 | 1.05 (0.37) | 0.32-1.78 | 2.83 | .005 | | Low |
| Mixed sex | 11 | 1.12 (0.21) | 0.71-1.53 | 5.38 | < .001 | | Very low |
| <i>Goal content</i> | | | | | | | |
| Goal type | | | | | | 2.17 (1), $p = .14$ | |
| Specific | | | | | | | |
| Relative | 5 | 0.81 (0.18) | 0.45-1.17 | 4.39 | < .001 | | Moderate |
| Absolute | 8 | 1.29 (0.27) | 0.77-1.81 | 4.83 | < .001 | | Very low |
| Goal timeframe | | | | | | 1.25 (1), $p = .26$ | |
| Daily | 7 | 1.33 (0.32) | 0.69-1.96 | 4.12 | < .001 | | Low |
| Weekly | 6 | 0.87 (0.25) | 0.37-1.36 | 3.43 | < .001 | | Very low |
| <i>Additional BCTs</i> | | | | | | | |
| Reward | | | | | | 5.39 (1), $p = .02$ | |
| Yes | 4 | 0.60 (0.20) | 0.20-1.00 | 2.94 | .003 | | Low |
| No | 9 | 1.30 (0.22) | 0.86-1.74 | 5.82 | < .001 | | Very low |

GOAL SETTING FOR INSUFFICIENTLY ACTIVE ADULTS

| | | | | | | | |
|-----------------------|---|-------------|-----------|------|--------|---------------------|-----|
| Educational component | | | | | | 0.64 (1), $p = .42$ | |
| Yes | 8 | 0.97 (0.21) | 0.56-1.39 | 4.58 | < .001 | | Low |
| No | 5 | 1.37 (0.44) | 0.50-2.24 | 3.08 | .002 | | Low |

1 BCTs = Behaviour change techniques

2