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TITLE PAGE

The added value of therapist communication on the effect of physical therapy treatment in older adults; a systematic review and meta- analysis

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Highlights

- Meta-analysis of the additional value of communication in physical therapy practice
- Additional communication has an effect on self-reported physical activities
- Additional communication has no effect on performance-based physical activities
- More research is required to differentiate effects of specific communication

ABSTRACT

Objective

Lower physical activity levels in older adults are associated with increased co-morbidities and disability. Physical therapists have a critical role in facilitating increases in physical activity. The communication they use may impact their effectiveness. This study investigates the additional value of therapist's communication during physical therapy on older adults' physical activity levels.

Methods

Systematic review and meta-analysis. Clinical trials were identified in PubMed, CINAHL, Embase, PsycINFO, PEDro, Cochrane, up to July 2016. Communication was classified with the Behavior Change Taxonomy(BCT). Effect sizes were pooled using Cochrane's Review-Manager. Strength of the evidence was analysed using GRADE's criteria.

Results

Twelve studies were identified. Overall, communication techniques revealed an immediate and long-term effect(ES:0.19;0.24) on self-reported physical activity measures but not on performance-based, with moderate to high strength of evidence. Divided in BCT-categories, only 'Generalisation of target behavior', defined as communication aimed to help patients generalise an exercise from one situation to another at home), had a positive effect on self-reported activity(ES:0.34), with low strength of evidence.

Conclusion

Adding a communication technique to physical therapy is effective on self-reported physical activity measures but not on performance-based measures.

Practice implications

Add communication to exercise when treatment aims at perceived, but not performed, physical activity.

1. Introduction

The absolute number of older adults (> 60 years) around the world is substantially increasing [1]. Ageing is associated with a decline in function and mobility and a higher prevalence of diabetes, pulmonary diseases, arthritis, and multimorbidity [1]. Physical activity is a key factor in staying healthy by preventing cardiovascular and metabolic diseases, obesity, falls, cognitive impairment, osteoporosis, muscular weakness, and dementia [1-3]. One of the main barriers to healthy ageing is that older adults tend to be less physically active. The obvious solution to this problem is for these individuals to become more physically active (or remain active).

Physical therapy provides individual, group, and population based services aimed at developing, maintaining, and restoring a maximum level of physical activity [4]. A physical therapist is in the unique situation of being able to deliver a multi-component intervention that comprises an instrumental and a common element [5]. The instrumental element includes the prescription of exercise. Traditionally, the aim of exercise is to treat diseases that impair physical mobility and to optimize function [6]. Exercise has a positive effect on muscle strength, body composition, physical functioning, and the immune system, including inflammation, in older adults [7-10]. Exercise programs prescribed by physical therapists also encourage an active lifestyle with the goal of preventing future diseases or co-morbidity [1]. One of the common elements of physical therapy intervention is therapist-patient communication and the relationship that is built between them that could provide ways to increase the effect of exercises on physical activity levels [5,11,12]. Adding communication to exercise might reveal an extra effect above the effect of exercise alone. Therefore, research into the additional effect of communication may provide insight into how to increase physical activity in older adults.

In previous articles, therapeutic communication skills were described that comprises verbal- and non-verbal communication skills (e.g., open- or closed-ended questions, non-medical chitchat, jokes, responses to cues and concerns, body orientation towards the client, affirmative head nods, smiling, and facial expressions) [13,14]. Especially in physical therapy practice, additionally, communication skills are applied aimed to achieve a behavioral change in patients [15,16]. The latter consciously deployed behavior change technique is defined as the smallest component of a behavior change intervention that, in favorable circumstances, brings about behavioral change [15,16]. In this study, the target behavior is physical activity. Examples of behavior change techniques are goal setting, feedback and monitoring, social support, shaping knowledge, and influencing self-beliefs. A variety of studies have investigated the effect of behavioral change techniques to increase physical activity in older adults [17-21] with both positive results [17-19] and negative results [20,21], leading to inconsistent evidence. However, these previous studies focused on the effect of communication separately from the effect of exercises [17-21]. A physical therapist applies communication techniques in addition to prescribing exercises. The additional effect of therapist-patient communication to exercise during physical therapy remains unclear.

Older adults require different therapeutic communication skills than do younger adults [22-24]. If it was known which type of communication techniques would most increase an older adult's physical activity level, physical therapists could employ these techniques and hopefully improve this population's health. A doctor's communication skills can affect general outcome measures such as adults' experiences of the health condition, adherence to therapy, and

satisfaction of care [25,26]. However, the effects of doctor-patient communication cannot be directly translated to a physical therapy context. In general, a physical therapist spends more time with the patient, and the treatment frequency is higher than other health care professionals [4]. It remains unclear which type of therapist-patient communication is the most effective for increasing or sustaining an older adult's physical activity. There are some small studies on the possible additional effects of communication added to exercise therapy, however, the results are not summarized yet [27-29].

The objective of this study is to determine the additional value of therapist communication during physical therapy treatment on older adults' physical activity levels.

2. Methods

2.1 Design and Outline

The study was a systematic review and meta-analysis of randomized and clinical controlled trials (RCT-CCT) that investigated the additional effect of therapist communication to the effect of exercise on physical activity levels in the elderly and were published up to July 2016. For the first selection of studies, one researcher (SL) performed an electronic search and screened the titles for potentially relevant studies. Two researchers (SL and MF) screened the abstracts for the second selection. The full text of the second selection studies were retrieved and assessed for inclusion by both reviewers. The selection of relevant studies was based on a set of inclusion and exclusion criteria (Table 1). In the next stage of the selection, relevant studies were assessed for methodological quality by means of the PEDro scale [30]. In every stage of the selection process, if consensus between the two researchers could not be achieved by means of discussion, a third reviewer (HH) made the final decision.

2.2 Search strategy

To identify relevant studies, a search of bibliographic electronic literature databases was conducted including PubMed, CINAHL, Embase, PsycINFO, PEDro, Cochrane, and references from studies using key words, MeSH terms, and free text words (Appendix A). Additionally, results from a twice-weekly database alert from August until January 2017 by means of the original search string were added. Only full-text original articles written in English, German, French, or Dutch meeting the following criteria were selected.

2.3 Inclusion/exclusion criteria

<Table 1>

Study design

Randomized controlled and clinically controlled trials were included that compared the effect of therapists' communication plus exercise compared to exercise alone.

2.4 Data extraction

For each included study, details were extracted regarding the study population, patient characteristics, and types of exercises in the comparison and intervention groups, and the

frequency and duration of treatment. Performance-based physical activity measures (e.g., walking) and self-reported measures (e.g., questionnaires) measure different constructs [31]. Therefore, study results were assigned according to their type of outcome measures: (1) performance-based or (2) self-reported. Communication techniques aimed to change physical activity were classified in accordance with the taxonomy of Behavior Change Techniques (BCTs) [32]. BCT taxonomy is a structured list of intervention components based on international expert consensus that are aimed at changing behavior [32]. The inter-rater agreement using this classification ranges from 86%-95% [33]. The BCT taxonomy comprises 16 main categories; Goals and planning, Feedback and monitoring, Social support, Shaping knowledge, Natural consequences, Comparison of behavior, Associations, Repetition and substitution, Comparison of outcomes, Reward and threat, Regulation, Antecedents, Identity, Scheduled consequences, Self-belief, and Covert learning [33]. First, in accordance with the BCT training, intervention texts were assigned to BCTs [32]. Second, two reviewers (SL and MF) independently extracted one BCT per study that mostly reflected the primary focus of the study by, firstly, reading the aim of the study and, secondly, extracting the BCT that was the primary focus of the intervention (compared to the control group). Agreement between reviewers on the categorisation of the main BCT category was assessed using Krippendorff's alpha ($K\alpha$) and rated as poor agreement if $K\alpha \leq 0.2$; fair if $0.2 < K\alpha \leq 0.4$; moderate if $0.4 < K\alpha \leq 0.6$; substantial if $0.6 < K\alpha \leq 0.8$; and good if $K\alpha > 0.8$ [34]. Disagreements between SL and MF were clarified and resolved by discussion during a consensus meeting. If disagreement persisted after one consensus meeting, a third reviewer (HH) made the final decision.

2.5 Risk of bias

Two reviewers (SL and MF) independently performed quality assessments of the included studies by utilizing the PEDro scale and specifically assessing the risk of bias. Studies were considered to have a low risk of bias when at least six out of ten items were scored as being positive [30]. Agreement between reviewers on the quality of the included studies was assessed using Krippendorff's alpha ($K\alpha$) (see 2.4). Disagreements were resolved by one discussion meeting, or if not, the third reviewer (HH) made the final decision.

2.6 Data analyses

First, the data were analyzed separately for types of outcome measures: performance-based or self-report. Secondly, data were analyzed based on the BCT main categories. If a group comprised at least three studies of the same BCT main category, a meta-analysis was performed including forest plots. Results of the meta-analysis (effect sizes and 95% confidence interval) between the experimental and control group were described on the short-term (the end of treatment), intermediate (3-12 months), and long-term (12 months or more). Mean scores, standard deviations, sample sizes, and effect sizes per included study were extracted and, if not available, estimated using methods recommended in the Cochrane Handbook [35]. The overall in-between group analyses were interpreted based on the standardized mean differences and the 95% confidence interval [36]. The effect size (d) between groups is rated as very small if $0.01 < d < 0.2$; small if $0.2 \leq d < 0.5$; medium if $0.5 \leq d < 0.8$; and large if $d \geq 0.8$ [37]. Publication bias was reviewed by means of symmetry displayed in a funnel plot [35]. Heterogeneity was established by a visual inspection of the forest plots, the Chi^2 test, and I^2 statistic [35]. Heterogeneity was determined to be present when $I^2 > 50\%$. After testing for heterogeneity, the overall quality of the evidence and the strength of the recommendations

were assessed using the GRADE approach, developed by the Grading of Recommendations, Assessment, Development and Evaluation Working Group [38]. A high level of evidence based on the included RCT design was downgraded into a moderate or low level of evidence based on risk of bias, inconsistency of results, indirectness, imprecision, or other publication bias [38].

3. Results

3.1 Literature search

The 10,482 eligible studies were identified (Figure 1). Some studies, i.e., 4,736, were duplicates and, therefore, removed. After titles and abstract screening, 127 studies were excluded based on the preset criteria: Age (< 60 years), the communication in the intervention group was not according to the preset criteria, the exercise in the intervention and control group did not resemble each other, the outcome was falling or there was no physical activity, or the study design was not an RCT or CCT (Figure 1). Finally, twelve studies were eligible for inclusion in this review [27-29,39-47].

<Figure 1>

3.2 Data extraction

Ten studies included older adults with musculoskeletal dysfunction [27,42,44], low back pain [39], arthritis [41,45], and hip fracture [28,40] while two studies included older adults with system diseases (COPD and stroke) [43,47] (Table 2). No studies included participants with severe cognitive impairments. In total, 1,581 participants were included with a mean age of 72.9 years. Two types of outcome measurements were retrieved from the studies (Table 3): 1) Performance-based outcome measures walking speed, Time-up-and-Go-test, and muscle strength and 2) Self-reported outcome measures reflecting self-perceived effects of physical activities; i.e., assessment of self-reported physical activities; motivation to be physically active, minutes a day of physical functioning, and confidence to perform exercises. The exercises in the control and the intervention groups corresponded in the included studies and varied from stretching, endurance, flexibility, functional tasks, early mobilization program, and aquatic exercise (Table 2).

<Table 2 and 3>

The frequency of the intervention varied between daily to once weekly over a period of five days to nine months. All of the included studies focused on the effect of behavioral change techniques rather than verbal or non-verbal communication skills. There was a broad variety of BCT codes per study (range 5-12) (Table 2). The primary focus of the interventions was Social support (BCT 3) [27,39-43], Repetition and substitution (BCT 8), specifically, Generalisation of target behavior (BCT 8.6) [28,29,44], and Goals and planning (BCT 1) [45-47]. The agreement between reviewers on the categorisation of the main BCT category was good ($K\alpha = 0.87$). Both reviewers extracted the same BCT per study except in Desai et al.[45] that studied the effect of two BCTs; Signing a behavioral contract (BCT 1.8) and Telephone reinforcement (BCT 3.1). Credible source (BCT 9.1), described as the communication from a credible source in favor of the behavior, was delivered to all of the intervention groups [27-29,40-48].

- a) Social Support is described as providing practical help or social support (from friends, relatives or staff), or noncontingent praise or reward for performance of the behavior (encouragement and counseling) [15,16]. Social Support was the primary BCT in six of the included 12 studies [27,39-43]: 1) Transtheoretical Model-based counseling [39], 2) Daily home visits after discharge [40], 3) Providing positive feedback on the form, effort, and ability of physical activity based on the empowerment philosophy and the self-efficacy theory [41], 4) Applying a cognitive behavioral intervention based on a psycho-educational group approach [42], 5) Group discussions in a pain self-management program [27], and 6) Encouraging older adults to be physically active [43].
- b) Generalisation of the target behavior 'Being physically active' belongs to the BCT Repetition and Substitution and is described as the advice to perform the wanted behavior, which is already performed in a particular situation, in another situation [15,16]. This BCT was the main BCT in three of the included studies [28,29,44]: 1) Providing confidence for engaging in physical activity with special attention to being able to walk outdoors after a hip fracture [28], 2) Reinforcing the transition of the exercises in water (delivered to the intervention and control groups) to improving functional tasks on land [44], and 3) Gradually intensifying the physical activity in another situation with supervised training [29].
- c) Goals and Planning includes Signing a behavioral contract (create a written specification of the behavior, agreed by the older adult), Action planning (prompt detailed planning of performance of the behavior), and Problem solving (analyze factors influencing the behavior [15,16]. Goals and Planning was the main BCT in three studies [45-47]: 1) Building an action plan based on older adults' preferences for type, time, and location of physical activity, additional telephone calls aimed at exploring barriers and facilitators to physical activity, and signing a contract on an individualized maintenance plan [45], 2) Exploring barriers and facilitators to physical activity and shared decision-making on meaningful treatment goals in order to increase physical activity [46], and 3) A person-centred approach focused on older adults' participation based on their participation restriction and reviewing of behavioral goals [47].

3.3 Risk of bias

The risk of bias in eight studies was low [27,28,39-41,44,46,47] and moderate in four studies [29,42,43,45]. The agreement between assessors after initial screening was good ($K\alpha = 0.82$) (Table 4). Disagreements were clarified and resolved by discussion. In all of the studies, blinding of subjects and therapists could not be fulfilled.

<Table 4>

3.4 Data analyses

Taking into account the pre-defined criteria of including a minimum of three equivalent studies in a meta-analysis, two types of meta-analysis were performed: A) Outcome measures (performance-based and self-reported) and B) Type of intervention (BCT main codes). This analysis included studies on short term (to the end of treatment) and intermediate term (three to 12 months) outcome but none on long term (12 months or more).

A. *Outcome measures. Effect of all included communication interventions on performance-based and self-reported physical activity*

- a) *Performance-based short term (Fig. 2, Table 5)*. Nine studies assessed performance-based physical activity immediately after completing therapy [27-29,40,41,43,44,46,47]. There was high-quality evidence suggesting no effect of additional communication over exercise alone on performance-based physical activity measures (SMD, 0.05; 95% CI: -0.10, 0.20). There was no heterogeneity ($I^2 = 0\%$).
- b) *Self-reported short term (Fig. 2)*. Nine studies assessed self-reported outcome measures immediately after the completion of therapy [27-29,39,42,44-47]. The overall quality of effect of additional communication on self-reported outcomes was downgraded due to risk of bias based on the quality of the included studies (more than 25% lower quality RCTs with a PEDro score < 6). There was no heterogeneity ($I^2 = 0\%$). There was moderate-quality evidence suggesting a very small effect of additional communication on self-reported outcome measures of physical activity (SMD, 0.19; 95% CI: 0.07, 0.31).
- c) *Performance-based intermediate term (Fig. 3)*. Three studies assessed performance-based activity between the end of treatment to a 12 month follow up [27,40,46]. The quality was downgraded due to imprecision, concluding there was moderate-quality evidence suggesting no effect of additional communication on performance-based physical activity (SMD, -0.00; 95% CI: -0.22, 0.21).
- d) *Self-reported intermediate term (Fig. 3)*. Four studies assessed self-reported physical activity between the completion of treatment to a 12 month follow up [27,39,45,46]. There was high-quality evidence suggesting a small effect (SMD, 0.24; 95% CI: 0.045, 0.44) favoring additional communication. There was no inconsistency of results ($I^2 = 22\%$).

B. *Type of intervention. Effect of Behavior Change Techniques above exercise compared to exercise alone on physical activity end of treatment.*

- a) *Social support (BCT code 3) (Fig. 4)*. Six studies analyzed the effect of therapists' social support on physical activity immediate after the completion of therapy [27,39-43], i.e., four studies with performance-based outcome measures [27,40,41,43] and three with self-reported outcome measures [27,39,42] (Table 3). The overall quality for effect of additional social support on performance-based physical activity was moderate, downgraded for imprecision; there was no evidence of an effect (SMD, -0.02; 95% CI: -0.24, 0.20). In self-reported outcomes, there was inconsistency in the results ($I = 52\%$) and a risk of bias, concluding a low-quality evidence of no effect.
- b) *Generalisation of target behavior (BCT code 8.6)(Fig. 4)*. Three studies analyzed the effect of generalisation of physical activity behavior above only exercise [28,29,44]. The quality was downgraded due to a risk of bias and imprecision. There was low-quality evidence suggesting 1) no effect of generalisation of target behavior on performance-based physical activity (SMD, 0.24; 95% CI: -0.05, 0.53) and 2) a positive effect on self-reported behavior (SMD, 0.34; 95% CI: 0.05, 0.63).
- c) *Goals and Planning (BCT code 1)(Fig. 4)*. Three studies analyzed the effect of goals and planning [45-47]. The quality is downgraded due to a risk of bias. There was moderate-quality evidence for no effect in applying the behavior technique goals and planning to exercise for self-reported physical activity (SMD, 0.13; 95% CI: -0.06, 0.33).

< Figure 2-4, Table 5)

4. Discussion and Conclusion

4.1 Discussion

This meta-analysis classified and pooled the results of 12 RCTs that measured the effect of therapist-patient communication on physical activity levels in older adults. There is a moderate-quality level of evidence for an added effect of behavior change techniques improving older adults' physical activity levels measured immediately after therapy and high-quality level of evidence showing the same at intermediate follow-up (3 to 12 months). Behavior change techniques were not effective for improving any performance-based outcome measures (e.g. walking speed, TUG, and muscle strength) (Table 3). Generalisation of physical activity behavior (BCT 8.6) was the only behavior change technique that independently increased physical activity, with low-quality level of evidence. There was no effect of Social support or Goals and Planning (Fig. 4). The generalisation techniques focused on transferring the exercises learned in physical therapy to other contexts and situations and to everyday functional tasks and therewith giving confidence to older adults. The finding that Social Support was not effective to increase activity levels is in contrast with the belief of older adults that social support is the most effective technique to initiate exercise [49-51].

4.1.1 Effect size

The effect sizes of exercise therapy of the control groups of the included studies are in accordance with other reviews (Effect size (d) 0.18-0.66) [7,52]. In this review, the additional effect sizes (d) of communication were very small to small. These findings are in line with those from other studies that measured the effect of other additional interventions (e.g. manipulation) beyond exercise [53,54]. The only effect on physical activity levels was in self-reported physical activity outcomes and not in performance-based measures. This is in line with the model of pathways of therapeutic change in psychotherapy arguing that the instrumental part of an intervention (exercise) causes specific effects (muscle strength), whereas the more common part of the intervention (communication) causes general non-specific effects (self-perceived physical activity) [26]. Thus, self-reported outcome measures (e.g., questionnaires) are more related to therapists' communication techniques than performance-based outcome measures (e.g., walking speed, TUG, and muscle strength). Additionally, a response shift may possibly have occurred in which older adults might have changed their perception about physical activity during the course of therapy (and changed the answers on a questionnaire) while executing physical activity during performance-based measurements might not have been changed [26,55]. Both the model of pathways and the response shift might have caused the ambiguous magnitudes of effect between performance-based and self-reported outcome measures.

4.1.2 Strength, limitation and recommendations

The included studies showed heterogeneity among participating older adults, BCTs, exercises, as well as outcome measures. The diversity of older adults could feasibly have caused a selection bias. Older adults with specific impairments might respond differently on a BCT code

although, in this meta-analysis, no direct relationship between health condition and treatment effects could be identified. The included studies used a broad variety of BCTs (Table 2) but were classified into the primary focused BCT code delivered. Therefore, the effect of one single BCT code could not be clearly distinguished. Furthermore, it is notable that the words that are used in BCT training are more doctor-centered (e.g. advise, prompt, review) than patient-centered [32]. It is recommended to perform a multi-armed RCT in which the effect of separate BCT codes is studied. In all of the included studies, more intense attention was paid to the participants in the intervention group compared to the participants in the control group. It might be argued that the primary factor could be therapist time and not the specific behavior technique. There were four studies identified in which a therapist spent equal time with the intervention and control group [27,39,43,46]. Merging evidence of these four studies showed comparable results. In this review, no studies were included that studied the additional effect of non-verbal behavior. Although Henry et al. [56] concluded that communication-based interventions that target clinician warmth, listening, and less nurse negativity may lead to greater patient satisfaction, whereby patient satisfaction is assumed to be prognostic for patient health status [26]. It is recommended to perform studies into the effect of physical therapist's basic verbal and non-verbal communication on an older person's physical activities level. The aim of our study was to investigate the additional effect of the common element of the intervention (communication) beyond the instrumental element (exercise). A strength of this study is that studies were included that performed exercises in the control and intervention groups. Nevertheless, a bias might have occurred based on the communication that is delivered in the exercise part of both the control and intervention group. To avoid contamination between the effects of communication during exercises and the additional BCT code that is applied, the BCT collaboration advises applying the theoretical design framework in future RCT's [57]. The measures after therapy were taken at different time spans due to the diversity in the duration of the intervention (range four weeks to nine months). Arguing that the duration of a BCT might be more effective was not determined by the results of this study. Another bias might have been the diversity of questionnaires. The included questionnaires asked participants to rate the confidence in completing 16 common tasks [44], average duration of physical activity per day [39], difficulties in performing physical activities [27,29,42,46,47], or how strongly older adults agreed-disagreed with positive and negative statements about exercises [45]. Based on the results of this study, no pattern of bias due to a diversity of a self-reported questionnaire could be determined. The meta-analyses revealed more effect by means of self-reported than performance-based measures. In future studies, the selection of the most clinically relevant outcome measure in studies whereby only small effect sizes are expected is challenging. Such a clinically relevant outcome measure should fulfill the following criteria; it must be sensitive to change and have a positive predictive value for a higher quality of life, lower co-morbidity and, as a result, reduced health care costs. A strength of this study is the use of the best evidence synthesis analogous of the Cochrane Handbook. Another point of attention that might have caused a bias must be addressed. In those studies that used several outcome measures to determine the construct of physical activity, the authors chose just one [28], i.e., the outcome measure that accorded with the outcome measures of the other studies. In order to check for this bias, we performed a post-sensitivity analysis; if we would have included other measurements from the same studies, the results would not have changed. None of the included studies performed a subgroup analysis based on older adults' personal factors. Depressive feelings and fear are related to actual and perceived physical activity [58]. It might be argued that these personal factors mediate the effect of additional communication on a person's physical activity level. It is recommended to measure these potential

confounders in future studies. Strength of this study is that we did not limit the search string on dates and applied additional studies during the writing process by updating databases alerts of the original search string.

4.2 Conclusion

When investigating the added effect of therapist-patient communication in exercise prescription over exercise prescription alone, there is moderate to high evidence of a very small-to-small increase of older adult's perceived physical activity, measured immediately and up to 12 months after treatment, but no empirical evidence that these techniques enhance performance. When separated in BCT-categories, the only behavior change technique that was effective on older adult's perceived physical activity was Generalisation of target behavior (i.e., giving confidence and reinforcing transition of exercise to activities of daily living). More research needs to be performed on the effectiveness of behavior change techniques and innovative communication approaches that might enhance both self-reported and performance-based measures of physical activity.

4.3 Practice Implications

Although the effects from the included RCTs are very small-to-small, it is recommended that physical therapists add behavior change techniques to interventions with older adults when the aim of treatment is to increase self-reported physical activity. Policy makers in various areas (e.g. government, healthcare systems, education) might pay attention to these small additional effects, increase awareness to physical therapists and facilitate funding to further investigate the optimization of effective communication skills.

Table 1 In- and exclusion criteria

	Inclusion	Exclusion
Older adults	Age 60 years or older. Older adults with mild or severe cognitive impairments were included.	
Communication	The communication should be personally delivered by a therapist and be aimed at increasing the physical activity level. The communication might include an intervention by telephone call.	Multimedia campaigns Studies that aimed to study the effect of conversation about end of life, nutrition, cancer, medication, and public health promotion.
Exercise	The physical exercise therapy was aimed to increase or maintain the physical activity levels in older adults or increase adherence to an active lifestyle. The intervention and comparison group comprised at least five sessions of comparable physical exercise therapy that was guided by a therapist; physical therapist, psychologist, occupational therapist, exercise therapist, or nurse.	Studies of which the older adults received the exercise therapy before the start of the study.
Outcome	1) Performance-based physical activity 2) Self-reported physical activity	fall

Table 2. Description of participants and intervention

Participant and intervention	
Social Support (BCT 3)	
Basler 2007 [39]	<p>I n = 86; C n = 84; ≥ 65 yr (range 65-84); F unknown</p> <p>Visited the department of orthopedics or neurosurgery hospital; Chronic low back pain due to osteoporosis or to degenerative spine disorders with or without previous surgery of the spine</p> <hr/> <p>C 2 weekly 5 weeks 20 min. individual exercise. Stretching and individual needs muscle strength, endurance, flexibility and coordination with homework plus 10 min. sham Ultra sound</p> <p>I Control group without sham Ultra sound 2 weekly 5 weeks 10 min. Individual counseling based on TTM. The counselling was aimed to increase physical activities and took into consideration the individual's stage of change that was determined during the initial assessment. (BCT 1.9, 3.1*, 3.2, 5.1, 9.1, 9.2, 10.3, 10.4, 12.1)</p>
Karlsson 2016 [40]	<p>I n = 107; C n = 98; ≥ 70 yr (range 70- unknown); F 71.7%.</p> <p>Ordinary housing (69.3%) or residential care facilities (30.7%).</p> <p>After hip fracture surgery.</p> <hr/> <p>C Daily 5 days conventional individual rehab after hip fracture. Early mobilization and ADL high intensity exercise program. Specific training walking ability, prevent falls, functional strength and balance training according to the High Intensity Functional Exercise Program</p> <p>I Control group plus max 10 weeks individual encouragements of physical activities during home visits after discharge (first days daily and later according to participant's PA level). (BCT 1.3, 1.4, 3.1*, 4.1, 6.1, 8.1, 8.3, 9.1, 12.1)</p>
Katula 2006 [41]	<p>I n = 20; C n = 18; ≥ 60 yr (range 60- unknown); F 68%.</p> <p>47% Arthritis; 42% hypertension; 8% Heart diseases; 10% Cancer; 10% Diabetes; 10% other diseases. Self-reported difficulty in one or more activities of daily living that require ambulation and stable residence for 3 months;</p> <hr/> <p>C 3 weekly 6-week group strength training. Per week: 2 center-based training and prescription of 1 weekly home based exercise. Only general feedback (i.e., "That is correct" or "That was fine"). Focusing on corrective feedback and instruction ("Don't put your elbows down" or "Do not try to do it that fast").</p> <p>I Control group plus social interaction of therapist during training: giving frequent individual attention, providing specific reinforcement for positive behaviors to each participant, giving encouragement before and after each session as well as after mistakes, focusing on positive comments during instruction, providing specific feedback on the participant's ability and technique, rewarding effort immediately, and giving performance feedback and charting each participant's progress across the 6 weeks of the study. (BCT 3.1*, 2.2, 2.3 5.1, 9.1, 10.4, 15.1)</p>
Schneider 2008 [42]	<p>I n = 113; C n = 110; ≥ 65 yr (range 65- unknown); F 75.9%</p> <p>Community dwelling older adults; MMS ≥ 24</p> <hr/> <p>C 10 weeks of group exercise strength training, flexibility, endurance (40 to 45 min.) using resistance bands in 2 phases: Initial phase three times per week for 2 weeks. (40-45 min.). Second phase once per week for 8 weeks in which patients were encouraged to exercise independently for an additional 2 to 5 days per week. After the eight follow-up sessions, all participants were asked to exercise on their own.</p> <p>I Control group plus 8 sessions (60-70 min.) group based cognitive behavioral therapy towards exercise (psychologist) during the second phase of exercise training based on the self-regulation of exercise maintenance model of Herring Cook, and Schnieder[59]. Awareness and subjective</p>

appraisal of sensations, thoughts, and feelings associated with exercise. (BCT 1.1, 1.2, 1.4, 2.3, 3.1*, 5.1, 9.1, 13.2)

Nicholas 2013 [27]	I n = 49; C n = 53; ≥ 65 yr (range 65-87); F 65-70%
	Mean pain duration (month) 178 ± 208; Usual pain intensity (0-10) 5.48 ± 2.11; Quality of Life (EuroQol -0.59-1) 0.51 ± 0.28
	Referred by a doctor for treatment at the pain management and research centre;
	C 2 weekly (2hr.) 4 weeks group exercise (stretching, aerobic, strengthening, functional tasks). Open discussions about pain and impact on patient's life by Rybstein-Blinchick[60]. Psychologist is friendly and empathic. No home exercise encouragement.
	I Control group plus group intergraded pain self-management. Functional and realistic goal setting, directive answers. Encouragement for home exercises. Psychologist is friendly and empathic Activity pacing, arousal reduction, structured problem-solving. (BCT 1.1, 1.2, 2.2, 2.3, 3.1*, 6.1, 8.1, 8.6, 9.1, 10.4, 11.2, 15.4)
Norweg 2005 [43]	I n = 10; C n = 11; ≥ 60 yr (range 60-92); F(I) 90%; F(C) 100%
	Participants referred to a Medicine Pulmonary Rehabilitation Outpatient program; Stable outpatients with COPD
	C 2 weekly 10 weeks individual exercise 10-15 sessions (1 hr.). Treadmill and upper-body training using hand weights. Patients were encouraged to exercise at home unsupervised for at least 20 min, 2 to 3 days per week.
	I Control group plus one weekly group session about healthy lifestyle, stress management 5-7 sessions (45 min), and nutrition concurrently with the exercise. (BCT 3.1*, 4.1, 6.1, 8.1, 8.6, 8.7, 9.1, 11.2)
Generalisation of the target behavior 'Being physically active' (BCT 8)	
Ziden 2008 [28]	I n = 48; C n = 54; ≥ 65 yr (range 65-99); F 69.6%
	After hip fracture surgery
	C 18-20 days Individual exercise early mobilization program (bed transfer, dressing, grooming, and walking (by a PT and OT). When needed, 1 home visit. Daily individual training in ADL individual goals.
	I Control individual exercises to encourage confidence in PA with special attention to outdoor ambulation, by the approach 'learning by doing'. Based on the concept that people are more inclined to actually perform an activity they have physically tested than if they are merely instructed verbally. The patients were also encouraged to train on their own. Additionally, establishing individual goals and motivation (Pörn and Orem)[61,62]. Multi-professional actions aimed at sensitizing going home. Individual tailored rehab program during hospital stay with close cooperation between the OT, PT and health care staff. Pt was accompanied home by an OT and PT during 4 extra home visits. (BCT 1.3, 3.1, 3.3, 8.6*, 9.1, 11.2, 15.1)
Arnold 2010 [44]	I n = 28; C n = 26; ≥ 65 yr (range 65- unknown); F 71-77%
	Hip osteoarthritis
	C 2 weekly 11 weeks group aquatic exercise 45 min. To increase mobility, strength and balance.
	I Control group exercise plus 1 weekly 11 weeks 30 min. In 4 of 11 sessions, participants practiced functional tasks such as sit-to-stand to increase confidence, knowledge building, group discussion, sharing goals and solutions, and positive reinforcement from the group leader to change functional tasks behaviors, to motivate them to participate in functional tasks, and to increase their understanding that physiological changes associated with exercise such as fatigue or muscle soreness are not signs of failure or dysfunction. Group education about continuing exercise, confidence regarding falling, and individual goal setting based on self-efficacy theory of Bandura

(mastery experience, verbal persuasion, relationship of physiological and affective states)[63]. (BCT 1.3, 3.1,3.3, 4.1, 5.1, 8.3, 8.6*, 8.7, 9.1, 15.1)

Boshuizen	I n = 16; C n = 16; ≥ 65 yr (Mean yr (I) 80.0 ± 6.7; Mean yr (C) 79.3 ± 7.0); F(I) 100%; F(C) 87.5%
2005 [29]	Older adults living independently in block with apartments for elderly connected to 2 welfare centers. Older adults who experience difficulty in getting up from a chair. Maximum knee-extensor torque below 87.5 Nm.
	C 16 sessions 1 supervised and 1 unsupervised exercise therapy weekly in a 10 week period. 10 Min. warming up; 40 min. 6 muscle force exercises sitting in a chair and 3 muscle force exercised standing behind the chair in a variation of concentric, isometric, and eccentric knee-extensor activity of large muscle groups by means of elastic bands; 10 min. cooling down.
	I 17 sessions Control group but 2 supervised and 1 unsupervised exercise therapy weekly in a 10 week period. The intensity of the exercises was individually tailored. Graded tasks. Participants of the exercise groups practices extra exercises and received an instruction booklet in which the exercises were described. Therapists prompted the participants to practice at home. (BCT 2.3, 4.1, 6.1, 8.1, 8.6*, 8.7, 9.1)
Goals and Planning BCT 1	
Desai	I n = 201; C n=218; ≥ 60 yr (range 60-91); F 86,6%
2010 [45]	Hypertension 60,4%; Diabetes 23.4%; Cardiovascular disease 15.3%.
	Senior Centers; Community-dwelling older adults with lower extremity osteoarthritis.
	C 3 weekly 8 weeks group exercise Fit and Strong program: Stretching, aerobic, strengthening, balance plus group problem-solving health education managing with PA.
	I Control group plus in week 6 participants signed a contract to adhere the follow-up PA exercises plus telephone calls to explored barriers and facilitators to exercise 3-18 month after finishing therapy biweekly. (BCT 1.1, 1.2, 1.4, 1.8*, 3.2, 9.1)
De Vries	I n = 64; C n=65; ≥70 yr (range 70- unknown); F 69-75%
2016 [46]	Frailty older adults with mobility problems who signed in a PT practice
	C 4-18 sessions Exercise chosen by a general PT.
	I 4-18 sessions (mean 11)]. Exploring the barriers and facilitators aimed to overcome the barriers to become more physically active. 'Coach to move' exercise by a trained geriatric PT. Based on a decision algorithm and on the barriers and facilitators; motivational interviewing, setting meaningful goals, enhancing self-efficacy and self-management, giving feedback on the process, goal-oriented treatment plan that fits the preferences, needs, and barriers of the patient. (BCT 1.2*, 1.3, 3.1, 4.1, 6.1, 8.1, 9.1, 11.2)
Lund	I n = 39; C n= 47; ≥65 yr (Mean yr (I) 75 ± 7.2; Mean yr (C) 79 ± 6.5)*; F(I) 44%; F(C) 57%
2012 [47]	MMS ≥ 24 (range 0-30): I 87%, C 87%; Barthel ADL Index score >18 (0-20): I 80%, C 75%.
	Senior centers directly after stroke hospital stay; Stroke
	C 1 weekly 20 sessions (9 Month) (0.5-1 hr.) minutes group exercises. Sitting, standing, walking, balance and different mobility activities indoors.
	I 23 sessions Control group plus 1 weekly 28 group sessions (9 Month) lifestyle course (2 hr.) Group lifestyle Redesign program occupational based on individual needs and person's meaningful occupations. It comprises the specific knowledge on how to select or perform activities so as to achieve a healthy lifestyle. Themes were: Peer exchange, self-reflections, discussions, lectures, outings. (BCT 1.4,* 1.5, 3.1, 8.3, 9.1)
I = intervention group; C = control group; yr = year; F = female; TTM = Transtheoretical model; BCT = Behavior Change Technique; * = the BCT code that reflected th primary focus of the study; PA = physical activity; ADL = activity of daily live; MMS = Mini Mental Status Examination score; PT = physical therapist; OT = occupational therapist.	

Table 3 Data extraction

	T ₀ (before)	T ₁ (after)		T ₂ (follow up)	
	Measurement		SMD 95% CI	SMD 95% CI	
Social Support (BCT 3)					
Basler	Performance-based (Range of Motion lumbar flexion (degrees))			6 month	
2007 [39]	I 22.9 (9.8); C 22.1 (9.6)	I 24.2 (9.1); C 21.6 (9.5)	0.28 (-0.05, 0.61)	I 23.7 (9.3); C 21.5 (9.1)	0.24 (-0.09, 0.57)
	Self-reported				
	Average durations of physical activity (min. per day)				
	I 15.98 (21.1); C 14.11 (15.5)	I 29.24 (14.6); C 24.7 (16.3)	0.29 (-0.03, 0.62)	I 29.63 (24.2); C 25.3 (19.7)	0.29 (-0.01, 0.59)
	Functional capacity (percent of normal function)				
	I 67.3 (18.9); C 66.3 (19.2)	I 73.7 (16.5); C 70.2 (17.9)	0.20 (-0.10, 0.50)	I 72.5 (20.3); C 68.9 (19.7)	0.18 (-0.12, 0.48)
Karlsson	Performance-based			12 month	
2016 [40]	Maximum gait speed (m/s) over 2.4 mtr.				
	I and C unknown	I 0.70 (0.31); C 0.69 (0.29)	0.03 (-0.29, 0.35)	I 0.74 (0.3); C 0.75 (0.27)	-0.03 (-0.37, 0.30)
	Self chosen gait speed (m/s) over 2.4 mtr.				
	I and C unknown	I 0.43 (0.19); C 0.43 (0.20)	0.00 (-0.31, 0.31)	I 0.49 (0.19); C 0.48 (0.17)	0.06 (-0.28, 0.39)
Katula	Performance-based (Leg extension strength)				
2006 [41]	I 669.21 (2977); C 775.22 (420,22)	I 961.65 (279,61); C 1087.29 (617.06)	-0.26 (-0.90, 0.38)		
Schneider 2008 [42]	Self reported (SF-36 Physical Function)			9 month	
	I 73.8 (21.9); C 73.2 (22.0)	I 71.1 (24.6); C 72.0 (22.7)	-0.01 (-0.27, 0.25)	I 73.5 (22.87); C 72.8 (22.6)	0.03 (-0.23, 0.29)
	12 Month				
				I 72.7 (23.4); C 73.2 (22.2)	0.02 (-0.24, 0.28)
Nicholas	Performance-based			2 month	
2013 [27]	6-min Walk (mrt.)				
	I 361 (143); C 364 (140)	I vs. C 7.88 (-30,53-46,30)	0.08 (-0.31, 0.54)	-11.48 (-60.8, 37.9)	0.10 (-0.51, 0.31)
	Functional reach (10-48)				
	I 23.1 (8.3); C 24.1 (8.9)	I vs. C -4.41 (-7.39—0.90)*	0.58 (-1.0, 0.15)	-3.78 (-6.57, 0.99)	0.61 (-1.04, 0.18)
	Self-reported (Pain related disability (Modified RMDQ 0-24))				
	I 12.93 (5.37); C 12.24 (5.08)	I vs. C 1.49 (0.17-2.81)*	0.47 (0.04, -0.89)	-2.68 (1.21, 4.15)*	0.76 (0.33, 1.19)*
Norweg	Performance-based (6MWT (feet))				

2005 [43] I 1944 (475.63); C 882.27 (287.14) I 1026.50 (84.88); C 1083.96 (83.64) -0.20 (-1.06, 0.66)

Generalisation of the target behavior 'Being physically active' (BCT 8)

Ziden
2008 [28]

Performance-based (Timed Up and Go (s.))

I and C unknown I 24.9 (15.4); C 30.8 (16) 0.37 (-0.02, 0.76)

Self reported

Domestic activities (0-28) I 15.4 (6.7); C 12.2 (7.2) 0.46 (0.06, 0.85)*

ADL Independency in personals activities (FIM)

Self-Care (0-42) I 38.4 (2.9); C 33.5 (7.2) 0.87 (0.46, 1.27)*

Mobility (0-21) I 18.3 (1.5); C 16.3 (3.3) 0.76 (0.36, 1.16)*

Locomotion (0-14) I 10.4 (2.5); C 7.6 (3.6) 0.89 (0.48, 1.30)*

ALD independency in instrumental activities (IAM)

Outdoor activities (0-28) I 11.3 (6,5); C 7.9 (5.4) 0.57 (0.17, 0.96)*

ADL frequency (FAI)

Domestic activities (0-15) I 9.0 (5.0); C 6.4 (5.3) 0.50 (0.10, 0.90)*

Outdoor activities (0-15) I 5.7 (4.8); C 2.7 (3.8) 0.69 (0.29, 1.09)*

Leisure and Work (0-15) I 3.4 (2.3); C 2.6 (2.3) 0.35 (-0.05, 0.74)

Arnold
2010 [44]

Performance-based

6MWT (mtr.)

I 355.2 (93.9); C 357.4 (118.1) I 398.5 (89.3); C 371.9 (136.9) 0.23 (-0.31, 0.76)

Berg Balance Scale (0-36)

I 30.4 (3.8); C 29.3 (5.2) I 31.4 (3.2); C 30.5 (5.1) 0.21 (-0.33, 0.75)

TUG (sec.)

I 14.9 (5.6); C 15.8 (9.1) I 12.6 (3.9); C 15.1 (9.5) 0.34 (-0.19, 0.88)

Chair stand test (30 sec.)

I 7.6 (3.0); C 6.9 (4.3) I 9.1 (2.8); C 7.5 (3.9) 0.47 (-0.07, 1.01)

Self-reported

Activity and Balance Confidence

I 69.2 (19.9); C 70.4 (21.9) I 75.0 (15.2); C 69.6 (24.4) 0.26 (-0.27, 0.80)

Boshuizen
2005 [29] **Performance-based**

Timed Walking test (time sec. 20 mtr),

I 29.1 (13.6); C 27.4 (7.3)	I 25.2 (8.23); C 26.4 (7.6)	-0.15 (-0.84, 0.55)
Max knee-extensor torque peak force		
I 56.1 (19.9); C 57.4 (23.1)	I 69.3 (17.2); C 65.6 (20.5)	0.19 (-0.50, 0.89)
TUG (sec.)		
I 15.3 (7.5); C 14.0 (3.4)	I 14.0 (7.5); C 13.6 (3.5)	-0.07 (-0.76, 0.63)
Box-stepping test, cm.		
I 23.7 (10.8); C 28.8 (12.5)	I 26.0 (8.9); C 31.9 (7.9)	-0.68 (-1.40, 0.03)
Balance test, grade		
I 4.9 (1.2); C 5.4 (0.7)	I 4.8 (1.0); C 5.4 (0.9)	9.63 (7.02, 12.25)*
Tandem stance, s		
I 5.1 (4.6); C 7.1 (3.6)	I 3.9 (4.3); C 8.0 (3.5)	1.47 (0.67, 2.26)*
Self-reported (GARS 18-72)		
I 27.0 (8.3); C 24.3 (5.7)	I 27.5 (9.6); C 26.5 (7.2)	0.11 (-0.58, 0.81)

Goals and Planning (BCT 1)

Desai	Self-reported (Decision Balance (1-5))		6 month		
2010 [45]	I 2.23 (1.15); C 2.52 (1.07)	I 2.31 (1.13); C 2.51 (1.06)	0.18 (-0.09, 0.45)	I 2.36 (1.04); C 2.54 (1.03)	0.17 (-0.13, 0.48)
				12 month	
				I 2.37 (1.08); C 2.47 (1.14)	0.09 (-0.23-0.40)
				18 month	
				I 2.38 91.04); C 2.55 (1.11)	0.16 (-0.18-0.49)
De Vries 2016 [46]	Performance-based		6 month		
	6 MWT				
	I 225.1 (117.3); C 240.4 (102.9)	I 278.4 (252.3-304.5); C 273.2 254.2-292.2)	5.2 (-21.1, 31.5)	I 288.60 (261.9-316.3); C 287.8 (268.6-307.0)	0.8 (-26.1, 27.6)
	TUG				
	I 34.7 (15.0); C 35.1 (18.1)	I 30.7 (26.4-35.0); C 31.1 (28.0-34.2)	-0.4 (-4.8, 4.0)	I 30.8 (26.3-35.4); C 31.4 (28.3-34.5)	-0.7 (-5.0, 3.9)
	Self-reported				
	PSK				
	I 7.6 (3.1); C 7.2 (2.1)	I 5.0 (3.9-6.0); C 5.3 (4.6-6.0)	-0.3 (-1.4, 0.7)	4.6 (3.6-5.7); 5.3 (4.6-6.0)	-0.7 (1.7-0.4)
	Total PA per day				
	I 87.0(56.6); C 87.9 (61.0)	I 117.90 (97.3-138.5); C 109.1 (94.4-123.8)	8.8 (-11.9, 29.5)	I 118.4 (97.8-139.0); C 104.3 (89.6-119.0)	14.1 (-6.6, 34.9)

Moderate intensity PA	I 55.0 (41.3-68.7); C 45.1 (35.3-54.9)	9.9 (-3.9, 23.7)	I 62.7 (49.0-76.4); C 44.8 (35.0-54.6)	17.9 (4.0, 31.7)*
I 28.8 (29.7); C 35.4 (35.4)				
SF-36 physical function scale				
I 30.8 (9.3); C 34.0 (10.3)	I 40.2 (36.9-43.5); C 40.5 (38.1-42.9)	-0.3 (-3.6, 3.0)	I 42.2 (38.9-45.5); C 39.1 (36.7-41.5)	3.1 (-0.2, 6.4)
<hr/>				
Lund	Performance-based (Timed Up and Go (sec.))			
2012 [47]	I 19.4 (31.6); C 13.2 (6.0)	I 23.2 (61.5); C 13.4 (7.8)	-0.23 (-0.66, 0.20)	
	Self-reported			
	Canadian Occupational Performance Measure (0-10)			
I 4.1 (2.2); C 4.3 (2.0)	I 6.2 (2.0); C 6.0 (2.0)	0.10 (-0.36, 0.56)		
	SF-36 Physical function (0-100)			
I 52.6 (25.9); C 53.8 (23.6)	I 55.3 (27.2); C 55.3 (27.2)	0.00 (-0.42, 0.42)		

SMD = standard mean difference; 95% CI = 95% Confidence Interval; BCT = the Behavior Change Taxonomy; I = intervention group; C = control group; * = significant difference ($p < 0.05$); SF-36 = 36-item short form survey; RMDQ = Roland Morris Disability Questionnaire; 6MWT = 6 minute walk-test; FIM = Functional independence measure; ADL = Activities of daily living; IAM = Instrumental Activity Measure; FAI = Frenchay Activity Index; TUG = Timed up and Go test; GARS = Groningen Activity Restriction scale; TTM = Transtheoretical model; vs. = versus.

Table 4 PEDro scale scores of included studies

	Desai 2010 [45]	Basler 2007 [39]	Karlsson 2016 [40]	Ziden 2008 [28]	Arnold 2010 [44]	Katula 2006 [41]	Schneider 2008 [42]	Nicholas 2013 [27]	De vries 2016 [46]	Norweg 2005 [43]	Lund 2012 [47]	Boshuizen 2005 [29]
1. Eligibility criteria	+	+	+	+	-	+	+	+	+	+	+	+
2. Random allocation	+	+	+	+	+	+	+	+	+	+	+	+
3. Concealed allocation	-	+	+	+	+	-	-	+	+	-	+	-
4. Baseline comparability	-	+	+	+	+	+	+	+	+	-	+	+
5. Blind subjects	-	-	-	-	-	-	-	-	-	-	-	-
6. Blind therapist	-	-	-	-	-	-	-	-	-	-	-	-
7. Blind assessors	-	+	+	-	+	+	-	+	+	-	+	-
8. Adequate follow-up	+	+	-	+	-	+	+	+	+	-	+	-
9. Intention-to-treat analysis	-	+	+	-	-	-	-	+	+	-	-	-
10. Between-group comparison	-	+	+	+	+	+	+	+	+	+	+	+
11. Point estimates and variability	+	+	+	+	+	+	+	+	+	+	+	+
	3	8	7	6	6	6	5	8	8	3	7	4

Table 5 Overview of the quality of evidence and direction of the effect of additional communication

	Outcome measure	
	Performance-based	Self-reported
All types of communication		
– End of treatment	High	Moderate*
– End of treatment till 12 month	Moderate	High*
Behavior Change Techniques		
– Social Support	Moderate	Low
– Generalisation of target behavior	Low	Low*
– Goals and Planning	n.a.	Moderate

Low= low quality evidence; moderate = moderate quality evidence; high= high quality evidence; in bold* = positive effect; not in bold = no effect.

APPENDIX A

PUBMED

1	RCT sensitive search string	randomized controlled trial[pt] OR controlled clinical trial[pt] OR randomized controlled trials[mh] OR random allocation[mh] OR double-blind method[mh] OR single-blind method[mh] OR clinical trial[pt] OR clinical trials[mh] OR ('clinical trial'[tw] OR ((singl*[tw] OR doubl*[tw] OR trebl*[tw] OR tripl*[tw]) AND (mask*[tw] OR blind[tw])) OR ('latin square'[tw]) OR placebos[mh] OR placebo*[tw] OR random*[tw] OR research design[mh:noexp] OR comparative study[mh] OR evaluation studies[mh] OR follow-up studies[mh] OR prospective studies[mh] OR cross-over studies[mh] OR control*[tw] OR prospectiv*[tw] OR volunteer*[tw]) NOT (animal[mh])
2a	Aged (title abstract)	"Aged"[Mesh] OR "Aged, 80 and over"[Mesh] OR "Senior Centers"[Mesh] OR "Homes for the Aged"[Mesh] OR
2b	Cognitive decline	"Alzheimer Disease"[Mesh] OR "Geriatric Psychiatry"[Mesh] OR ("Cognition Disorders"[Mesh] OR "Mild Cognitive Impairment"[Mesh]) OR "Dementia"[Mesh] OR (aged[Title] OR ageing[Title] OR aging[Title] OR elders[Title] OR elderly[Title] OR "older adult"[Title] OR "Old people"[Title] OR older[Title] OR "postmenopausal women"[Title] OR residents[Title] OR "aged60+"[Title] OR "80 and over"[Title] OR senior[Title] OR seniors[Title] OR elder[Title] OR geriatric[Title] OR old*[Title] OR frail*[Title] OR community-dwelling[Title] OR arthrosis[Title] OR (Alzheimer[Title] OR alzheimer's[Title] OR alzheimers[Title] OR psychogeriatrics[Title] OR "cognitive impairment"[Title] OR "cognitive decline"[Title] OR "cognitive functioning"[Title] OR dement*[Title])
3	Activity (title abstract)	"Motor Activity"[Mesh] OR "Movement"[Mesh] OR "Human Activities"[Mesh] OR "Musculoskeletal and Neural Physiological Phenomena"[Mesh] OR (Activit*[Title/Abstract] OR "Healthy life-style"[Title/Abstract] OR "daily living activities"[Title/Abstract] OR exercise[Title/Abstract] OR disability[Title/Abstract] OR disabled[Title/Abstract] OR function*[Title/Abstract] OR walk*[Title/Abstract] OR training[Title/Abstract] OR trained[Title/Abstract] OR climbing[Title/Abstract] OR running[Title/Abstract] OR bicycle*[Title/Abstract] OR swimming[Title/Abstract] OR gait[Title/Abstract] OR performance[Title/Abstract] OR mobility[Title/Abstract] OR vitality[Title/Abstract] OR function[Title/Abstract] OR strength[Title/Abstract] OR fall[Title/Abstract] OR fall*[Title/Abstract])
4	Communication (title abstract)	"Counseling"[Mesh] AND "Behavior and Behavior Mechanisms"[Mesh] OR "Health Promotion"[Mesh] OR "Interview, Psychological"[Mesh] OR "Health Education"[Mesh] OR "Self Care"[Mesh] OR ("Disease Management"[Mesh] OR "Health Information Management"[Mesh] OR "Pain Management"[Mesh] OR "Knowledge Management"[Mesh] OR "Information Management"[Mesh]) OR "Communication"[Mesh] AND (discussion[Title/Abstract] OR interpersonal[Title/Abstract] OR peer[Title/Abstract] OR collaborative[Title/Abstract] OR education[Title/Abstract] OR independence[Title/Abstract] OR independence[Title/Abstract] OR management[Title/Abstract] OR self-management[Title/Abstract] OR counseling[Title/Abstract] OR coordinator[Title/Abstract] OR visits[Title/Abstract] OR visit[Title/Abstract] OR consultation[Title/Abstract] OR consultations[Title/Abstract] OR perception[Title/Abstract] OR beliefs[Title/Abstract] OR attitude[Title/Abstract] OR training[Title/Abstract] OR promotion[Title/Abstract] OR priority-setting[Title/Abstract] OR evaluation[Title/Abstract] OR support[Title/Abstract] OR supported[Title/Abstract] OR program[Title/Abstract] OR problem-based[Title/Abstract] OR homecare[Title/Abstract] OR monitor[Title/Abstract] OR monitoring[Title/Abstract] OR self-care[Title/Abstract] OR communication[Title/Abstract] OR communication skills[Title/Abstract] OR history taking[Title/Abstract] OR consultation[Title/Abstract] OR consultation skills[Title/Abstract] OR breaking bad news[Title/Abstract] OR cross cultural[Title/Abstract] OR interpersonal relation[Title/Abstract] OR end of life[Title/Abstract] OR informed consent[Title/Abstract] OR anamnesis[Title/Abstract] OR interview[Title/Abstract] OR medical interview[Title/Abstract] OR doctor patient interaction[Title/Abstract] OR doctor patient relation[Title/Abstract] OR physician patient relation[Title/Abstract] OR physician patient interaction[Title/Abstract] OR referral[Title/Abstract] OR counseling[Title/Abstract] OR non verbal communication[Title/Abstract] OR electronic communication[Title/Abstract] OR email communication[Title/Abstract] OR doctor nurse communication[Title/Abstract] OR health beliefs[Title/Abstract] OR treatment plan*[Title/Abstract] OR confidence[Title/Abstract] OR "behavior change"[Title/Abstract] OR "motivational interviewing"[Title/Abstract] OR empathy[Title/Abstract] OR empathic[Title/Abstract] OR hopefulness[Title/Abstract] OR enablement[Title/Abstract] OR narrative[Title/Abstract] OR coping[Title/Abstract] OR trust[Title/Abstract] OR autonomy[Title/Abstract] OR paternalistic[Title/Abstract] OR motivation[Title/Abstract] OR adherence[Title/Abstract] OR

	<p>beliefs[Title/Abstract] OR education[Title/Abstract] OR coaching[Title/Abstract] OR "Goal setting"[Title/Abstract] OR "Self monitoring"[Title/Abstract] OR planning[Title/Abstract] OR awareness[Title/Abstract] OR information[Title/Abstract] OR "Self-monitoring"[Title/Abstract] OR social[Title/Abstract] OR prompts[Title/Abstract] OR triggers[Title/Abstract] OR cues[Title/Abstract] OR expectation[Title/Abstract] OR communication[Title/Abstract] OR regulation[Title/Abstract] OR emotional[Title/Abstract] OR "Socio-emotional"[Title/Abstract] OR centered[Title/Abstract] OR feedback[Title/Abstract] OR centered[Title/Abstract] OR reminder[Title/Abstract] OR telephone[Title/Abstract] OR "cognitive-enhancement"[Title/Abstract] OR enhancement[Title/Abstract] OR engagement[Title/Abstract] OR cognitive[Title/Abstract] OR concordance[Title/Abstract] OR adher*[Title/Abstract] OR complian*[Title/Abstract] OR complying[Title/Abstract] OR change[Title/Abstract] OR changes[Title/Abstract] OR changing[Title/Abstract] OR behaviour[Title/Abstract] OR behavior[Title/Abstract] OR modify[Title/Abstract] OR modifies[Title/Abstract] OR modifying[Title/Abstract] OR modification[Title/Abstract] OR communication[Title/Abstract] OR verbal[Title/Abstract] OR nonverbal[Title/Abstract] OR non-verbal[Title/Abstract] OR "non verbal"[Title/Abstract] OR empathy*[Title/Abstract] OR "Solicitous behav*"[Title/Abstract] OR "inhibiting behav*"[Title/Abstract] OR exhibiting[Title/Abstract] OR concern[Title/Abstract] OR cues[Title/Abstract] OR facilitate*[Title/Abstract] OR reinforcemen*[Title/Abstract] OR discourag*[Title/Abstract] OR assistan*[Title/Abstract] OR inference[Title/Abstract] OR "eye gaze"[Title/Abstract] OR expression[Title/Abstract] OR affirmative[Title/Abstract] OR nodding[Title/Abstract] OR grimacing[Title/Abstract] OR facial[Title/Abstract] OR expression[Title/Abstract] OR touching[Title/Abstract] OR interest[Title/Abstract] OR timing[Title/Abstract] OR statements[Title/Abstract] OR protective[Title/Abstract] OR stimulating[Title/Abstract] OR incentive[Title/Abstract] OR facilitative[Title/Abstract] OR smiling[Title/Abstract] OR posture[Title/Abstract] OR distance[Title/Abstract] OR appropriate[Title/Abstract] OR tone[Title/Abstract] OR talk[Title/Abstract] OR messag*[Title/Abstract] OR restatemen*[Title/Abstract] OR clarification[Title/Abstract] OR listen*[Title/Abstract] OR "emotional probe*"[Title/Abstract] OR reassurance[Title/Abstract] OR support[Title/Abstract] OR reflection[Title/Abstract] OR feelings[Title/Abstract] OR encouragement[Title/Abstract] OR acknowledgement*[Title/Abstract] OR disapproval[Title/Abstract] OR disruption[Title/Abstract] OR jargon[Title/Abstract] OR "content question*"[Title/Abstract] OR "content remarks"[Title/Abstract] OR check[Title/Abstract] OR understanding[Title/Abstract] OR encouragement[Title/Abstract] OR "social amenities"[Title/Abstract] OR silence[Title/Abstract] OR immediacy[Title/Abstract] OR "body orientation"[Title/Abstract] OR open[Title/Abstract] OR closed[Title/Abstract] OR position[Title/Abstract] OR intimacy[Title/Abstract] OR touch*[Title/Abstract] OR instrumental[Title/Abstract] OR reassurance[Title/Abstract] OR handshake[Title/Abstract] OR helpfulness[Title/Abstract] OR affective[Title/Abstract] OR rapport[Title/Abstract] OR reassurance[Title/Abstract] OR manipulation[Title/Abstract] OR write*[Title/Abstract] OR gesture[Title/Abstract] OR cessation[Title/Abstract] OR event[Title/Abstract] OR nods[Title/Abstract] OR nodding[Title/Abstract] OR smil*[Title/Abstract] OR looking[Title/Abstract] OR question-asking[Title/Abstract] OR understand*[Title/Abstract] OR close*[Title/Abstract] OR open*[Title/Abstract] OR supportive[Title/Abstract] OR posture[Title/Abstract] OR clarification*[Title/Abstract] OR suggestion*[Title/Abstract] OR command[Title/Abstract] OR instructive[Title/Abstract] OR optimis*[Title/Abstract] OR laughter[Title/Abstract] OR joking[Title/Abstract] OR chit-chat[Title/Abstract] OR worry[Title/Abstract] OR socio-emotional[Title/Abstract] OR "partnership building"[Title/Abstract] OR support[Title/Abstract] OR compliment*[Title/Abstract] OR negative[Title/Abstract] OR back-channel[Title/Abstract] OR disapproval[Title/Abstract] OR abrupt[Title/Abstract] OR disagreement[Title/Abstract] OR criticism[Title/Abstract] OR withholding[Title/Abstract] OR interrupt*[Title/Abstract] OR interjection*[Title/Abstract] OR talk[Title/Abstract] OR reflect*[Title/Abstract] OR partnership[Title/Abstract] OR self-disclosure[Title/Abstract] OR feelings[Title/Abstract] OR asking[Title/Abstract] OR empathic[Title/Abstract] OR statement*[Title/Abstract] OR paraphrase[Title/Abstract] OR interpret[Title/Abstract] OR recognize[Title/Abstract] OR opinion[Title/Abstract] OR restatement[Title/Abstract] OR acceptance[Title/Abstract] OR accord[Title/Abstract] OR procedural[Title/Abstract] OR silence[Title/Abstract] OR conversation*[Title/Abstract] OR coding[Title/Abstract] OR space[Title/Abstract] OR tell[Title/Abstract] OR facial[Title/Abstract] OR hesitation[Title/Abstract] OR interaction[Title/Abstract] OR warmth[Title/Abstract] OR compassion[Title/Abstract] OR daring[Title/Abstract] OR relation[Title/Abstract] OR adhere[Title/Abstract] OR "communication skill*"[Title/Abstract] OR trust[Title/Abstract] OR Behave* AND PR cognitive*[Title/Abstract] OR relax*[Title/Abstract] OR "graded activity"[Title/Abstract] OR reinforcement[Title/Abstract] OR respondent[Title/Abstract] OR support[Title/Abstract] OR Motivat*[Title/Abstract] OR session*[Title/Abstract] OR counsel*[Title/Abstract] OR practi*[Title/Abstract] OR behav*[Title/Abstract] OR "Patient education"[Title/Abstract] OR "pain management"[Title/Abstract] OR "self care"[Title/Abstract] OR "self management"[Title/Abstract] OR encourage[Title/Abstract]</p>
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		OR promot*[Title/Abstract] OR uptake[Title/Abstract] OR increase[Title/Abstract] OR start[Title/Abstract] OR educat*[Title/Abstract] OR program* AND Motivate*[Title/Abstract] OR session*[Title/Abstract] OR counsel*[Title/Abstract] OR practi*[Title/Abstract] OR behave*[Title/Abstract] OR "Patient education"[Title/Abstract] OR "pain management"[Title/Abstract] OR "self care"[Title/Abstract] OR "self management"[Title/Abstract] OR encourage[Title/Abstract] OR promot*[Title/Abstract] OR uptake[Title/Abstract] OR increase[Title/Abstract] OR start[Title/Abstract] OR educat*[Title/Abstract] OR program*[Title/Abstract] OR "Behavior Therapy"[Title/Abstract] OR conditioning, operant[Title/Abstract] OR reinforcement AND (psychology) AND "OR " AND behavior therapy AND "OR " AND operant conditioning AND "OR " AND respondent treatment AND "OR behavioral therapy" AND "OR AND "behavioural therapy"[Title/Abstract] OR "cognitive therapy/"[Title/Abstract] OR "cognitive therapy"[Title/Abstract] OR "behavior treatment"[Title/Abstract] OR "relaxation"[Title/Abstract] OR "exp relaxation"[Title/Abstract] OR "graded activity"[Title/Abstract] OR stimulat*[Title/Abstract] OR teach[Title/Abstract] OR strategy[Title/Abstract] OR tailored[Title/Abstract] OR information[Title/Abstract] OR monitoring[Title/Abstract] OR supervis*[Title/Abstract] OR multifactorial[Title/Abstract] OR telephone[Title/Abstract] OR call[Title/Abstract]
5	Not (title abstract)	"Chemicals and Drugs Category"[Mesh] OR "Allergy and Immunology"[Mesh] OR "analysis"[Subheading] OR "Nutritional Sciences"[Mesh] OR "Vision Disorders"[Mesh] OR "Food"[Mesh] OR "Urogenital System"[Mesh] OR "Emergencies"[Mesh] OR "Sleep"[Mesh] OR "Weather"[Mesh] OR "Stomatognathic System"[Mesh] OR "Lymphatic System"[Mesh] OR (Medic*[Title/Abstract] OR vaccine[Title/Abstract] OR immune*[Title/Abstract] OR cortic*[Title/Abstract] OR MRI[Title/Abstract] OR nutrition[Title/Abstract] OR children[Title/Abstract] OR eyes[Title/Abstract] OR chemicals[Title/Abstract] OR drugs[Title/Abstract] OR seasonal[Title/Abstract] OR DNA[Title/Abstract] OR intranasal[Title/Abstract] OR bemiparin[Title/Abstract] OR vitamin[Title/Abstract] OR Visual[Title/Abstract] OR leukocyte[Title/Abstract] OR glutamine[Title/Abstract] OR weather[Title/Abstract] OR colorectal[Title/Abstract] OR leukem*[Title/Abstract] OR renal[Title/Abstract] OR FDA[Title/Abstract] OR emergency[Title/Abstract] OR sleep[Title/Abstract] OR brain[Title/Abstract] OR dental[Title/Abstract] OR plasma[Title/Abstract] OR drug[Title/Abstract] OR aspirin[Title/Abstract]
		(1 AND (2a OR 2b)) AND 3 AND 4) NOT 5

CINAHL

1	RCT sensitive search string	(AB "randomized") OR (MJ "treatment outcomes") OR (PT "clinical trial") narrowed by subject age 65+.
2a	Aged (title abstract)	aged OR ageing OR aging OR elders OR elderly OR "older adult*" OR "Old people" OR older OR "postmenopausal women" OR residents OR "aged60+" OR "80 and over" OR senior OR seniors OR elder OR geriatric OR old* OR frail* OR community-dwelling OR arthrosis OR (MM "Aged") OR (MM "Aged, 80 and Over") OR (MM "Aged, Hospitalized") OR (MM "Housing for the Elderly") OR (MM "Gerontologic Nursing") OR (MM "Gerontologic Care") OR (MM "Frail Elderly")
2b	Cognitive decline	Alzheimer OR alzheimer's OR alzheimers OR psychogeriatrics OR "cognitive impairment" OR "cognitive decline" OR "cognitive functioning" OR dement* OR (MM "Alzheimer's Disease") OR (MM "Lewy Body Disease") OR (MM "Delirium, Dementia, Amnesic, Cognitive Disorders") OR (MM "Geriatric Psychiatry") OR (MM "Dementia") OR (MM "Dementia, Senile") OR (MM "Dementia, Presenile")
3	Activity (title abstract)	Activit* OR "Healthy life-style" OR "daily living activities" OR "daily living" OR "activities of daily living" OR exercise OR disability OR disabled OR function* OR walk* OR training OR trained OR climbing OR running OR bicycle* OR swimming OR gait OR performance OR mobility OR vitality OR function OR strength OR fall OR fall* OR (MM "Activities of Daily Living") OR (MM "Physical Activity") OR (MM "Human Activities") OR (MM "Motor Activity") OR (MM "Leisure Activities") OR (MM "Instrumental Activities of Daily Living Alteration (Saba CCC)") OR (MM "Instrumental Activities of Daily Living (Saba CCC)") OR (MM "Diversional Activity Deficit (Saba CCC)") OR (MM "Activity Therapy (Iowa NIC)") OR (MM "Activity Intolerance Risk (Saba CCC)") OR (MM "Activity Intolerance (Saba CCC)") OR (MM "Activity Component (Saba CCC)") OR (MM "Life Style") OR (MM "Human Activities") OR (MM "Exertion") OR (MM "Exercise") OR (MM "Exercise Physiology")

		OR (MM "Physical Endurance") OR (MM "Physical Therapist Attitudes") OR (MM "Physical Stimulation") OR (MM "Physical Mobility") OR (MM "Physical Endurance")
4	Communication (title abstract)	discussion OR interpersonal OR peer OR collaborative OR education OR independence OR independence OR management OR self-management OR counseling OR coordinator OR visits OR visit OR consultation OR consultations OR perception OR beliefs OR attitude OR training OR promotion OR priority-setting OR evaluation OR support OR supported OR program OR problem-based OR homecare OR monitor OR monitoring OR self-care OR communication OR communication skills OR history taking OR consultation OR consultation skills OR breaking bad news OR cross cultural OR interpersonal relation OR end of life OR informed consent OR anamnesis OR interview OR medical interview OR doctor patient interaction OR doctor patient relation OR physician patient relation OR physician patient interaction OR referral OR counseling OR non verbal communication OR electronic communication OR email communication OR doctor nurse communication OR health beliefs OR treatment plan*" OR confidence OR "behavior change" OR "motivational interviewing" OR empathy OR empathic OR hopefulness OR enablement' OR narrative OR coping OR trust OR autonomy OR paternalistic OR motivation OR adherence OR beliefs OR education OR coaching OR "Goal setting" OR "Self monitoring" OR planning OR awareness OR information OR "Self-monitoring" OR social OR prompts OR triggers OR cues OR expectation OR communication OR regulation OR emotional OR "Socio-emotional" OR centered OR feedback OR centered OR reminder OR telephone OR "cognitive-enhancement" OR enhancement OR engagement OR cognitive OR concordance OR adher* OR complian* OR complying OR change OR changes OR changing OR behaviour OR behavior OR modify OR modifies OR modifying OR modification OR communication OR verbal OR nonverbal OR non-verbal OR "non verbal" OR empathy* OR "Solicitous behav*" OR "inhibiting behav*" OR exhibiting OR concern OR cues OR facilitate* OR reinforcemen* OR discourag* OR assistan* OR inference OR "eye gaze" OR expression OR affirmative OR nodding OR grimacing OR facial OR expression OR touching OR interest OR timing OR statements OR protective OR stimulating OR incentive OR facilitative OR smiling OR posture OR distance OR appropriate OR tone OR talk OR messag* OR restatemen* OR clarification OR listen* OR "emotional probe*" OR reassurance OR support OR reflection OR feelings OR encouragement OR acknowledgement* OR disapproval OR disruption OR jargon OR "content question*" OR "content remarks" OR check OR understanding OR encouragement OR "social amenities" OR silence OR immediacy OR "body orientation" OR open OR closed OR position OR intimacy OR touch* OR instrumental OR reassurance OR handshake OR helpfulness OR affective OR rapport OR reassurance OR manipulation OR write* OR gesture OR cessation OR event OR nods OR nodding OR smil* OR looking OR question-asking OR understand* OR close* OR open* OR supportive OR posture OR clarification* OR suggestion* OR command OR instructive OR optimis* OR laughter OR joking OR chit-chat OR worry OR socio-emotional OR "partnership building" OR support OR compliment* OR negative OR back-channel OR disapproval OR abrupt OR disagreement OR criticism OR withholding OR interrupt* OR interjection* OR talk OR reflect* OR partnership OR self-disclosure OR feelings OR asking OR empathic OR statement* OR paraphrase OR interpret OR recognize OR opinion OR restatement OR acceptance OR accord OR procedural OR silence OR conversation* OR coding OR space OR tell OR facial OR hesitation OR interaction OR warmth OR compassion OR daring OR relation OR adhere OR "communication skill*" OR trust OR Behave* PR cognitive* OR relax* OR "graded activity" OR reinforcement OR respondent OR support OR Motivat* OR session* OR counsel* OR practi* OR behav* OR "Patient education" OR "pain management" OR "self care" OR "self management" OR encourage OR promot* OR uptake OR increase OR start OR educat* OR program* Motivate* OR session* OR counsel* OR practi* OR behave* OR "Patient education" OR "pain management" OR "self care" OR "self management" OR encourage OR promot* OR uptake OR increase OR start OR educat* OR program* OR "Behavior Therapy" OR conditioning, operant OR reinforcement (psychology) "OR " behavior therapy "OR " operant conditioning "OR " respondent treatment "OR behavioral therapy" 'OR "behavioural therapy" OR "cognitive therapy/" OR "cognitive therapy" OR "behavior treatment" OR "relaxation" OR "exp relaxation" OR "graded activity" OR stimulat* OR teach OR strategy OR tailored OR information OR monitoring OR supervis* OR multifactorial OR telephone OR call OR (MM "Counseling") OR (MM "Ergonomics") OR (MM "Psychology, Educational") OR (MM "Psychology, Occupational") OR (MM "Psychology, Sports") OR (MM "Psychology, Applied") OR (MH "Community Networks") OR (MM "Occupational Health Services") OR (MM "Preventive Health Care") OR (MM "Rehabilitation, Community-Based") OR (MM "Communication") OR (MM "Communication Methods, Total") OR (MM "Nonverbal Communication") OR (MM "Alternative and Augmentative Communication") OR (MM "Impaired Verbal Communication (NANDA)") OR (MM "Communication Skills Training") OR (MM "Communication Protocols") OR (MM "Communication Skills") OR (MM "Communication Care (Saba CCC)") OR (MM "Education") OR (MM "Education, Non-Traditional") OR (MM "Education, Physical Education") OR (MM "Education, Nursing, Diploma Programs") OR (MM "Adult

		Education") OR (MM "Patient Education") OR (MM "Patient Discharge Education") OR (MM "Education, Respiratory Therapy")
5	Not (title abstract)	Medic* OR vaccine OR immune* OR cortic* OR MRI OR nutrition OR children OR eyes OR chemicals OR drugs OR seasonal OR DNA OR intranasal OR bemiparin OR vitamin OR Visual OR leukocyte OR glutamine OR weather OR colorectal OR leukem* OR renal OR FDA OR emergency OR sleep OR brain OR dental OR plasma OR drug OR aspirin OR (MM "Medication Side Effects (Saba CCC)") OR (MM "Medication Treatment (Saba CCC)") OR (MM "Vaccines") OR (MM "Renal Artery Obstruction") OR (MM "Renal Insufficiency") OR (MM "Renal Insufficiency, Chronic") OR (MM "Drug Therapy") OR (MM "Esterases Metabolism") OR (MM "Blood Transfusion") OR (MM "Deglutition Disorders") OR (MM "Cannabis")
		(1 AND (2a OR 2b)) AND 3 AND 4) NOT 5

Embase

1	RCT sensitive search string	random* OR placebo OR 'double blind'
2a	Aged (title abstract)	aged:ti OR ageing:ti OR aging:ti OR elders:ti OR elderly:ti OR (older AND adult*):ab OR (Old AND people):ab OR older:ti OR (postmenopausal AND women):ti OR residents:ti OR senior:ti OR seniors:ti OR elder:ti OR geriatric:ti OR old*:ti OR frail*:ti OR 'community-dwelling':ti OR arthritis:ti OR 'aged'/exp OR 'resident'/de OR 'senior center'/de OR 'elderly care'/exp OR 'osteoarthritis'/exp
2b	Cognitive decline	Alzheimer:ti OR alzheimer's:ti OR alzheimers:ti OR psychogeriatrics:ti OR 'cognitive impairment':ti OR 'cognitive decline':ti OR 'cognitive functioning':ti OR dement*:ti OR 'gerontopsychiatry'/de OR 'dementia'/exp OR 'degenerative disease'/exp
3	Activity (title abstract)	Activit*:ab,ti OR 'Healthy life-style':ab,ti OR 'daily living activities':ab,ti OR exercise:ab,ti OR disability:ab,ti OR disabled:ab,ti OR function*:ab,ti OR walk*:ab,ti OR training:ab,ti OR trained:ab,ti OR climbing:ab,ti OR running:ab,ti OR bicycle*:ab,ti OR swimming:ab,ti OR gait:ab,ti OR performance:ab,ti OR mobility:ab,ti OR vitality:ab,ti OR function:ab,ti OR strength:ab,ti OR fall:ab,ti OR fall*:ab,ti OR 'general health status assessment'/exp OR 'physical activity, capacity and performance'/exp OR 'disability'/exp OR 'musculoskeletal function'/exp OR 'muscle strength'/exp OR 'falling'/de OR 'joint mobility'/de
4	Communication (title abstract)	discussion:ab,ti OR interpersonal:ab,ti OR peer:ab,ti OR collaborative:ab,ti OR education:ab,ti OR independence:ab,ti OR independence:ab,ti OR management:ab,ti OR self-management:ab,ti OR counseling:ab,ti OR coordinator:ab,ti OR visits:ab,ti OR visit:ab,ti OR consultation:ab,ti OR consultations:ab,ti OR perception:ab,ti OR beliefs:ab,ti OR attitude:ab,ti OR training:ab,ti OR promotion:ab,ti OR priority-setting:ab,ti OR evaluation:ab,ti OR support:ab,ti OR supported:ab,ti OR program:ab,ti OR problem-based:ab,ti OR homecare:ab,ti OR monitor:ab,ti OR monitoring:ab,ti OR self-care:ab,ti OR communication:ab,ti OR communication skills:ab,ti OR 'history taking':ab,ti OR consultation:ab,ti OR 'consultation skills':ab,ti OR 'cross cultural':ab,ti OR 'interpersonal relation':ab,ti OR 'informed consent':ab,ti OR anamnesis:ab,ti OR interview:ab,ti OR 'medical interview':ab,ti OR 'doctor patient interaction':ab,ti OR 'doctor patient relation':ab,ti OR 'physician patient relation':ab,ti OR 'physician patient interaction':ab,ti OR referral:ab,ti OR counseling:ab,ti OR 'non verbal communication':ab,ti OR 'electronic communication':ab,ti OR 'email communication':ab,ti OR 'doctor nurse communication':ab,ti OR 'health beliefs':ab,ti OR 'treatment plan':ab,ti OR 'treatment plans':ab,ti OR confidence:ab,ti OR 'behavior change':ab,ti OR 'motivational interviewing':ab,ti OR empathy:ab,ti OR empathic:ab,ti OR hopefulness:ab,ti OR enablement:ab,ti OR narrative:ab,ti OR coping:ab,ti OR trust:ab,ti OR autonomy:ab,ti OR paternalistic:ab,ti OR motivation:ab,ti OR adherence:ab,ti OR beliefs:ab,ti OR education:ab,ti OR coaching:ab,ti OR 'Goal setting':ab,ti OR (Self AND monitoring):ab,ti OR planning:ab,ti OR awareness:ab,ti OR information:ab,ti OR 'Self-monitoring':ab,ti OR social:ab,ti OR prompts:ab,ti OR triggers:ab,ti OR cues:ab,ti OR expectation:ab,ti OR communication:ab,ti OR regulation:ab,ti OR emotional:ab,ti OR 'Socio-emotional':ab,ti OR centered:ab,ti OR feedback:ab,ti OR centered:ab,ti OR reminder:ab,ti OR telephone:ab,ti OR 'cognitive-enhancement':ab,ti OR enhancement:ab,ti OR engagement:ab,ti OR cognitive:ab,ti OR concordance:ab,ti OR adher*:ab,ti OR complian*:ab,ti OR complying:ab,ti OR change:ab,ti OR changes:ab,ti OR changing:ab,ti OR behaviour:ab,ti OR behavior:ab,ti OR modify:ab,ti OR modifies:ab,ti OR modifying:ab,ti OR modification:ab,ti OR communication:ab,ti OR verbal:ab,ti OR nonverbal:ab,ti OR non-verbal:ab,ti OR 'non verbal':ab,ti OR empathy*:ab,ti OR (Solicitous AND behav*):ab,ti OR (inhibiting AND

		<p>behav*):ab,ti OR exhibiting:ab,ti OR concern:ab,ti OR cues:ab,ti OR facilitate*:ab,ti OR reinforcement*:ab,ti OR discourag*:ab,ti OR assistan*:ab,ti OR inference:ab,ti OR 'eye gaze':ab,ti OR expression:ab,ti OR affirmative:ab,ti OR nodding:ab,ti OR grimacing:ab,ti OR facial:ab,ti OR expression:ab,ti OR touching:ab,ti OR interest:ab,ti OR timing:ab,ti OR statements:ab,ti OR protective:ab,ti OR stimulating:ab,ti OR incentive:ab,ti OR facilitative:ab,ti OR smiling:ab,ti OR posture:ab,ti OR distance:ab,ti OR appropriate:ab,ti OR tone:ab,ti OR talk:ab,ti OR messag*:ab,ti OR restatemen*:ab,ti OR clarification:ab,ti OR listen*:ab,ti OR 'emotional probe*':ab,ti OR reassurance:ab,ti OR support:ab,ti OR reflection:ab,ti OR feelings:ab,ti OR encouragement:ab,ti OR acknowledgement*:ab,ti OR disapproval:ab,ti OR disruption:ab,ti OR jargon:ab,ti OR 'content question*':ab,ti OR 'content remarks':ab,ti OR check:ab,ti OR understanding:ab,ti OR encouragement:ab,ti OR 'social amenities':ab,ti OR silence:ab,ti OR immediacy:ab,ti OR 'body orientation':ab,ti OR open:ab,ti OR closed:ab,ti OR position:ab,ti OR intimacy:ab,ti OR touch*:ab,ti OR instrumental:ab,ti OR reassurance:ab,ti OR handshake:ab,ti OR helpfulness:ab,ti OR affective:ab,ti OR rapport:ab,ti OR reassurance:ab,ti OR manipulation:ab,ti OR write*:ab,ti OR gesture:ab,ti OR cessation:ab,ti OR event:ab,ti OR nods:ab,ti OR nodding:ab,ti OR smil*:ab,ti OR looking:ab,ti OR question-asking:ab,ti OR understand*:ab,ti OR close*:ab,ti OR open*:ab,ti OR supportive:ab,ti OR posture:ab,ti OR clarification*:ab,ti OR suggestion*:ab,ti OR command:ab,ti OR instructive:ab,ti OR optimis*:ab,ti OR laughter:ab,ti OR joking:ab,ti OR chit-chat:ab,ti OR worry:ab,ti OR socio-emotional:ab,ti OR 'partnership building':ab,ti OR support:ab,ti OR compliment*:ab,ti OR negative:ab,ti OR back-channel:ab,ti OR disapproval:ab,ti OR abrupt:ab,ti OR disagreement:ab,ti OR criticism:ab,ti OR withholding:ab,ti OR interrupt*:ab,ti OR interjection*:ab,ti OR talk:ab,ti OR reflect*:ab,ti OR partnership:ab,ti OR self-disclosure:ab,ti OR feelings:ab,ti OR asking:ab,ti OR empathic:ab,ti OR statement*:ab,ti OR paraphrase:ab,ti OR interpret:ab,ti OR recognize:ab,ti OR opinion:ab,ti OR restatement:ab,ti OR acceptance:ab,ti OR accord:ab,ti OR procedural:ab,ti OR silence:ab,ti OR conversation*:ab,ti OR coding:ab,ti OR space:ab,ti OR tell:ab,ti OR facial:ab,ti OR hesitation:ab,ti OR interaction:ab,ti OR warmth:ab,ti OR compassion:ab,ti OR daring:ab,ti OR relation:ab,ti OR adhere:ab,ti OR (communication AND skill*):ab,ti OR trust:ab,ti OR Behave* OR cognitive*:ab,ti OR relax*:ab,ti OR 'graded activity':ab,ti OR reinforcement:ab,ti OR respondent:ab,ti OR support:ab,ti OR Motivat*:ab,ti OR session*:ab,ti OR counsel*:ab,ti OR practi*:ab,ti OR behav*:ab,ti OR 'Patient education':ab,ti OR 'pain management':ab,ti OR 'self care':ab,ti OR (self AND management):ab,ti OR encourage:ab,ti OR promot*:ab,ti OR uptake:ab,ti OR increase:ab,ti OR start:ab,ti OR educat*:ab,ti OR program* Motivate*:ab,ti OR session*:ab,ti OR counsel*:ab,ti OR practi*:ab,ti OR behave*:ab,ti OR (Patient AND education):ab,ti OR (pain AND management):ab,ti OR (self AND care):ab,ti OR (self AND management):ab,ti OR encourage:ab,ti OR promot*:ab,ti OR uptake:ab,ti OR increase:ab,ti OR start:ab,ti OR educat*:ab,ti OR program*:ab,ti OR (Behavior AND Therapy):ab,ti OR (behavior AND Therapy):ab,ti OR conditioning, operant:ab,ti OR reinforcement:ab,ti OR (operant AND conditioning):ab,ti OR (respondent AND treatment):ab,ti OR (behavioral AND therapy):ab,ti OR (behavioural AND therapy):ab,ti OR (cognitive AND therapy):ab,ti OR (cognitive AND therapy):ab,ti OR (behavior AND treatment):ab,ti OR (behavior AND treatment):ab,ti OR relaxation:ab,ti OR (graded AND activity):ab,ti OR stimulat*:ab,ti OR teach:ab,ti OR strategy:ab,ti OR tailored:ab,ti OR information:ab,ti OR monitoring:ab,ti OR supervis*:ab,ti OR multifactorial:ab,ti OR telephone:ab,ti OR call:ab,ti OR 'behavior'/exp OR 'counseling'/exp OR 'education'/exp OR 'self care'/exp OR 'body weight management'/exp OR 'patient care'/exp</p>
5	Not (title abstract)	<p>(Medic*:ab,ti OR vaccine:ab,ti OR immune*:ab,ti OR cortic*:ab,ti OR MRI:ab,ti OR nutrition:ab,ti OR children:ab,ti OR eyes:ab,ti OR chemicals:ab,ti OR drugs:ab,ti OR seasonal:ab,ti OR DNA:ab,ti OR intranasal:ab,ti OR bempirin:ab,ti OR vitamin:ab,ti OR Visual:ab,ti OR leukocyte:ab,ti OR glutamine:ab,ti OR weather:ab,ti OR colorectal:ab,ti OR leukem*:ab,ti OR renal:ab,ti OR FDA:ab,ti OR emergency:ab,ti OR sleep:ab,ti OR brain:ab,ti OR dental:ab,ti OR plasma:ab,ti OR drug:ab,ti OR aspirin:ab,ti) OR 'drug therapy'/exp OR 'biological product'/exp OR 'immunology'/exp OR 'analysis'/exp OR 'nutrition'/exp OR 'juvenile'/exp OR 'visual system'/exp OR 'chemicals and drugs'/exp OR 'vitamin'/exp OR 'urogenital system'/exp OR 'food and drug administration'/exp OR 'emergency'/exp OR 'sleep'/exp OR 'weather'/exp OR 'tooth'/exp OR 'hemolymphatic system'/exp</p>
		(1 AND (2a OR 2b)) AND 3 AND 4) NOT 5

PsychINFO

1	RCT sensitive search string	SU.EXACT("Treatment Effectiveness Evaluation") OR SU.EXACT.EXPLODE("Treatment Outcomes") OR SU.EXACT("Placebo") OR SU.EXACT("Followup Studies") OR placebo* OR random* OR "comparative stud*" OR clinical NEAR/3 trial* OR research NEAR/3 design OR
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		evaluat* NEAR/3 stud* OR prospectiv* NEAR/3 stud* OR (singl* OR doubl* OR trebl* OR tripl*) NEAR/3 (blind* OR mask*)
2a	Aged (title abstract)	aged OR ageing OR aging OR elders OR elderly OR "older adult*" OR "Old people" OR older OR "postmenopausal women" OR residents OR "aged60+" OR "80 and over" OR senior OR seniors OR elder OR geriatric OR old* OR frail* OR community-dwelling OR arthritis
2b	Cognitive decline	Alzheimer OR alzheimer's OR alzheimers OR psychogeriatrics OR "cognitive impairment" OR "cognitive decline" OR "cognitive functioning" OR dement*
3	Activity (title abstract)	Activit* OR "Healthy life-style" OR "daily living activities" OR "daily living" OR "activities of daily living" OR exercise OR disability OR disabled OR function* OR walk* OR training OR trained OR climbing OR running OR bicycle* OR swimming OR gait OR performance OR mobility OR vitality OR function OR strength OR fall OR fall*
4	Communication (title abstract)	discussion OR interpersonal OR peer OR collaborative OR education OR independence OR independence OR management OR self-management OR counseling OR coordinator OR visits OR visit OR consultation OR consultations OR perception OR beliefs OR attitude OR training OR promotion OR priority-setting OR evaluation OR support OR supported OR program OR problem-based OR homecare OR monitor OR monitoring OR self-care OR communication OR communication skills OR history taking OR consultation OR consultation skills OR breaking bad news OR cross cultural OR interpersonal relation OR end of life OR informed consent OR anamnesis OR interview OR medical interview OR doctor patient interaction OR doctor patient relation OR physician patient relation OR physician patient interaction OR referral OR counseling OR non verbal communication OR electronic communication OR email communication OR doctor nurse communication OR health beliefs OR treatment plan** OR confidence OR "behavior change" OR "motivational interviewing" OR empathy OR empathic OR hopefulness OR enablement* OR narrative OR coping OR trust OR autonomy OR paternalistic OR motivation OR adherence OR beliefs OR education OR coaching OR "Goal setting" OR "Self monitoring" OR planning OR awareness OR information OR "Self-monitoring" OR social OR prompts OR triggers OR cues OR expectation OR communication OR regulation OR emotional OR "Socio-emotional" OR centered OR feedback OR centered OR reminder OR telephone OR "cognitive-enhancement" OR enhancement OR engagement OR cognitive OR concordance OR adher* OR complian* OR complying OR change OR changes OR changing OR behaviour OR behavior OR modify OR modifies OR modifying OR modification OR communication OR verbal OR nonverbal OR non-verbal OR "non verbal" OR empathy* OR "Solicitous behav*" OR "inhibiting behav*" OR exhibiting OR concern OR cues OR facilitate* OR reinforcement* OR discourag* OR assistan* OR inference OR "eye gaze" OR expression OR affirmative OR nodding OR grimacing OR facial OR expression OR touching OR interest OR timing OR statements OR protective OR stimulating OR incentive OR facilitative OR smiling OR posture OR distance OR appropriate OR tone OR talk OR messag* OR restatemen* OR clarification OR listen* OR "emotional probe*" OR reassurance OR support OR reflection OR feelings OR encouragement OR acknowledgement* OR disapproval OR disruption OR jargon OR "content question*" OR "content remarks" OR check OR understanding OR encouragement OR "social amenities" OR silence OR immediacy OR "body orientation" OR open OR closed OR position OR intimacy OR touch* OR instrumental OR reassurance OR handshake OR helpfulness OR affective OR rapport OR reassurance OR manipulation OR write* OR gesture OR cessation OR event OR nods OR nodding OR smil* OR looking OR question-asking OR understand* OR close* OR open* OR supportive OR posture OR clarification* OR suggestion* OR command OR instructive OR optimis* OR laughter OR joking OR chit-chat OR worry OR socio-emotional OR "partnership building" OR support OR compliment* OR negative OR back-channel OR disapproval OR abrupt OR disagreement OR criticism OR withholding OR interrupt* OR interjection* OR talk OR reflect* OR partnership OR self-disclosure OR feelings OR asking OR empathic OR statement* OR paraphrase OR interpret OR recognize OR opinion OR restatement OR acceptance OR accord OR procedural OR silence OR conversation* OR coding OR space OR tell OR facial OR hesitation OR interaction OR warmth OR compassion OR daring OR relation OR adhere OR "communication skill*" OR trust OR Behave* PR cognitive* OR relax* OR "graded activity" OR reinforcement OR respondent OR support OR Motivat* OR session* OR counsel* OR practi* OR behav* OR "Patient education" OR "pain management" OR "self care" OR "self management" OR encourage OR promot* OR uptake OR increase OR start OR educat* OR program* Motivate* OR session* OR counsel* OR practi* OR behave* OR "Patient education" OR "pain management" OR "self care" OR "self management" OR encourage OR promot* OR uptake OR increase OR start OR educat* OR program* OR "Behavior Therapy" OR conditioning, operant OR reinforcement (psychology) OR " behavior therapy "OR " operant conditioning "OR " respondent treatment "OR behavioral therapy" 'OR "behavioural therapy" OR "cognitive therapy/" OR "cognitive therapy" OR "behavior treatment" OR "relaxation" OR "exp relaxation" OR "graded

		activity" OR stimulat* OR teach OR strategy OR tailored OR information OR monitoring OR supervis* OR multifactorial OR telephone OR call
5	Not (title abstract)	Medic* OR vaccine OR immune* OR cortic* OR MRI OR nutrition OR children OR eyes OR chemicals OR drugs OR seasonal OR DNA OR intranasal OR bempiparin OR vitamin OR Visual OR leukocyte OR glutamine OR weather OR colorectal OR leukem* OR renal OR FDA OR emergency OR sleep OR brain OR dental OR plasma OR drug OR aspirin
		(1 AND (2a OR 2b)) AND 3 AND 4) NOT 5

PEDro

Clinical trial AND (Behavioral therapy OR aged OR older OR resident OR aging OR Ageing OR elder* OR seni* OR geriatric OR frail* OR dwelling)

Cochrane

1	RCT sensitive search string	Limited on 'Trials'
2a	Aged (title abstract)	aged OR ageing OR aging OR elders OR elderly OR "older adult*" OR "Old people" OR older OR "postmenopausal women" OR residents OR "aged60+" OR "80 and over" OR senior OR seniors OR elder OR geriatric OR old* OR frail* OR community-dwelling OR arthritis
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4	Communication (title abstract)	discussion OR interpersonal OR peer OR collaborative OR education OR independence OR independence OR management OR self-management OR counseling OR coordinator OR visits OR visit OR consultation OR consultations OR perception OR beliefs OR attitude OR training OR promotion OR priority-setting OR evaluation OR support OR supported OR program OR problem-based OR homecare OR monitor OR monitoring OR self-care OR communication OR communication skills OR history taking OR consultation OR consultation skills OR breaking bad news OR cross cultural OR interpersonal relation OR end of life OR informed consent OR anamnesis OR interview OR medical interview OR doctor patient interaction OR doctor patient relation OR physician patient relation OR physician patient interaction OR referral OR counseling OR non verbal communication OR electronic communication OR email communication OR doctor nurse communication OR health beliefs OR treatment plan*" OR confidence OR "behavior change" OR "motivational interviewing" OR empathy OR empathic OR hopefulness OR enablement' OR narrative OR coping OR trust OR autonomy OR paternalistic OR motivation OR adherence OR beliefs OR education OR coaching OR "Goal setting" OR "Self monitoring" OR planning OR awareness OR information OR "Self-monitoring" OR social OR prompts OR triggers OR cues OR expectation OR communication OR regulation OR emotional OR "Socio-emotional" OR centered OR feedback OR centered OR reminder OR telephone OR "cognitive-enhancement" OR enhancement OR engagement OR cognitive OR concordance OR adher* OR complian* OR complying OR change OR changes OR changing OR behaviour OR behavior OR modify OR modifies OR modifying OR modification OR communication OR verbal OR nonverbal OR non-verbal OR "non verbal" OR empathy* OR "Solicitous behav*" OR "inhibiting behav*" OR exhibiting OR concern OR cues OR facilitate* OR reinforcemen* OR discourag* OR assistan* OR inference OR "eye gaze" OR expression OR affirmative OR nodding OR grimacing OR facial OR expression OR touching OR interest OR timing OR statements OR protective OR stimulating OR incentive OR facilitative OR smiling OR posture OR distance OR appropriate OR tone OR talk OR messag* OR restatemen* OR clarification OR listen* OR "emotional probe*" OR reassurance OR support OR reflection OR feelings OR encouragement* OR acknowledgement* OR disapproval OR disruption OR jargon OR "content question*" OR "content remarks" OR check OR understanding OR encouragement OR "social amenities" OR silence OR immediacy OR "body orientation" OR open OR closed OR position OR intimacy OR touch* OR instrumental OR reassurance OR

		handshake OR helpfulness OR affective OR rapport OR reassurance OR manipulation OR write* OR gesture OR cessation OR event OR nods OR nodding OR smil* OR looking OR question-asking OR understand* OR close* OR open* OR supportive OR posture OR clarification* OR suggestion* OR command OR instructive OR optimis* OR laughter OR joking OR chit-chat OR worry OR socio-emotional OR "partnership building" OR support OR compliment* OR negative OR back-channel OR disapproval OR abrupt OR disagreement OR criticism OR withholding OR interrupt* OR interjection* OR talk OR reflect* OR partnership OR self-disclosure OR feelings OR asking OR empathic OR statement* OR paraphrase OR interpret OR recognize OR opinion OR restatement OR acceptance OR accord OR procedural OR silence OR conversation* OR coding OR space OR tell OR facial OR hesitation OR interaction OR warmth OR compassion OR daring OR relation OR adhere OR "communication skill*" OR trust OR Behave* PR cognitive* OR relax* OR "graded activity" OR reinforcement OR respondent OR support OR Motivat* OR session* OR counsel* OR practi* OR behav* OR "Patient education" OR "pain management" OR "self care" OR "self management" OR encourage OR promot* OR uptake OR increase OR start OR educat* OR program* Motivate* OR session* OR counsel* OR practi* OR behave* OR "Patient education" OR "pain management" OR "self care" OR "self management" OR encourage OR promot* OR uptake OR increase OR start OR educat* OR program* OR "Behavior Therapy" OR conditioning, operant OR reinforcement (psychology) "OR " behavior therapy "OR " operant conditioning "OR " respondent treatment "OR behavioral therapy" 'OR "behavioural therapy" OR "cognitive therapy/" OR "cognitive therapy" OR "behavior treatment" OR "relaxation" OR "exp relaxation" OR "graded activity" OR stimulat* OR teach OR strategy OR tailored OR information OR monitoring OR supervis* OR multifactorial OR telephone OR call
5	Not (title abstract)	Medic* OR vaccine OR immune* OR cortic* OR MRI OR nutrition OR children OR eyes OR chemicals OR drugs OR seasonal OR DNA OR intranasal OR bemiparin OR vitamin OR Visual OR leukocyte OR glutamine OR weather OR colorectal OR leukem* OR renal OR FDA OR emergency OR sleep OR brain OR dental OR plasma OR drug OR aspirin
		(1 AND (2a OR 2b)) AND 3 AND 4) NOT 5

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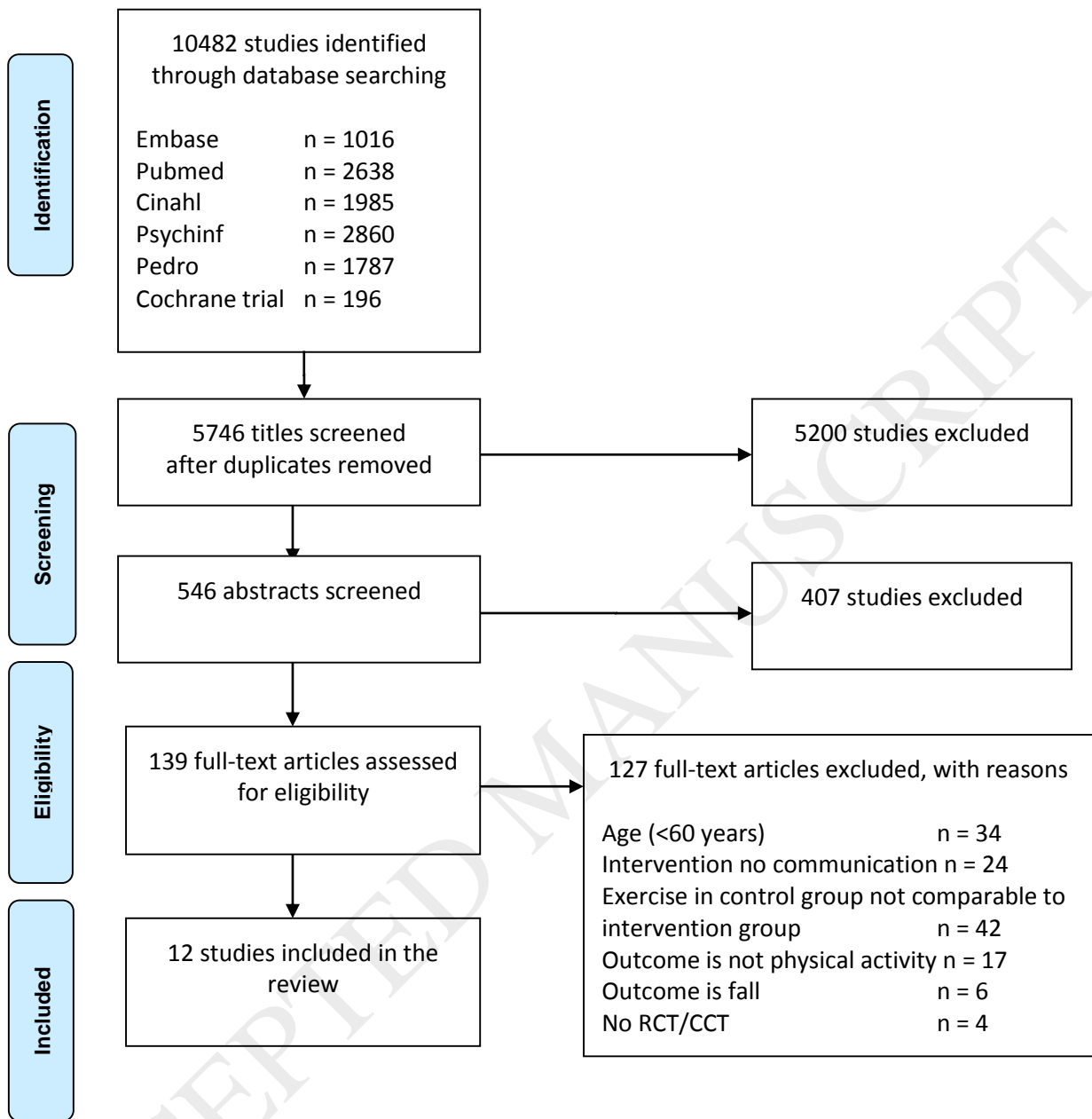
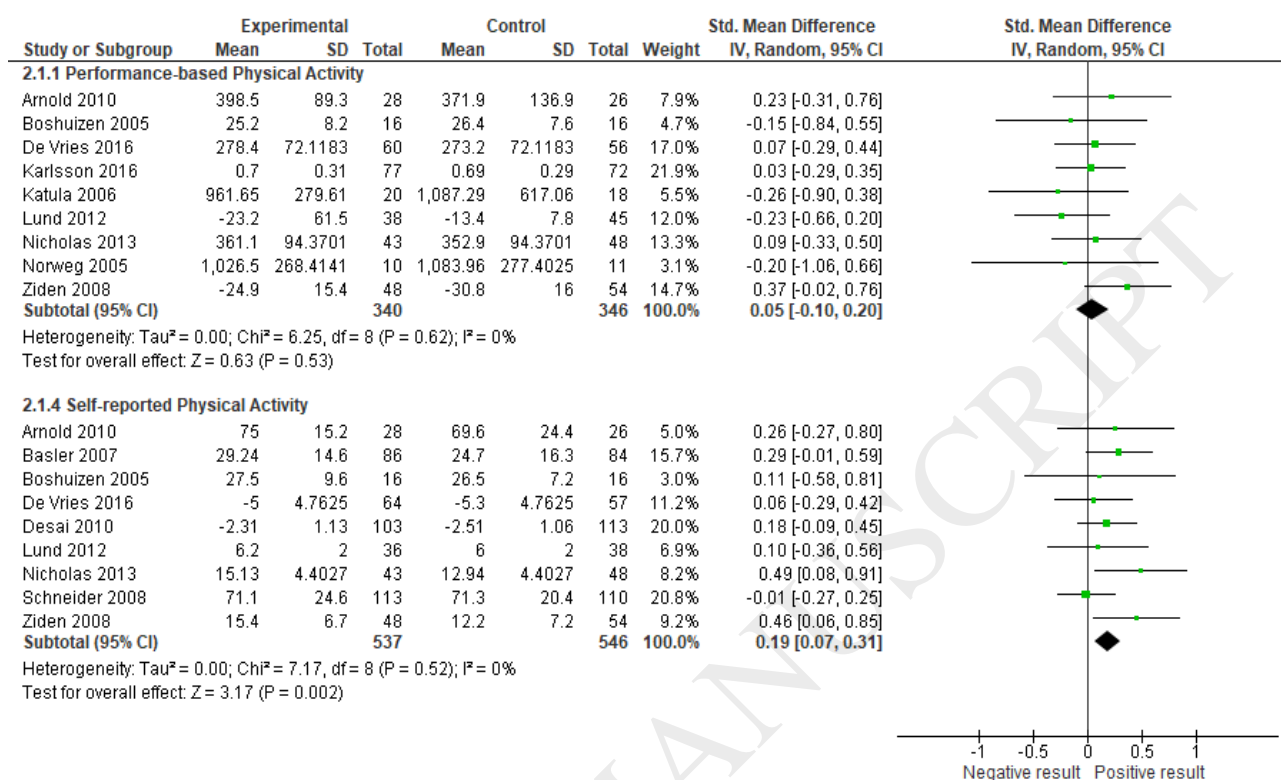
Figure 1 Flow Chart of the literature search

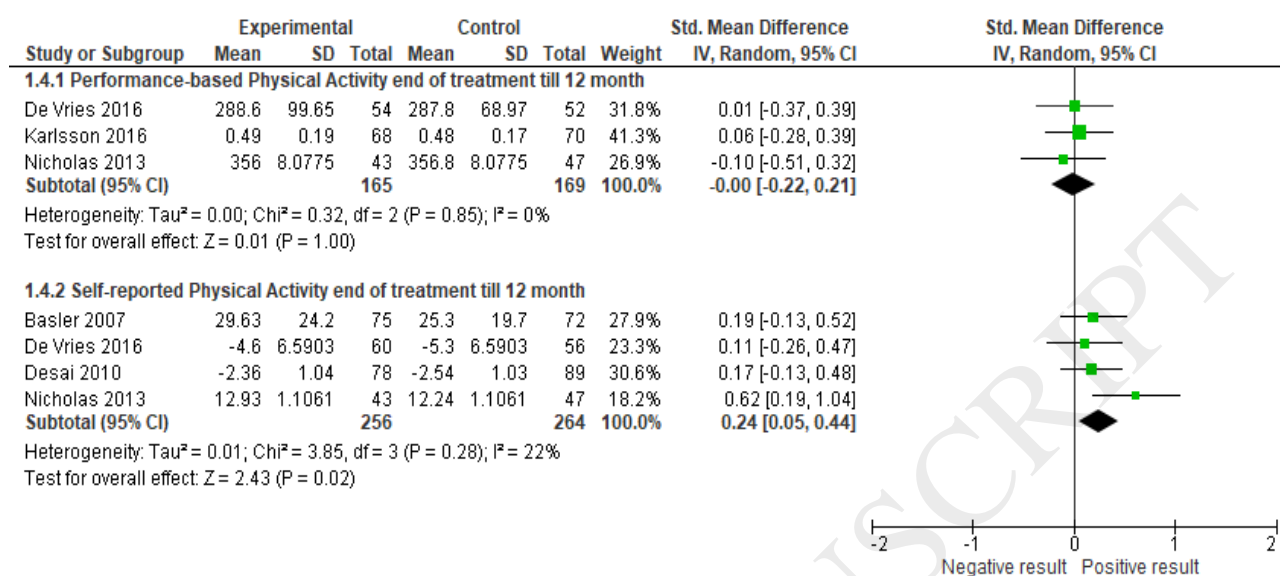
Figure 2 Forest plot Outcome measures (short term outcomes – end of treatment-)
The overall effect of all included additional communication interventions above exercise compared to exercise alone on performance-based and self-reported physical activity.



The diamonds represent the pooled treatment effects per outcome measure from meta-analysis. Std = standard; 95% CI = 95% Confidence Interval.

Figure 3 Forest plot Outcome measures. (> end of treatment till 12 month)

The overall effect of all included additional communication interventions above exercise compared to exercise alone on self-reported physical activity.



The diamonds represent the pooled treatment effects per outcome measure from meta-analysis. Std = standard; 95% CI = 95% Confidence Interval.

Figure 4 Forest plot Intervention.

The overall effect of Behavior Change Techniques above exercise compared to exercise alone on performance-based or self-reported physical activity (short term outcomes – end of treatment-).

