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Non-Pharmacological Interventions Targeting Sense of Coherence Among Older Adults and Adults With Chronic Conditions: A Meta-Analysis With Trial Sequential Analysis

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ABSTRACT

Background: Sense of coherence (SoC) is a core concept of 'salutogenesis' in positive psychology, correlated with emotional distress and disease development in adults with chronic disease and older adults. A diversity of non-pharmacological interventions (NPIs) has been developed to enhance SoC, but research findings are conflicting and the adequacy of sample sizes is uncertainty.

Objective: This paper aimed to explore appropriate interventions, evaluate the effectiveness of these SoC interventions and verify the statistical robustness and reliability of pooled results.

Methods: Search terms including 'sense of coherence' and 'randomised controlled trial (RCT)' were performed in nine electronic databases. Publications were written in English from January 1979 to February 2024. A narrative synthesis was performed to determine intervention details, and classical meta-analysis was used to analyse available data on SoC using RevMan. Besides, trial sequential analysis (TSA) was conducted to verify the robustness of pooled effect size.

Results: Meta-analysis was carried out with 27 RCTs involving 2178 patients. It showed significant effects on SoC compared to usual care among this population for all NPIs at post-intervention and 3-month follow-up. Of these follow-up durations, the effective NPIs were salutogenic-based intervention, self-management intervention, while no significant difference was observed at 6-month or > 6-month follow-up. TSA showed that the significant finding of meta-analysis in salutogenic-based intervention was stable and reliable, while the pooled sample size on self-management intervention was insufficient.

Conclusions: Non-pharmacological (salutogenic-based) interventions could improve SoC among older adults and adults with chronic conditions within 3 months after-intervention. However, its effects were not sustained over a longer period, which further studies will need larger sample sizes to draw definitive conclusions.

Implications for Practice: This meta-analysis provided the evidence that salutogenic-based interventions could improve SoC among the target population within 3 months after-intervention, providing a solid foundation for healthcare professionals to base their therapeutic strategies.

Reporting Method: The searching results were reported in accordance with the Preferred Reporting Items for Systematic Review and Meta-analysis checklist.

No Patient or Public Contribution: This study is a systematic review with meta-analysis and trial sequential analysis, and the aforementioned details are not applicable to our research.

Trial Registration: PROSPERO: CRD42023401215

1 | Introduction

Global aging is a phenomenon with widespread implications, particularly concerning health-related challenges, among which chronic diseases predominate (Cheng et al. 2020). Data from the National Health Commission of China indicate that approximately 75% of the elderly population is afflicted by one or more chronic conditions (Liu et al. 2022). Comparatively, in the USA, the prevalence is even higher, with 88% of individuals aged 65 and above reporting at least one chronic disease (Muhuri 2022). These statistical data show that older adults face greater risk of developing chronic disease (Muhuri 2022). Chronic diseases are long-lasting and usually continue for several years, do not recover independently and tend to cause physical changes that make the patient more susceptible to other more acute concomitant diseases (Maresova et al. 2019). Chronic illness can lead to reduced physical, emotional and social functioning and an increased risk of depression and anxiety (Lebel et al. 2020). Individuals at high risk of or suffering from chronic diseases are living with relative uncertainty and constant fear due to repeated changes of health status and physical capacity, continuous medical encounters and even invasive surgery (Röhrich, Giordano, and Kohls 2021). This has put them in a position to face complex physical and psychosocial challenges (Lebel et al. 2020).

These chronic non-healthy states, which cannot be cured by the acute care model, can be alleviated, restored and improved by a complementary, health-promoting approach—salutogenesis—to the challenges of chronic disease (Röhrich, Giordano, and Kohls 2021). The salutogenic model was introduced by Antonovsky in his book 'Health, Stress and Coping' (Antonovsky 1979), where health is defined as a measurable continuum between remaining healthy and developing a pathology under high-stress circumstances (Antonovsky 1987). Sense of coherence (SoC) as the core concept of salutogenesis was the controlled and meaningful confidence tendency response to internal and external stimuli in one's life, consisting of comprehensibility, manageability and meaningfulness. A strong SoC among chronic disease has been shown to be associated with lower mortality rates (Haukkala et al. 2013), less functional decline (Boeckxstaens et al. 2016), positive coping (Reguera-García et al. 2020) and better health outcomes, including improved mental and physical health (Kekäläinen et al. 2018), and increased quality of life (Tan et al. 2016). Thus, understanding the importance of SoC and identifying interventions that improve SoC in individuals with chronic diseases are crucial for promoting overall well-being and better disease management.

A recent scoping review has illuminated that current interventions aiming at enhancing SoC predominantly prioritise non-pharmacological interventions (NPIs), such as cognitive-behavioural therapy, psychodynamic and occupational therapy (Suárez Álvarez et al. 2022). However, this review primarily catalogued the types of interventions without undertaking a pooled analysis of statistical data. Besides, its conclusion also suggested that further studies should track and elucidate the intervention's long-term effects of salutogenic intervention (Suárez Álvarez et al. 2022). Additionally, only a single systematic review reported the significant effectiveness of salutogenic-based intervention on community-dwelling older adults immediately post-intervention, yet it showed considerable heterogeneity in pooled results with meta-analysis (Chow et al. 2023). Moreover, when looking over the findings of other NPIs for improving SoC, there is no uniform reference for the measurement time-point and their effectiveness at different time-points after-intervention is still inconsistent. For example, the significant effectiveness showed on older adults at 12-week (Tan et al. 2016), 3- or 9-month (Kekäläinen et al. 2018) and patients with chronic disease at 8-week after-intervention (Hourzad et al. 2018), while non-significant results were found on stroke patients at 6- or 9-month (Bragstad et al. 2020), old women at immediately after-intervention (Ericson et al. 2018). In order to explore these research gaps, a systematic review urgently needs to be implemented in order to identify and systematically synthesise the evidence based on the existing literature to test the effectiveness of NPIs on SoC in older adults and adults with chronic conditions at different measurement time-points. The research questions of this study are as follows: (1) What are the effects of NPIs for SoC in older adults and adults with chronic diseases at different time-points? (2) Which NPIs are effective for improving SoC among this population?

2 | Methods

This systematic review was conducted according to the Joanna Briggs Institute methodology for systematic reviews of effectiveness evidence (Tonin et al. 2017) and registered at PROSPERO (CRD42023401215). The searching results were reported in accordance with the Preferred Reporting Items for Systematic Review and Meta-analysis (PRISMA) checklist (Page et al. 2021).

2.1 | Search Strategies

A three-step search strategy was used to conduct a feasible and systematic search strategy and include both published and unpublished RCTs. Firstly, an initial search on three databases (PubMed, Embase and Web of Science) was conducted for multiple changes to explore suitable search strategies and explore potential articles related to this topic. Keywords were selected after reading title, abstract and full-text of the related articles, and the index terms were chosen from the Medical Subject Headings of Medline (MeSH) of PubMed and EMTREE of Embase. These keywords and index terms were developed as an example of full search strategy after discussion with librarian staff (Lydia Ngai)

Summary

What does this paper contribute to the wider global clinical community?

- Non-pharmacological interventions (NPIs), particularly salutogenic-based interventions, bring benefits to older adults and individuals with chronic conditions, and the effect could be maintained up to 3 months post-intervention.
- Further investigation of the medium-term effect (6 months or more) of NPIs is needed.
- Research on self-management intervention with sufficient sample size is warrant in the future.

in the Hong Kong Polytechnic University. These search terms were as follows: 'sense of coherence', 'salutogenesis', 'generalised resistance resource', 'adult' and 'randomised controlled trial'.

Secondly, the example search strategy including all identified keywords and index terms was adapted for each searching databases. The formal searching was performed comprehensively in seven electronic databases and two grey literature sources including Cochrane, Scopus, PubMed, Embase, CINAHL Plus with Full Text, APA PsycINFO, Web of Science, ProQuest dissertation and ClinicalTrials.gov. The search strategy was conducted by using the MeSH, EMTREE, free words and keywords combinated by the Boolean algorithm 'OR' and 'AND'. Publication's date was from January 1979 to January 2023. The starting point was fixed as 1979 because 'sense of coherence' concept was brought out by Antonovsky (1979).

Thirdly, reference lists of all included studies and relevant reviews were checked to identify any eligible papers. Authors of eligible ongoing clinical trials or protocols were contacted for additional information to avoid delays in updating. Formal search strategy example is presented in Table 1.

2.2 | Inclusion and Exclusion Criteria

The inclusion and exclusion criteria were established by utilising the PICOs format, which systematically incorporates population, intervention, comparator, outcomes and study design. Populations focus on older adults aged over 65 and patients with chronic diseases according to the list of conditions published by the office of the Assistant Secretary for Health in the Department of Health and Human Services of the United States (Goodman et al. 2013). There were no limitation on settings and numbers of chronic diseases for this population. However, patients with a diagnosis of mental illness, cancer or serious co-morbidities were excluded. Interventions: (i) single or multi-component non-pharmacological interventions include psychological or psychosocial interventions targeted at assessing SoC; (ii) no limitation on dosage or intensity, settings or mode of delivery, frequency, treatment duration and follow-up time of intervention; and (iii) exclude single or mixed pharmacological interventions. Comparators: included passive control (placebo, no treatment, standard care, or a waiting list control) and active control (variation of the intervention, alternate intervention). Outcomes: studies targeting to measure SoC as primary or secondary outcome. Study design: included randomised control trials (RCTs), excluded the quasi-experimental studies, observational studies, case reports, abstract, and study protocols. All included studies were limited to the language of English.

2.3 | Study Selection

Literature recordings exported from the database were deduplicated using the Endnote software. The title and abstract of the recording were screened by two reviewers (YQL and LYY) independently using the Rayyan software. Depending on the inclusion and exclusion criteria, each recording was labelled for inclusion or exclusion, and a label for the type of chronic disease included was added. Relevant reviews and references of included studies were fully browsed. Of these, papers that potentially meet the inclusion criteria were included in the reference list and their citation details were imported into Rayyan. Then, full texts of initially included recordings were downloaded and fully assessed by two independent reviewers (YQL and LYY) against the inclusion criteria, and full texts that did not meet the criteria were detailed with reasons for exclusion recorded and the number of excluded records reported in Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA). Any disagreement at each stage of the literature selection

TABLE 1 | Searching strategy example in PubMed.

Search	Search strategy	Results
#1	"Sense of Coherence"[Mesh] OR "sense of coherence*"[tw] OR "Coherence Sense*"[tw] OR "Salutogenes*"[tw] OR "salutogenic*"[tw] OR "salutogenesis"[tw] OR "generalised resistance resource*"[tw] OR "health asset*"[tw]	3932
#2	"Adult"[Mesh] OR Adult[tw] OR old[tw] OR aged[tw] OR Elderly[tw] OR man[tw] OR women[tw] OR men[tw] OR woman[tw]	10,145,409
#3	("controlled clinical trial"[pt] OR "Controlled Clinical Trials as Topic"[MeSH] OR "Random Allocation"[MeSH] OR "Double-Blind Method"[MeSH] OR "single-blind method"[MeSH] OR "Control Groups"[MeSH] OR "cross-over studies"[MeSH] OR random*[tiab] OR placebo[tiab] OR trial[tiab] OR groups[tiab] OR crossover[tiab] OR cross-over[tiab]) NOT ("Animals"[Mesh] NOT ("Humans"[Mesh] AND "Animals"[Mesh]))	3,734,980
#4	(#1 and #2 and #3) AND (("1979/01/01"[Date—Publication]: "2024/02/01"[Date—Publication]))	615

process was resolved through consultation or discussion with a third supervisory assessor (JM). The results of the screening record and study inclusion process were reported in the results section in the systematic review and presented in the PRISMA flow diagram.

2.4 | Quality Critical Appraisal

The included studies were appraised by two reviewers (YAL and BHZ) for quality using the Cochrane Risk-of-Bias Tool (RoB-2) for randomised controlled trials (RCTs) (Higgins and Green 2008). The RoB-2 tool evaluates five domains of each study, including the risk of bias arising from the randomisation process, risk of bias due to deviations from the intended interventions, missing outcome data, risk of bias in measurement of the outcome, and risk of bias in selection of the reported result. Evaluators rated the level of risk in each domain and overall risk of bias for each study as 'low', 'high risk of bias' or 'some concerns' providing justifications for their assessments.

2.5 | Data Extraction

Data extractions were conducted by two reviewers (YAL and BHZ) independently. A customised data extraction form tailored to the research purpose was developed to comprehensively encode key data points of included articles, including full citation information (e.g. reference number, author, year, country, study design), sociodemographic and baseline characteristics of target population (e.g. disease diagnose, sample size), intervention and comparison components (e.g. programme name, theoretical foundation, content description, duration, frequency, follow-up time, intervention provider, setting), outcomes (e.g. outcome name, measurement tool, assessment time-points), results (e.g. outcome data, attribute rate, intention-to-treat analysis, protocol). For missing data or unclear details, the author of article was contacted by email to provide additional data and explanations as necessary. Any disagreements arising between two reviewers were resolved through a third supervisor (JM).

2.6 | Data Synthesis

A classical meta-analysis was performed to directly assess the effect size of SoC using RevMan software. Standard mean difference (SMD) and 95% confidence interval (95% CI) were adopted for the assessment of pooled effects as continuous variables (Morton et al. 2018), because of its superior ability to generalise and apply the findings to similar populations. Additionally, SMD is less susceptible to over- or underestimation regardless of the different measurement tools used, making it a more reliable measure of effect size. The Chi^2 test, P value and I^2 index were used to determine statistical heterogeneity (Morton et al. 2018). A $p \leq 0.1$ and $I^2 \geq 50\%$, there was statistical heterogeneity between study groups, a random-effects model was chosen for analysis due to the heterogeneity of interventions and dosages used across the included studies, it was not feasible to assume clinical homogeneity, and subgroup analysis was conducted to identify the heterogeneity sources in SoC which had over two studies each subgroup (Tufanaru et al. 2015). Sensitivity analysis was conducted by systematically removing one study at a time to assess whether the findings were significantly impacted by any individual study (Higgins and Green 2008). In addition, trial sequential analysis (TSA) was used the TSA software (v0.9.5.10) developed by the Copenhagen Clinical Trials Center in Denmark (https://ctu.dk/tsa/downloads/), with the required information size (two-sided, $a = 0.05$), 80% power ($b = 0.20$) and traditional cut-off value ($Z = 1.96$). TSA was used to test the robustness and reliability of the pooled effect size by checking whether sample size is enough and false-positive conclusions (type I errors) or false negative conclusions (type II errors) exist in the meta-analysis (Wetterslev, Jakobsen, and Gluud 2017).

3 | Results

3.1 | Searching Results

A total of 2902 literature records from seven English databases and 38 records from reference lists and grey literature were initially obtained. After de-duplication, titles and abstracts of 1446 records were independently evaluated by two reviewers according to inclusion and exclusion criteria. After narrowing down the number of records, 75 full-text records were obtained. Two reviewers went through the full-text articles independently and discussed the inconsistent results with the other two researchers until agreement was reached. Finally, 27 records were included in the study. The PRISMA flow chart of the literature screening process is reported in Figure 1.

3.2 | Characteristics of Included Studies

3.2.1 | Study Characteristics

A total of 2178 participants of 27 RCTs were included in this meta-analysis (Table 2). The targeting population was distributed among older adults (age > 65 years; 9 studies) and patients with chronic diseases (21 studies) including stroke, type 2 diabetes, heart failure, mental disorders, chronic pain and other chronic conditions in chronic diseases lists. Sample size in each RCT ranged from 21(Tyni-Lenne et al. 2002) to 322 (Bragstad et al. 2020). The country distributions of included studies included Finland (4 studies), Iran (5 studies), Norway (5 studies), Sweden (7 studies) and only 1 study, respectively, in China, Italy, Singapore, Switzerland, Turkey and USA. The measurement tools for SoC included SoC-13 (19 studies), SoC-29 (6 studies) and two adapted versions in Italy and Iran (Graziano et al. 2014; Momenabadi et al. 2020). The measurement time-points included 13 studies at immediately post-intervention (Aci and Kutlu 2022; Daneshvar, Shafiei, and Basharpoor 2022; Ericson et al. 2018; Faag et al. 2017; Forsberg et al. 2010; Graziano et al. 2014; Hesselmark, Plenty, and Bejerot 2014; Lei 2018; Momenabadi et al. 2020; Musavinasab et al. 2016; Sundsli et al. 2014; Tyni-Lenne et al. 2002), 12 studies at 1- to 3-month follow-up (Aci and Kutlu 2022; Arvidsdotter, Marklund, and Taft 2014; Hourzad et al. 2018; Kekäläinen et al. 2018; Lei 2018; Luberto et al. 2020; Momenabadi et al. 2020; Pakkala et al. 2012; Quinto et al. 2022; Seah et al. 2022; Tan et al. 2016; Valsø et al. 2020), 8 studies with 6-month follow-up (Arvidsdotter,

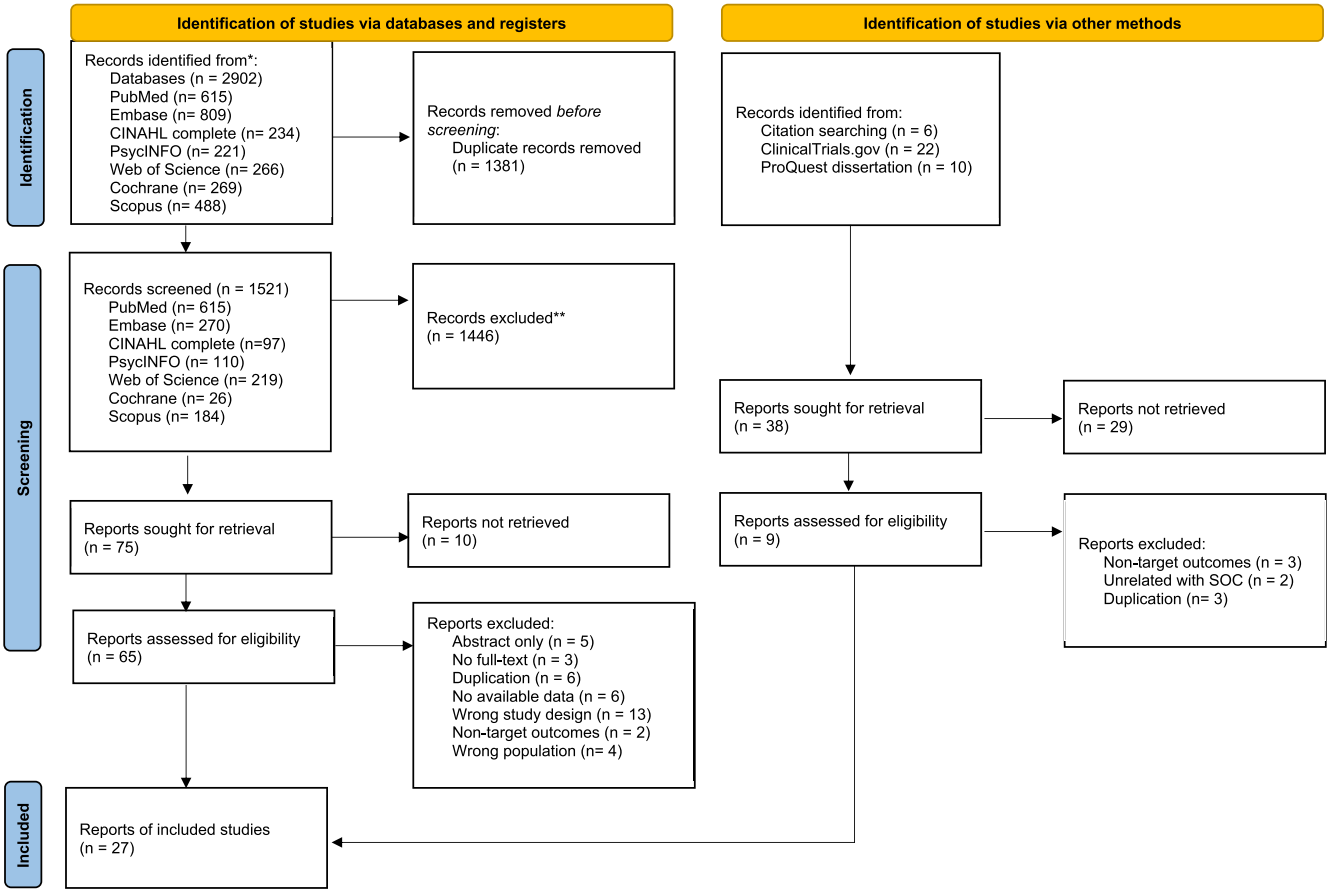

FIGURE 1 | The PRISMA flow diagram.

Marklund, and Taft 2014; Bragstad et al. 2020; Faag et al. 2017; Gabrielsen Hjelle et al. 2019; Luutonen et al. 2019; Nøst et al. 2018; Oxelmark et al. 2007; Valsø et al. 2020), 6 studies over 6-month follow-up (Bragstad et al. 2020; Kekäläinen et al. 2018; Malm et al. 2018; Nøst et al. 2018; Oxelmark et al. 2007; Valsø et al. 2020). Comparators included passive control (12 studies in usual care, 8 studies in no-treatment) and 7 studies in active control. Twenty-one studies reported their study protocol, and 15 studies conducted intention-to-treat analysis. Only 14 studies reported the model or theory of the intervention development.

The overall attrition rates of 21 included studies ranged from 3% (Hourzad et al. 2018) to 32% (Forsberg et al. 2010; Graziano et al. 2014), while six studies reported no attrition (Daneshvar, Shafiei, and Basharpoor 2022; Faag et al. 2017; Momenabadi et al. 2020; Musavinasab et al. 2016; Seah et al. 2022; Sundsli et al. 2014). The attrition rates of non-pharmacological interventions groups ranged from 2% (Luberto et al. 2020) to 44% (Graziano et al. 2014), while control group ranged from 1% (Aci and Kutlu 2022) to 34% (Quinto et al. 2022). According to different non-pharmacological intervention types, the attribution rates of salutogenic-based intervention ranged from 0% (Seah et al. 2022) to 26% (Aci and Kutlu 2022), cognitive behavioural intervention ranged from 0% (Daneshvar, Shafiei, and Basharpoor 2022) to 44% (Graziano et al. 2014), self-management intervention ranged from 0% (Momenabadi et al. 2020; Musavinasab et al. 2016; Sundsli et al. 2014) to 13% (Nøst et al. 2018), nurse-led health education ranged from 0% (Faag et al. 2017) to 29% (Forsberg et al. 2010), exercise training ranged from 2% (Luberto et al. 2020) to 12% (Ericson et al. 2018).

3.2.2 | Characteristics of Included Interventions

Table 2 presents the overall characteristics of included interventions in meta-analysis. The non-pharmacological interventions included 8 studies in salutogenic-based intervention (Aci and Kutlu 2022; Arvidsdotter, Marklund, and Taft 2014; Bragstad et al. 2020; Langeland et al. 2006; Lei 2018; Quinto et al. 2022; Seah et al. 2022; Tan et al. 2016), 5 studies in cognitive behavioural intervention (Daneshvar, Shafiei, and Basharpoor 2022; Graziano et al. 2014; Hesselmark, Plenty, and Bejerot 2014; Luberto et al. 2020; Malm et al. 2018), 5 studies in self-management intervention (Hesselmark, Plenty, and Bejerot 2014; Momenabadi et al. 2020; Musavinasab et al. 2016; Nøst et al. 2018; Sundsli et al. 2014), 4 studies in nurse-led health education (Faag et al. 2017; Forsberg et al. 2010; Oxelmark et al. 2007; Valsø et al. 2020) and 5 studies in exercise training (Ericson et al. 2018; Kekäläinen et al. 2018; Luberto et al. 2020; Pakkala et al. 2012; Tyni-Lenne et al. 2002).

The salutogenic-based interventions of included studies were based on Antonovsky's salutogenic health model. Salutogenic interventions adhere to five key criteria (Mittelmark et al. 2022): (a) General and Specific Resistance Resources (GRRs and SRRs): These interventions prioritise the dynamic interplay among GRRs, SRRs and stressors, focusing on

TABLE 2 | Characteristic and interventions for SoC of included randomised controlled trials (RCT).

Author/Year/Country	Participants/sample size (IG/CG)	Intervention Content	Theoretical foundation	Intervention sessions' duration, frequency	Intervention names for Subgroup analysis	Setting/Provider	Comparator	Tool	Protocol	Intention-To-Treat analysis	Attrition, % (All/IG/CG)
Aci & Kutlu (2022); Turkey	Schizophrenic patients; IG: 22 CG: 27	Salutogenic approach-based interviews (talk therapy) Main components: (1) relaxing music; (2) short and daily conversations emphasising the recovery of the schizophrenic patients according the materials; (3) give homework and discuss in each session	Antonovsky's salutogenic model	Sessions: 16 sessions Dosage: 45–90 min, twice a week Duration: 8 eight weeks	Salutogenic-based intervention	Community Mental Health Center; group manager received basic training in group psychotherapy	Usual care: routine rehabilitation activities	SoC-13	Yes	No; Peer Protocol analysis	All: 21% IG: 26% CG: 1%
Arvidsdotter, Marklund, and Taft (2014); Sweden	Psychologically distressed primary care patients; IG: 40 CG: 40	Integrative treatment (IT) combined Therapeutic acupuncture (TA); Main components: salutogenic dialogue, discussion about the patients' inner feelings, personal relations, everyday activities (diet, exercise, relaxation, sleep habits) and existential issues	Antonovsky's salutogenic model	Sessions: Eight sessions Dosage: 60 min, once a week Duration: for 8 weeks	Salutogenic-based intervention	Health care centre; acupuncturist	Therapeutic acupuncture (TA); A week (45-min sessions) for eight consecutive weeks	SoC-13	Yes	Yes	All: 11% IG: 7% CG: 15%

(Continues)

TABLE 2 | (Continued)

Author/Year/Country	Participants/sample size (IG/CG)	Intervention Content	Theoretical foundation	Intervention sessions' duration, frequency	Intervention names for Subgroup analysis	Setting/Provider	Comparator	Tool	Protocol	Intention-To-Treat analysis	Attrition, % (All/IG/CG)
Bragstad et al. (2020); Norway	Stroke patients; IG: 166 CG: 156	Dialogue-based Salutogenic intervention; Main components: A guide of stroke-related topics and work-sheets for each session; (1) Invitation for collaboration; (2) Lifeline focusing on background, values and interests; (3) Life after stroke concerning bodily changes, thoughts and experiences; (4) Daily life and emotions after stroke; (5) Dynamic problem-solving process; (6) Establishing how the stroke affects life now and in the future; (7) Promote coping and balancing activities; (8) Conclusion and future prospects	Antonovsky's salutogenic model	Sessions: eight sessions Dosage: 60–90 min, once a week Duration: for 17 weeks	Salutogenic-based intervention	Participants' homes; a specially trained nurse or occupational therapist completing a 3-day training programme	Usual stroke care	SoC-13	Yes	Yes	All: 12% IG: 14% CG: 10%
Daneshvar, Shafiei, and Basharpoor (2022); Iran	Women with post-traumatic stress disorder (PTSD); IG: 21 CG: 21	Compassion-focused therapy (CFT) Main components: CFT as a unique and acceptance-based cognitive behavioural approach that is based on evolutionary psychology, neuroscience, and Buddhist teachings, in which empathy, sympathy, compassion, acceptance, tolerance, responsibility, and self-worth is taught.	NR	Sessions: eight sessions Dosage: 120 min each session Duration: Not reported	Salutogenic-based intervention	Setting: not reported; Psychotherapist	No treatment	SoC-13	NR	NA	0

(Continues)

TABLE 2 | (Continued)

Author/Year/Country	Participants/sample size (IG/CG)	Intervention Content	Theoretical foundation	Intervention sessions' duration, frequency	Intervention names for Subgroup analysis	Setting/Provider	Comparator	Tool	Protocol	Intention-To-Treat analysis	Attrition, % (All/IG/CG)
Ericson et al. (2018); Sweden	Healthy women aged 65–70; IG: 14 CG: 18	Resistance training Main components: exercise included squats, leg extensions, leg presses, seated rows and pulldowns, squat jumps, and core stability exercises	NR	Sessions: not reported Dosage: 60 min each session Duration: 24 weeks	Exercise training	Gym; physician	No training	SoC-13	Yes	Yes	All/CG: NR IG: 12%
Faag et al. (2017); Sweden	Patients with peripheral vestibular disorders; IG: 18 CG: 18	Nursing intervention Main components: a group education programme in combination with the individual visits on (1) explaining symptoms of and issues about the disease, (2) providing patients with advice and guidance in discovering coping and self-care strategies	NR	Sessions: Five sessions Dosage: 120 min, once a week Duration: 5 weeks Follow-up: visits or telephone contact during day-time 5 days a week by nurses	Nurse-led health education	Audiology department in hospital; a specialist nurse as group leader	Routine care only	SoC-13	Yes	NA	0
Forsberg et al. (2010); Sweden	Patients with a psychiatric disability; IG: 17 CG: 14	Health lifestyle intervention programme Main components: study circles with diet sessions and physical activities; study material handbook on motivation, food content, stress and fitness	NR	Sessions: 33–37 for diet sessions; 35–39 for physical activity sessions Dosage: 120 min, once a week for diet sessions and physical activities Duration: 12 months	Nurse-led health education	Community; medical residents and staffs.	An aesthetic study circle called 'Colour and Shape': learn and practise various kinds of artistic techniques	SoC-13	Yes	Yes	All: 32% IG: 29% CG: 17%

(Continues)

TABLE 2 | (Continued)

Author/Year/Country	Participants/sample size (IG/CG)	Intervention Content	Theoretical foundation	Intervention sessions' duration, frequency	Intervention names for Subgroup analysis	Setting/Provider	Comparator	Tool	Protocol	Intention-To-Treat analysis	Attrition, % (All/IG/CG)
Graziano et al. (2014); Italy	Patients with multiple sclerosis; IG: 27 CG: 29	A group-based cognitive behavioural therapy Main components: (1) six subgroups based on age; (2) at beginning and end of each session: practice exercises for physical relaxation. (3) four topics each session on copies of sheets: identity change and redefinition following the diagnosis of multiple sclerosis; set new, realistic, and personally meaningful goals in life; strategies to reach goals and behaviour evaluation; the management of negative emotions related to the illness. (4) set homework and do relaxation exercise at home every day	NR	Sessions: five sessions Dosage: 120 min, 15 min break, duration: Four sessions over 2 months and a fifth follow-up session after 6 months	Cognitive behaviour treatment	Non-medical setting; psychologist	Attending informative sessions; conducted by different therapists about stem cells, complementary and alternative therapies, and nourishment, respectively	SoC-11 (Italian version based on SoC-13)	NR	No	All: 32% IG: 44% CG: 7%

(Continues)

TABLE 2 | (Continued)

Author/Year/Country	Participants/sample size (IG/CG)	Intervention Content	Theoretical foundation	Intervention sessions' duration, frequency	Intervention names for Subgroup analysis	Setting/Provider	Comparator	Tool	Protocol	Intention-To-Treat analysis	Attrition, % (All/IG/CG)
Hesselmark, Plenty, and Bejerot (2014); Sweden	Patients with autism spectrum disorders; IG: 33 CG: 27	Group-based cognitive behavioural therapy Main components: (a) structure, (b) group setting, (c) psycho-education (e.g. ASD and psychiatric symptoms), (d) social training (e) cognitive behavioural techniques (e.g. setting goals, role-playing, exposure exercises and conducting behaviour analysis). Three thematic modules of 36 sessions in manual: (a) self-esteem and ASD awareness, (b) social contacts and everyday life and (c) psychological and physical health	NR	Sessions: 36 sessions, 6–8 patients each group Dosage: 180 min each week Duration: for 36 weeks	Cognitive behaviour treatment	At outpatient tertiary psychiatric clinic; A psychiatrist and a clinical psychologist received qualified supervision once or twice monthly and 3–4 community support-workers	Recreational activity led by A psychiatric nurse assistant and a social worker	SoC-29	NR	Yes	All: 9% IG: 3% CG: 15%
Hourzad et al. (2018); Iran	Retired elderly with chronic diseases; IG: 29 CG: 29	Empowering self-management intervention Main components: (1) self-awareness of changes and understanding their personal level of performance and expectations; (2) optimal goal setting; (3) planning; (4) adjusting physical, psychological, and social structures; and (5) evaluation; using informative booklet	Empowering self-management model	Sessions: Eight sessions Dosage: 45 min each session, 2 weeks for face-to-face interviews and 6 weeks for in-person training Duration: For 2 months	Self-management intervention	Health care centre; nurse	Routine care	SoC-29	Yes	No	All: 3% IG: 3% CG: 3%

(Continues)

TABLE 2 | (Continued)

Author/Year/Country	Participants/sample size (IG/CG)	Intervention Content	Theoretical foundation	Intervention sessions' duration, frequency	Intervention names for Subgroup analysis	Setting/Provider	Comparator	Tool	Protocol	Intention-To-Treat analysis	Attrition, % (All/IG/CG)
Kekäläinen et al. (2018); Finland	Older adults; IG: 79 CG: 20	9-month resistance training intervention Main components: (1) months 1–3: learning RT methods and local muscular endurance using low loads; (2) Months 4–9: muscle hypertrophy and maximum strength training by different training frequencies (1–2 weeks/circle or 2 weeks/3 circles)	NR	Sessions: Dosage: 60 min, 10-min warm-up and 8–9 exercises for different muscle groups Duration: For 9 months	Exercise training	Gym; supervised by experienced personnel.	Non-training	SoC-13	Yes	Yes	All: 7% IG: 3% CG: 20%
Langeland et al. (2006); Norway	Patients with mental health problems; IG: 79 CG: 20	Talk-therapy groups based on salutogenic treatment principles Main components: (1) discuss situations and experiences important for their coping in everyday life; (2) conversation about patients' reflective note of their homework on inner feelings; immediate personal relations; major activity; and existential issues	Antonovsky's salutogenic model	Sessions: two sessions Dosage: 90 min weekly, five–nine participants each group Duration: 16 weeks	Salutogenic-based intervention	Psychiatric outpatient Sectors; a mental health professional undergone a 3-week training programme	Standard care	SoC-29	NR	Yes	All: 13% IG: 10% CG: 17%

(Continues)

TABLE 2 | (Continued)

Author/Year/Country	Participants/sample size (IG/CG)	Intervention Content	Theoretical foundation	Intervention sessions' duration, frequency	Intervention names for Subgroup analysis	Setting/Provider	Comparator	Tool	Protocol	Intention-To-Treat analysis	Attrition, % (All/IG/CG)
Lei (2018); China	Older adults with type 2 diabetes; IG: 77 CG: 77	A strengths-based intervention based on Salutogenic Model Main components: (a) Based on salutogenic model, use of strengths-based approach (goal orientation, strengths assessment, resourceful environment, explicit methods, hope-inducing relationship and meaningful choice); (b) Use of solution-focused therapy in six-step cycle: (1) health education, (2) discuss self-care experience and identify challenge, (3) describe exceptions, (4) explore the strengths, (5) miracle question and scaling and (6) establish the action plan	Antonovsky's salutogenic model	Sessions: five face-to-face sessions Dosage: 20–40 min, weekly Duration: 5 weeks	Salutogenic-based intervention	Community; A principal investigator delivered the pilot study, and trained the four registered nurses	Usual care	SoC-13	Yes	Yes	All: 22% IG: 18% CG: 26%
Luberto et al. (2020); USA	Patients with heart failure; IG: 50 CG: 50	Tai chi exercise Main components: (1) Introductory session: overview of programme; (2) Warm-up exercises (standing and sitting); (3) Grasp sparrow's tail and Brush knee twist step; (4) Wave hands like clouds. Learning exercise by 45-min video and home practice	NR	Sessions: Four sessions Dosage: 60 min weekly courses and home practice at least 3 times per week Duration: 12 weeks	Exercise training	Medical centres and hospital; 1 or 2 certified and experienced instructors (6 total study instructors with average experience of 20 years)	Health education on cholesterol	SoC-13	Yes	Yes	All: 4% IG: 2% CG: 6%

(Continues)

TABLE 2 | (Continued)

Author/Year/ Country	Participants/ sample size (IG/CG)	Intervention Content	Theoretical foundation	Intervention sessions' duration, frequency	Intervention names for Subgroup analysis	Setting/Provider	Comparator	Tool	Protocol	Intention-To-Treat analysis	Attrition, % (All/IG/CG)
Luutonen et al. (2019); Finland	Long-term frequent attenders in primary care; IG: 30 CG:20	One-session cognitive behaviour treatment Main components: CBT sessions: (1) encourage patients to talk about the health problems and see the patient as the best expert of his/her health; (2) Psychoeducation on the meaning of stress for wellbeing and bodily sensations. (3) provide a short leaflet about stress, well-being and measures to release these symptoms	NR	Sessions: one session Dosage: 60–90 min Duration: None	Cognitive behaviour treatment	Public health care centre services; a resident in psychiatry (MM) had attended some CBT workshops as part of the training programme for residents in psychiatry	Usual care	SoC-13	Yes, but not registered	No	All: 11% IG: 6% CG: 16%
Malm et al. (2018); Iran	Atrial fibrillation patients; IG: 37 CG:41	Brief mindfulness-based cognitive behavioural therapy Main components: A detailed tutorial manual 'HeartMath Scandinavia' for CBT sessions. (1) Introducing self-awareness; (2) Training physical, psychological and mental functions; (3) Evaluating what gives energy and positive feelings, and influences both the heart and brain. Mindfulness practice: heart focus, heart breathing and practice at home on a daily basis	NR	Sessions: three sessions Dosage: 2.5-h for CBT,15–20 min for mindfulness practice, 4–6 patients each group Duration: 9weeks	Cognitive behaviour treatment	Hospital; three trained therapists (a cardiac nurse, a cardiologist and an educationalist)	Usual care	SoC-13	Yes	Yes	All: 31% IG: 32% CG: 29%

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TABLE 2 | (Continued)

Author/Year/Country	Participants/sample size (IG/CG)	Intervention Content	Theoretical foundation	Intervention sessions' duration, frequency	Intervention names for Subgroup analysis	Setting/Provider	Comparator	Tool	Protocol	Intention-To-Treat analysis	Attrition, % (All/IG/CG)
Momenabadi et al. (2020); Iran	Patients with Multiple Sclerosis; IG: 40 CG: 40	Self-care education programme based on Health-Promoting Self-Care Behaviours System Model Main components: Setup online group 'self-care group': the sense of coherence (five sessions), resilience (eight sessions), self-esteem (three sessions) and nutrition knowledge and health (two sessions). Learning materials: a self-care guidebook for patients with MS, educational slides and video clips, as well as images	Health-Promoting Self-Care Behaviours Model	Sessions: 18 sessions Dosage: 45–60 min, twice a week Duration: 3 months, followed up by phone calls and texts	Self-management intervention	Hospital; providers: NR	Usual care	SoC-35	Yes	No	0
Musavinasab et al. (2016); Iran	Elderly patients with cardiovascular disease; IG: 48 CG: 48	Education based on a self-management empowerment model Main components: Similar approach adopted by Hourzad et al. (2018); face-to-face interviews, Individual sessions with help of family member/companion, use of educational booklet	Self-management empowerment model	Sessions: 3–4 sessions Dosage: 45 min, for first 2 sessions and one 60-min third session or two 30-min Duration: 1.5 months	Self-management intervention	Hospital/home; Researcher	Usual care	SoC-29	Yes	NR	0

(Continues)

TABLE 2 | (Continued)

Author/Year/Country	Participants/sample size (IG/CG)	Intervention Content	Theoretical foundation	Intervention sessions' duration, frequency	Intervention names for Subgroup analysis	Setting/Provider	Comparator	Tool	Protocol	Intention-To-Treat analysis	Attrition, % (All/IG/CG)
Nøst et al. (2018); Norway	Adults with chronic pain; IG: 60 CG: 61	Group-based chronic pain self-management course Main components: (1) Self-management session: education introducing cognitive and behavioural strategies for pain management, pain theory, discussions of barriers in everyday life due to chronic pain, and techniques to deal with fatigue, poor sleep, frustration and isolation; (2) the movement exercises; (3) group discussions and sharing of experiences among participants	Self-management empowerment model	Sessions: 3 sessions Dosage: 2.5 h each group session weekly Duration: 6 weeks	Self-management intervention	Healthcare services; Two physiotherapists educated within behavioural changes, self-management and chronic pain facilitated the self-management course	Low-impact physical outdoor activity	SoC-13	Yes	Yes	All: 17% IG: 13% CG: 21%

(Continues)

TABLE 2 | (Continued)

Author/Year/Country	Participants/sample size (IG/CG)	Intervention Content	Theoretical foundation	Intervention sessions' duration, frequency	Intervention names for Subgroup analysis	Setting/Provider	Comparator	Tool	Protocol	Intention-To-Treat analysis	Attrition, % (All/IG/CG)
Oxelmark et al. (2007); Sweden	Inflammatory bowel disease patients: IG: 20 CG: 15	Group-based salutogenic intervention programme Main components: (1) The lectures comprised aetiology, diagnostic procedures, treatment of and research in IBD; (2) Group therapy themes: consequences of the disease; Anatomy and function of the bowel, endoscopy psychological reactions; Psychological reactions, receiving information of diagnosis, coping; stress management, positive and negative stress; The significance of diet and food intake; disease and self-image; Conclusion and evaluation	NR	Sessions: Nine sessions Dosage: 11-12 h each session weekly, 6–8 persons each group Duration: 3 months	Salutogenic-based intervention	Hospital outpatient clinic; psychotherapist conducted the group therapy; a gastroenterologist and specialist nurse conducted the lectures.	Usual care: conventional 'on Demand' medical and psychosocial/psychological treatment.	SoC-13	NR	No	All: 20% IG: 17% CG: 25%

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TABLE 2 | (Continued)

Author/Year/Country	Participants/sample size (IG/CG)	Intervention Content	Theoretical foundation	Intervention sessions' duration, frequency	Intervention names for Subgroup analysis	Setting/Provider	Comparator	Tool	Protocol	Intention-To-Treat analysis	Attrition, % (All/IG/CG)
Pakkala et al. (2012); Finland	60-85-year-old people with hip fracture; IG: 24 CG: 22	Individually tailored, strength-power training programme Main components: (1) strength session: standing on 1 leg and trained the weaker leg, leg press, knee extension, and hip abduction and adduction exercises, conducting 1-repetition maximum assessments and isometric strength and leg extension power measurements; (2) power exercises session: started with a 10-min warm-up sitting on a chair, the leg press and ankle plantarflexion power exercises	NR	Sessions: two sessions Dosage: 1–1.5 h, twice a week Duration: 12 weeks	Exercise training	A senior gym; supervised by an experienced physiotherapist	No training	SoC-13	Yes	Yes	All: 7% IG: 4% CG: 9%

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TABLE 2 | (Continued)

Author/Year/Country	Participants/sample size (IG/CG)	Intervention Content	Theoretical foundation	Intervention sessions' duration, frequency	Intervention names for Subgroup analysis	Setting/Provider	Comparator	Tool	Protocol	Intention-To-Treat analysis	Attrition, % (All/IG/CG)
Quinto et al. (2022); Switzerland	Patients with skin diseases; IG: 23 CG: 21	Guided written disclosure Main components: Patients are guided to describe about traumatic or stressful life events. (1) the stressful event without expressing emotions; (2) their thoughts and feelings at the time of the event as well as its impact on their life; and (3) how they currently think and feel about the event, whether their experience contributed to their personal growth, and how they will cope with similar events in the future	Cognitive coherence of one's life situation	Sessions: three sessions Dosage: 20 min per day, Duration: 3 weeks	Salutogenic-based intervention	At home; researchers	Active control: patients were asked to report daily events during the last week, without focusing on the emotional aspects related to the illness	SoC-13	Yes	Yes	All: 25% IG: 14% CG: 34%

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TABLE 2 | (Continued)

Author/Year/Country	Participants/sample size (IG/CG)	Intervention Content	Theoretical foundation	Intervention sessions' duration, frequency	Intervention names for Subgroup analysis	Setting/Provider	Comparator	Tool	Protocol	Intention-To-Treat analysis	Attrition, % (All/IG/CG)
Seah et al. (2022); Singapore	Community-dwelling older adults living alone and with their spouses only; IG: 16 CG: 18	Salutogenic Healthy Aging Programme Embracement (SHAPE) Main components: Face-to-face individual & group sessions, use of health resource booklet Themes of sessions: (1) Understanding natural biological aging process; Cognitive health and understanding dementia; Eating nutritiously; Engaging in functional physical exercises; Decrease in social network; (2) Coping with life transitions; Understanding and maintaining positive psycho-social-spiritual health; (3) Understanding falls and maintaining home safety; (4) Identifying common acute and chronic conditions, knowing when to seek assistance; Coping with illness and hospitalisation; Managing money and assets; Learning about end-of-life and planning for illness and death-related concerns; (5) Understanding health from the salutogenic perspective; Appreciating aging as developmental process; Understanding own health needs; Living meaningfully	The two concepts of salutogenic model of health on sense of coherence (SoC) and generalised resistance resources (GRRs), use an asset-based approach	Sessions: 10 group sessions Dosage: 2 h weekly, Duration: 12 weeks, at least 2 home visits	Salutogenic-based intervention	Community-based senior centres and participants' homes; Registered nurse and physical trainer	No intervention	SoC-13	Yes	No	0

(Continues)

TABLE 2 | (Continued)

Author/Year/Country	Participants/sample size (IG/CG)	Intervention Content	Theoretical foundation	Intervention sessions' duration, frequency	Intervention names for Subgroup analysis	Setting/Provider	Comparator	Tool	Protocol	Intention-To-Treat analysis	Attrition, % (All/IG/CG)
Sundsli et al. (2014); Norway	Urban home-living persons 75+ years of age; IG: 15 CG: 15	Telephone-based self-care intervention Main components: a first meeting with health professionals and additional five self-care telephone calls, hand out intervention material. Themes were: (1) self-care habits, eating habits and nutrition, and physical activity, (2) health promotion, identity, and self-esteem, (3) roles and relationships, (4) communication, and (5) building meaning	A model of self-care for health promotion in aging	Sessions: five sessions Dosage: 30 min Duration: 19 weeks	Self-management intervention	Home; two occupational therapists and one physiotherapist with well skilled in conversations	No intervention	SoC-29	NR	No	0
Tan et al. (2016); Finland	Older people in community; IG: 32 CG: 32	A salutogenesis-based self-care programme Main components: Face-to-face group sessions. (1) Focusing on engagement with community to enhance self-care ability, tapping on personal strength to care for oneself and use available resources and strengthening participants' motivation to use both their internal and external resources; (2) Participants required to review their motivation and examine their coping strategies to acquire autonomy and a sense of purpose in life	Antonovsky's salutogenic model	Sessions: 24 sessions Dosage: 90 min, twice weekly Duration: 12 weeks	Salutogenic-based intervention	Senior activity centre; Registered nurses, counsellors, social workers, public librarians, police officers and volunteers	No intervention	SoC-13	Yes	Yes	All: 8% IG: 6% CG: 9%

(Continues)

TABLE 2 | (Continued)

Author/Year/Country	Participants/sample size (IG/CG)	Intervention Content	Theoretical foundation	Intervention sessions' duration, frequency	Intervention names for Subgroup analysis	Setting/Provider	Comparator	Tool	Protocol	Intention-To-Treat analysis	Attrition, % (All/IG/CG)
Tyni-Lenne et al. (2002); Sweden	Women with coronary syndrome X; Physical training group (PT): 7 Relaxation therapy group (RT): 7 CG: 7	Physical training and relaxation therapy Main components: (1) endurance training on a cycle ergometer three times a week for 8 weeks at the intensity of 50% of the peak work rate achieved in VO_{2max} test; relaxation training twice a week for 8 weeks. (2) Relaxation training consisted of a modified Jacobson's approach and autogenous training	NR	Sessions: two sessions Dosage: 30–60 min, 2–3 times a week Duration: 8 weeks	Exercise training	Hospital outpatient clinic; a physical therapist	No training, only normal daily activities	SoC-29	Yes	No	All: 14% PT + RT: 7% CG: 14%
Valsø et al. (2020); Norway	Discharged ICU patients with clinically relevant post-traumatic stress symptoms; IG: 111 CG: 113	Nurse-led consultations Main components: based on a semi-structured guide with elements from trauma-related cognitive behavioural therapy (focusing on cognitive restructuring, restrictive thoughts, avoidant, and dysfunctional behaviour) inspired by a previous intervention guide for consultations with injured patients	A narrative method combined with Antonovsky salutogenic theory	Sessions: Three sessions Dosage: 45–60 min Duration: NR	Nurse-led health education	First consultation in ward of hospital, two in face-to-face or phone); Two trained ICU nurses	Usual care: early mobilisation and physical therapy, physical rehabilitation	SoC-13	Yes	Yes	All: 24% IG: 25% CG: 22%

Note: Attrition rate (overall and each separate treatment group)—defined as the proportion of participants at defined study points who discontinued the intervention or were lost to follow-up (calculated as number of participants that withdraw [numerator]/number of participants randomised [denominator]). Attrition rates will be calculated as three points: after randomisation, during the intervention and at final follow-up.
Abbreviations: CBT, cognitive behaviour treatment; IBD, inflammatory bowel diseases; MS, multiple sclerosis; NA, not applicable; NR, not reported; VO_{2max} test, oxygen consumption in six-min walk test.

enhancing individuals' capacity to manage stress. (b) Whole-Person Approach (WPA): Interventions consider participants holistically, recognising and addressing their unique life narratives and current situations. (c) Active Adaptation (A): Strategies are tailored to participants' priorities, motivations, and abilities, fostering meaningful engagement and active participation. (d) Stressors and Tension as Health-Promoting (ST): This principle acknowledges that stressors, when matched with appropriate personal resources or the capacity to utilise such resources, can lead to positive coping experiences and movement towards health on the ease-disease continuum. (e) Sense of Coherence as a Learning Process (L): The interventions facilitate the discovery and application of GRRs and SRRs, thereby enhancing sense of coherence (SoC) and health. In short, the main components with the intervention formats of dialogue, written or face-to-face group sessions focused on (a) comprehensibility: guided participants describe about traumatic or stressful life events, their thoughts or feelings of the event and its impact on their life; (b) manageability: coping with stressful events using available resources and strengthening participants' motivation to use both their internal and external resources; and (c) meaningfulness: reflections on how they cope with similar events in future and find meanings from their experiences. The intervention duration ranged from 3 weeks (Quinto et al. 2022) to 17 weeks (Bragstad et al. 2020). The number of intervention sessions varied from three (Quinto et al. 2022) to 24 (Tan et al. 2016). The dosage of intervention ranged from 20- to 120-min each session, once or twice a week.

The cognitive behavioural interventions (CBT) of included studies did not report the model or theory application. The intervention duration ranged from 9 weeks (Malm et al. 2018) to 9 months (Hesselmark, Plenty, and Bejerot 2014), which intervention sessions varied from one (Luutonen et al. 2019) to 36 sessions (Hesselmark, Plenty, and Bejerot 2014). The dosage of intervention ranged from 60- to 180-min each session with frequency from weekly to once per three-week. The main components of CBT included (a) structure: identify the changes or redefinition of current situation; (b) set target goals in life; (c) strategies to reach goals (e.g. psychoeducation; management of negative emotions); and (d) behaviour evaluation. The CBT interventions were conducted on group-based or individual session.

The self-management interventions of included studies were based on self-management empowerment model or self-care behaviours model. The intervention duration ranged from 6 weeks (Nøst et al. 2018) to 19 weeks (Sundsli et al. 2014) with dosage of intervention ranged from 30- to 150-min, and frequency from twice per week (Momenabadi et al. 2020) to once per two-week (Hourzad et al. 2018). The main components focused on self-awareness of changes and understanding their personal level of performance and expectations, optimal goal setting, planning, adjusting physical, psychological and social structures and evaluation.

The nurse-led education interventions provided (1) health education on the symptoms and issues related to the disease and (2) guidance and advice for patients to discover coping strategies and self-care practices, while the exercise training included resistance training, Tai chi exercise, strength-power training and physical training in gym supervised by an experienced physiotherapist.

3.3 | Assessment of Risk of Bias

Figure 2 summarises all the detailed information of risk of bias. Fourteen studies (51.85%) showed overall low risk of bias, nine studies (33.33%) in high risk and four studies (14.82%) in 'some concerns'. For the randomisation process, eight studies (29.63%) did not report any information about allocation sequence concealment and not provide clear randomisation description (Daneshvar, Shafiei, and Basharpoor 2022; Momenabadi et al. 2020; Musavinasab et al. 2016; Oxelmark et al. 2007; Quinto et al. 2022; Sundsli et al. 2014; Tan et al. 2016; Tyni-Lenne et al. 2002). For the deviation from the intended interventions, four studies (14.81%) did not report the blinded information among researchers and participants (Daneshvar, Shafiei, and Basharpoor 2022; Momenabadi et al. 2020; Oxelmark et al. 2007; Quinto et al. 2022), and other four studies (14.81%) reported that blinding of the participants and the investigators was not feasible (Malm et al. 2018; Tan et al. 2016; Tyni-Lenne et al. 2002; Valsø et al. 2020), which biased results may be caused by their knowledge of the intervention contents in an unblinded trail design. For the missing outcome data, it needs to note that four studies reported missing data but not using appropriate analysis to correct missing data (Aci and Kutlu 2022; Graziano et al. 2014; Oxelmark et al. 2007; Tyni-Lenne et al. 2002), which they were considered 'low risk of bias' because missing data were reported in the article independent of the intervention and there was no biased effect on the final findings. For the outcome measurement, nine studies (33.33%) were considered 'high risk' because the assessment procedure could not be blinded to assessors and SoC as a subjective outcome reported by participants, which may be affected by known received intervention, and Langeland et al. (2006) (Langeland et al. 2006) did not provide information about blinded assessor which was considered 'some concerns'. For the selection report, five (18.51%) studies were considered 'high risk of bias' due to the lack of trial protocol registration (Daneshvar, Shafiei, and Basharpoor 2022; Graziano et al. 2014; Hesselmark, Plenty, and Bejerot 2014; Oxelmark et al. 2007; Sundsli et al. 2014), which was not possible to determine whether the reporting of results was consistent with the previous analysis plan.

3.4 | Effects of Non-pharmacological Interventions for SoC and Results of Trial Sequential Analysis

3.4.1 | Overall Effects on After-Intervention

Twenty-seven studies ($n = 2178$) evaluated the effectiveness of nonpharmacological interventions on SoC after-intervention, and the pooled meta-analysis results showed a statistically significant effect of non-pharmacological interventions on SoC compared with control group after-intervention (SMD = 0.52, 95% CI 0.28–0.75, $p < 0.0001$) (Figure 3).

3.4.2 | Effect of Subgroup Analysis, Sensitive Analysis and TSA Results at Different Time-Points

Subgroup analyses with random effects model were performed due to significant statistical heterogeneity ($I^2 = 85\%$, $p < 0.0001$), focusing on different measurement time-points to explore the

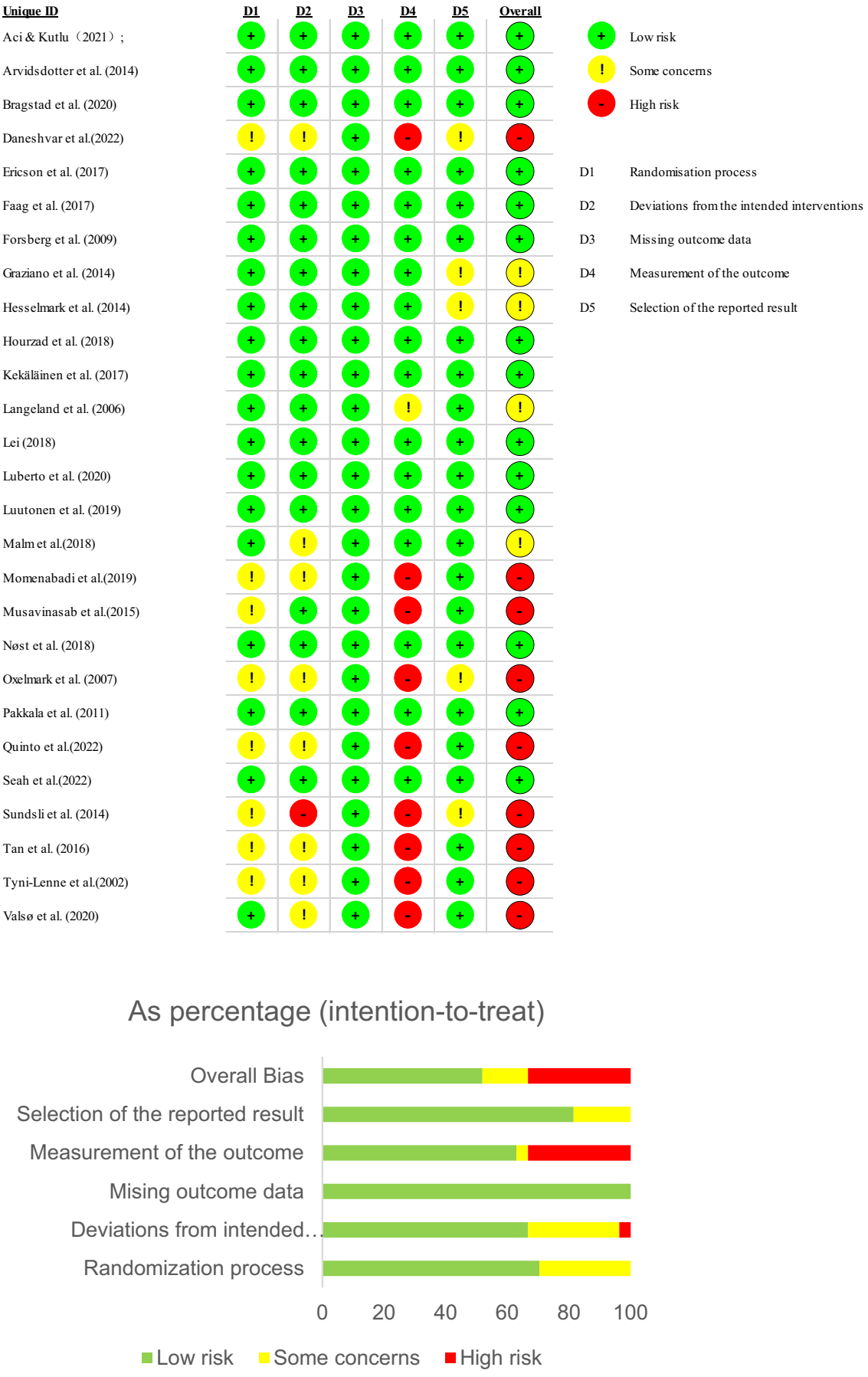

FIGURE 2 | Assessment of risk of bias of included studies.

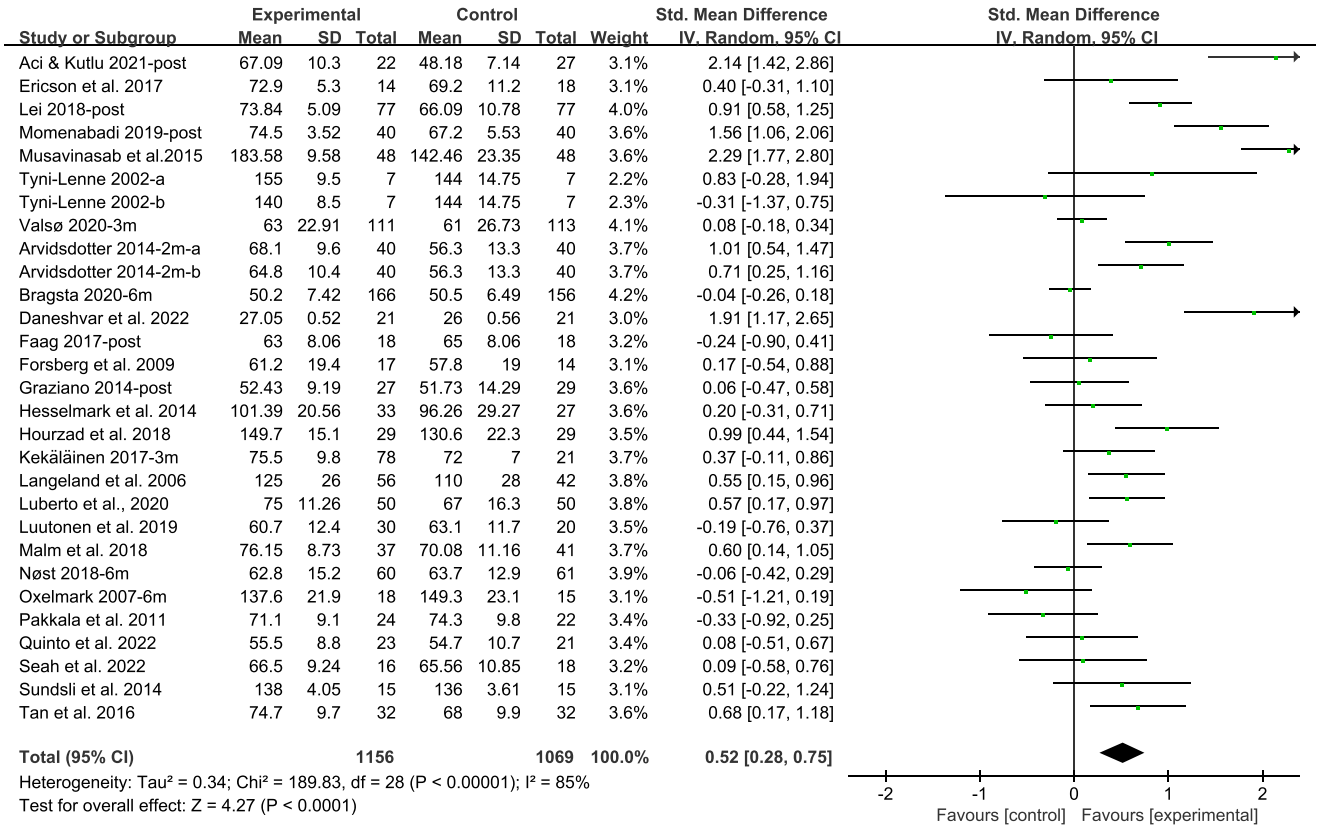

FIGURE 3 | The effect of non-pharmacological interventions on SoC after-intervention.

sources of heterogeneity (Figure 4). The results showed that the effectiveness of NPI in 19 studies was statistically significant on SoC < 3-month after-intervention (SMD = 0.85, 95% CI 0.40–1.29, $p = 0.0002$; SMD = 0.58, 95% CI 0.31–0.85, $p < 0.0001$), but no significant difference over 3-month (SMD = 0.07, 95% CI −0.14 to 0.27, $p = 0.53$; SMD = 0.10, 95% CI −0.13 to 0.34, $p = 0.39$).

In sensitivity analysis, all included studies were excluded one by one in each subgroup to test the stability of the subgroup analysis results. The significant effects for both the within-1-month and 1-3-month after-intervention subgroups remained unchanged (SMD = 0.37, 95% CI 0.07–0.66, $p = 0.01$; SMD = 0.52, 95% CI 0.32–0.72, $p < 0.00001$) after removing specific studies (Aci and Kutlu 2022; Momenabadi et al. 2020; Musavinasab et al. 2016) for within-1-month subgroup and (Aci and Kutlu 2022; Momenabadi et al. 2020; Pakkala et al. 2012; Valsø et al. 2020) for 1-3-month subgroup. This also reduced heterogeneities from 87% to 54% and from 78% to 36%, respectively. Besides, the subgroup analysis results for 4-6-month and > 6-month after-intervention did not change (SMD = −0.06, 95% CI −0.19 to 0.07, $p = 0.38$; SMD = −0.06, 95% CI −0.21 to 0.09, $p = 0.43$) after removing (Arvidsdotter, Marklund, and Taft 2014) in 4-6-month subgroup and (Kekäläinen et al. 2018; Malm et al. 2018) in > 6-month after-intervention subgroup, but the heterogeneities drop to 0% in both subgroups. Overall, a single study did not substantially change the pooled effect size results, indicating that the meta-analysis results are reliable (Figure 5).

TSA was performed based on data from sensitivity analyses due to the low heterogeneity in each subgroup. The TSA results of the effect of NPI on SoC within-1-month after-intervention showed the cumulative Z-curve crossed the traditional boundary and TSA boundary but the sample size did not reach the RIS, which suggested the meta-analysis finding was statistically significant and reliable but still need more sample sizes to strengthen this evidence. The TSA results in 1–3 month after-intervention showed that the cumulative Z-curve crossed the traditional boundary, TSA boundary as well as the RIS, suggesting that existing studies can firm that NPIs could improve SoC among older adults and patients with chronic disease within 1–3 month after-intervention. However, the TSA results in > 6-month after-intervention showed that the cumulative Z-curve did not cross either the traditional boundary, TSA boundary or RIS, suggesting that the evidence on this outcome was non-significant and insufficient. In addition, no TSA analysis was conducting at 4–6-month after-intervention due to low information use (< 1%). Overall, further large high-quality trials are warranted on two outcomes (Figure 6).

3.4.3 | Effect of Subgroup Analysis, Sensitive Analysis and TSA Results for Intervention Types Within-3-month After-Intervention

Even when subgroup analysis was done based on time-points, there was significant statistical heterogeneity in the pooled results that were statistically significant within 3 months. Thus, another subgroup analysis was conducted on included studies within 3-month according to the type of intervention (Figure 7). The effectiveness of salutogenic-based intervention and self-management intervention was statistically significant

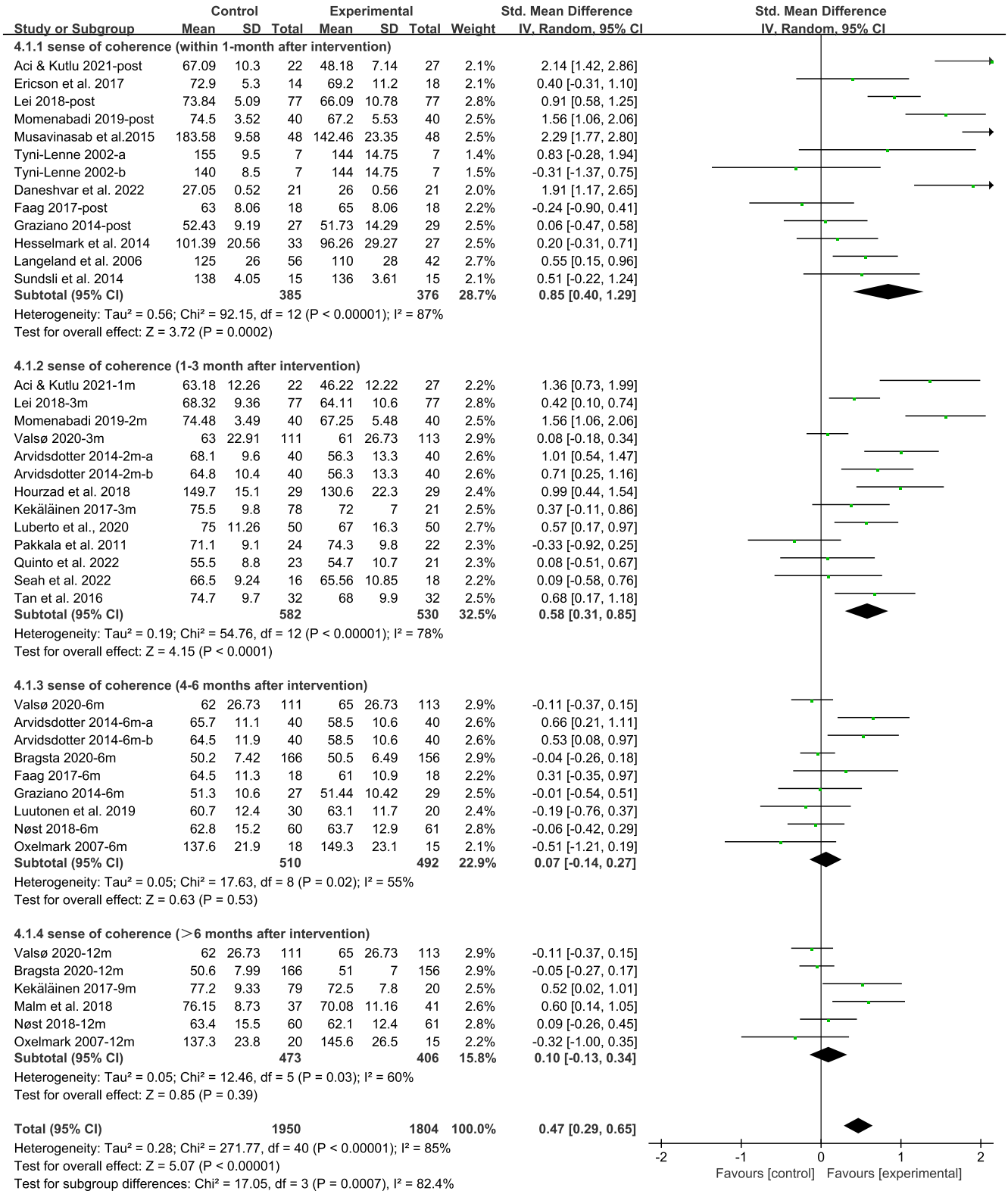

FIGURE 4 | The subgroup analysis of non-pharmacological interventions on SoC at different time-points.

for SoC within-3-month after-intervention (SMD = 0.82, 95% CI 0.45–1.19, $p < 0.0001$; SMD = 1.36, 95% CI 0.65–2.08, $p = 0.0002$), while the cognitive behavioural intervention, nurse-led health education and exercise training were not statistically different (SMD = 0.19, 95% CI −0.14 to 0.52, $p = 0.26$; SMD = 0.05, 95% CI −0.18 to 0.28, $p = 0.67$; SMD = 0.27, 95% CI −0.07 to 0.61, $p = 0.12$).

The sensitivity analysis (Figure 8) demonstrated that the pooled effects of four subgroups did not change after removing (Aci and Kutlu 2022; Arvidsdotter, Marklund, and Taft 2014; Daneshvar, Shafiei, and Basharpoor 2022; Lei 2018) in salutogenic-based intervention (SMD = 0.40, 95% CI −0.18 to 0.62, $p = 0.0004$), (Malm et al. 2018) in cognitive behavioural treatment (SMD = 0.04, 95% CI −0.27 to 0.34, $p = 0.82$), (Momenabadi

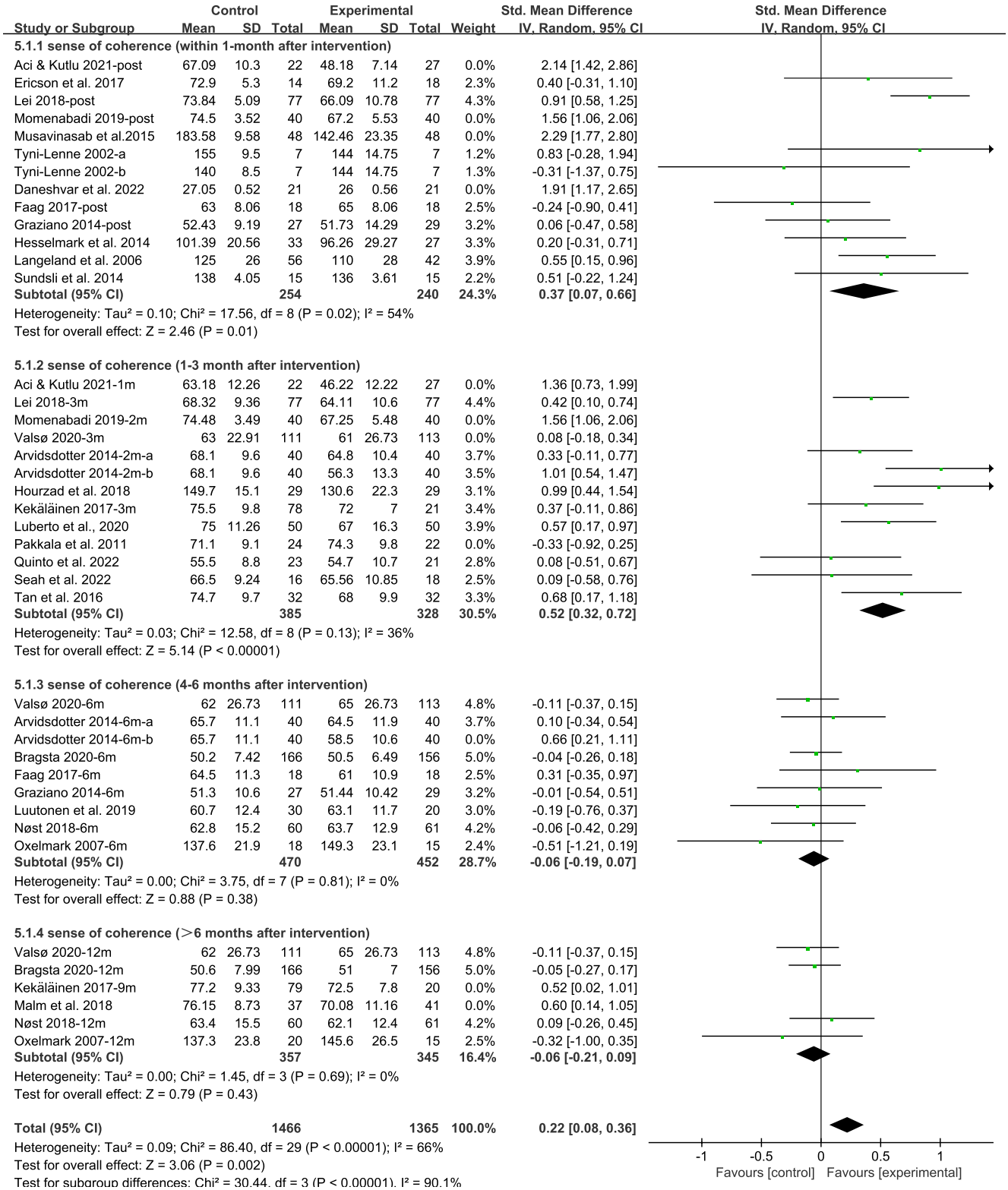

FIGURE 5 | The subgroup analysis after sensitivity analysis of non-pharmacological interventions on SoC at different time-points.

et al. 2020; Musavinasab et al. 2016) in self-management intervention (SMD = 0.81, 95% CI 0.35–1.27, $p = 0.0005$), nurse-led health education (SMD = 0.05, 95% CI −0.18 to 0.28, $p = 0.67$), while the heterogeneities were reduced from 80% to 0%, 41% to 0%, 84% to 7%. These results indicated that meta-analysis results are reliable on these outcomes. While after removing (Pakkala et al. 2012) in exercise training subgroup, the effectiveness was changed to significant (SMD = 0.44, 95% CI 0.18–0.71, $p = 0.001$) and heterogeneity reduced from 42% to 0%, which suggested that the pooled size effect was not stable in meta-analysis.

For the meta-analysis finding on salutogenic-based intervention, the TSA results showed that the cumulative Z-curve crossed the traditional boundary and TSA boundary but the sample size did

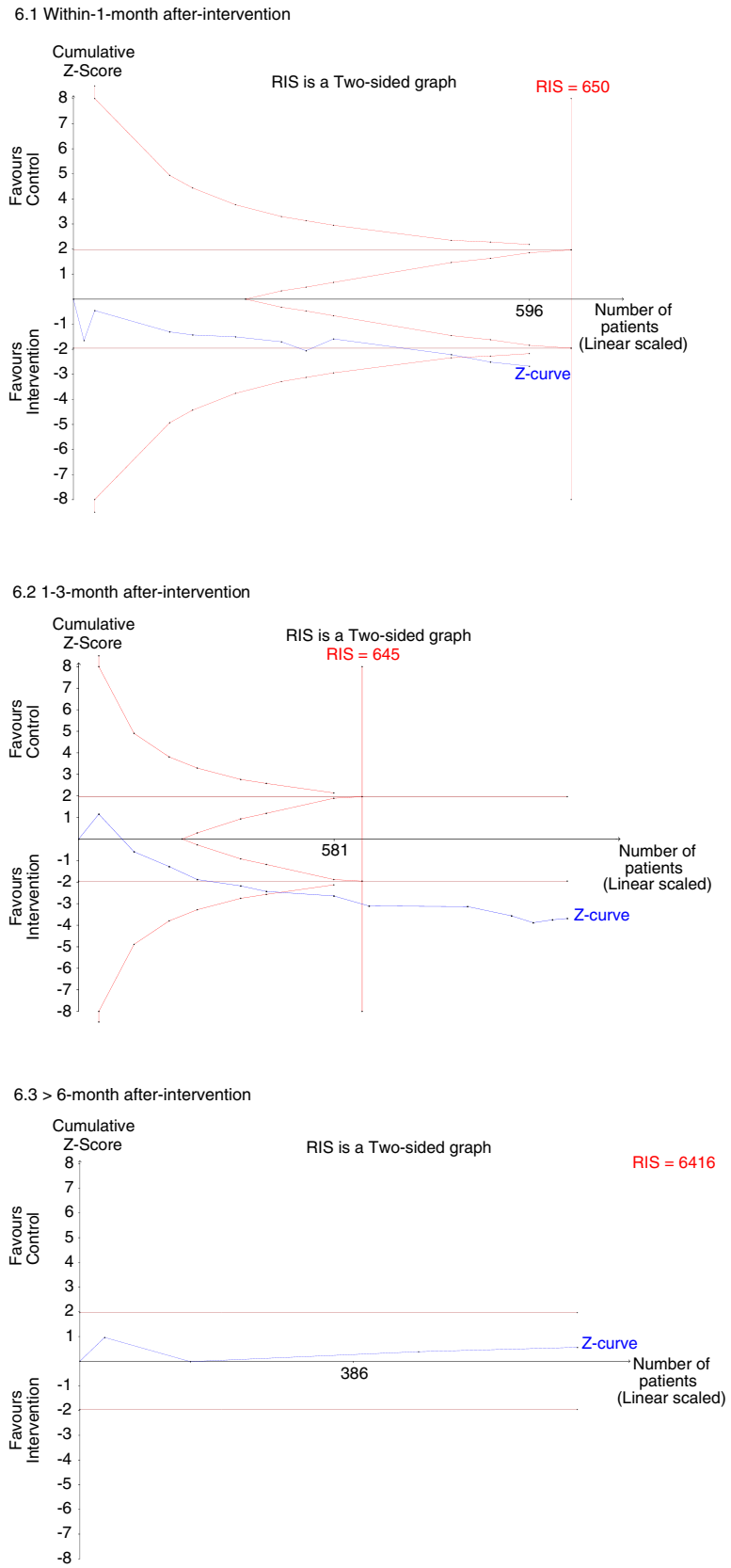

FIGURE 6 | The trial sequential analysis of non-pharmacological interventions on SoC at different time-points. 6.1 Within-1-month after-intervention. 6.2 1-3-month after-intervention. 6.3 > 6-month after-intervention. 6.4 4-6-month after-intervention. Results: No TSA analysis was conducting at 4–6-month after-intervention due to low information use (< 1%).

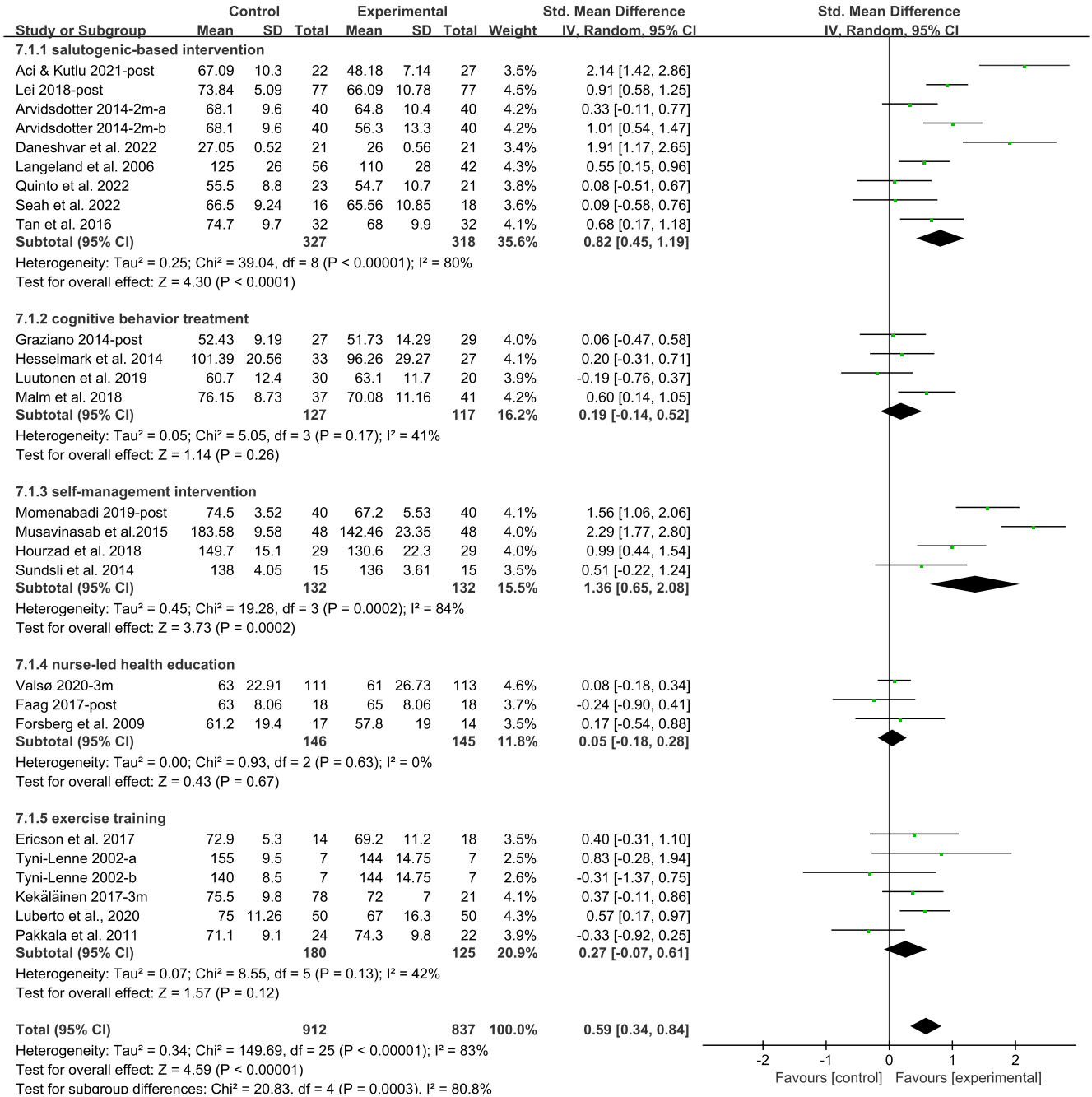

FIGURE 7 | The subgroup analysis of non-pharmacological interventions on SoC for intervention categories within-3-month after-intervention.

not reach the RIS, which suggested salutogenic-based intervention can improve SoC within-3-month after-intervention but still need more sample sizes for more powerful evidence. For self-management intervention, the cumulative Z-curve crossed the traditional boundary but not the TSA boundary and the sample size did not reach the RIS, suggesting that the meta-analysis result may be subject to the possibility of false positives and need to be confirmed by more studies. For cognitive behaviour treatment and nurse-led health education interventions, the cumulative Z-curve still existed in the non-statistically significant zone, indicating that the evidence is insufficient and unreliable. However, the TSA results of the exercise training showed that the cumulative Z-curve crossed the traditional boundary, TSA boundary as well as the RIS, suggesting that the meta-analysis result was reliable and provided strong evidence (Figure 9).

4 | Discussion

4.1 | Discussion About Different Results Compared to Previous Studies

This systematic review assessed the effectiveness of non-pharmacological interventions on SoC in older adults and patients with chronic diseases at different time-points after-intervention and explored effective NPI type, with a TSA

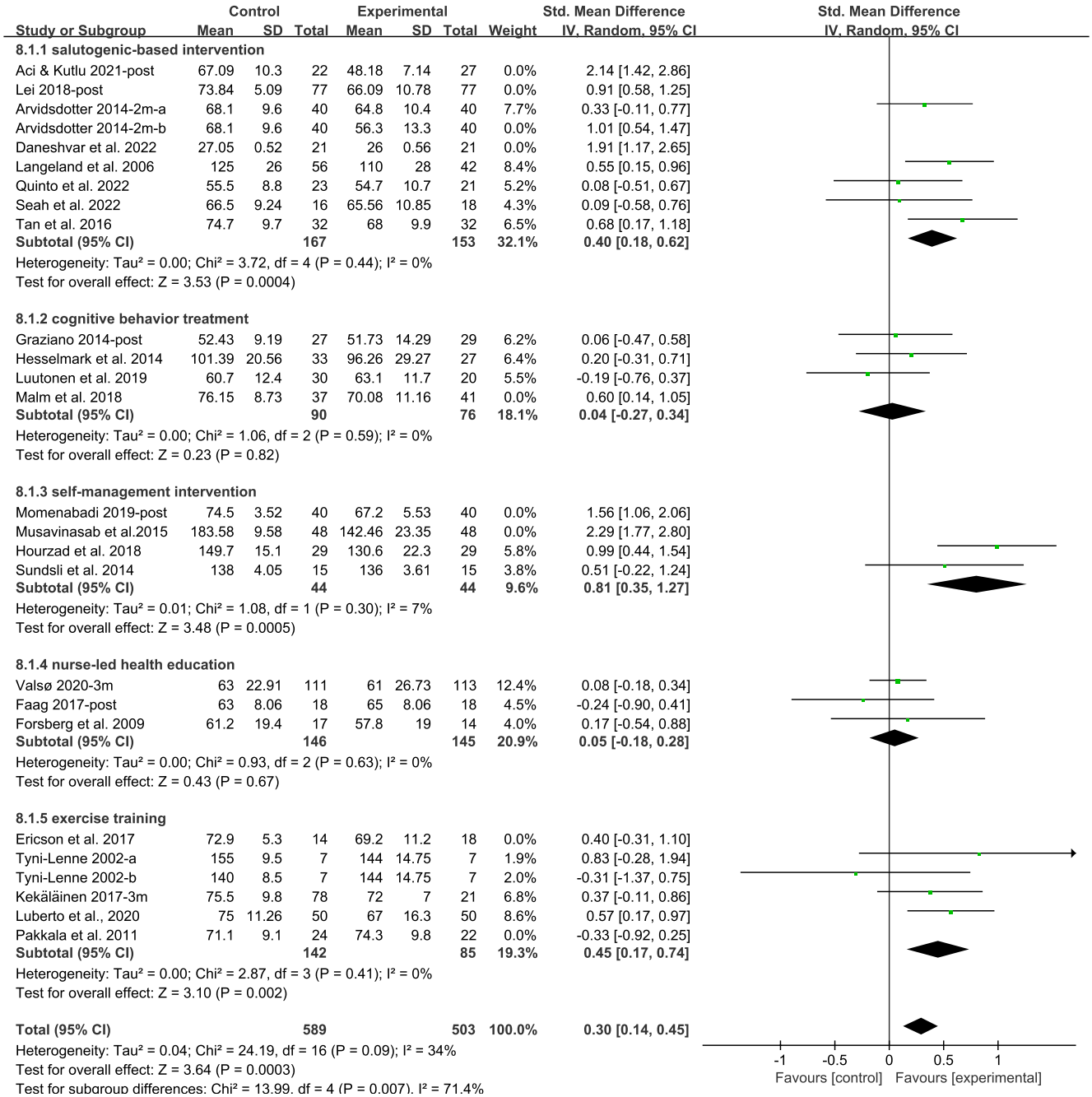

FIGURE 8 | The subgroup analysis after sensitivity analysis of non-pharmacological interventions on SoC for intervention categories within-3-month after-intervention.

analysis performed on the pooled results after sensitivity analysis. We found that the effectiveness of NPI on improving SoC could be maintained until 3 months post-intervention, in which effective NPIs may be salutogenic-based interventions.

It is difficult to compare with previous findings of systematic review to determine the validity of this study, as based on the systematic searching results, because this is the first study to explore the impact of different time-points on the post-intervention efficacy of NPIs for SoC on chronic disease. But there is one point need to notice that salutogenic-based interventions were found to be effective in improving SoC among older adults and patients with chronic diseases in this study. These results are consistent with previous research conducted on community-dwelling older adults (Chow et al. 2023), indicating the reliability of this finding. The effectiveness of salutogenic-based interventions in improving SoC may be due to their focus on strengthening individuals' resources and coping mechanisms, which can help individuals better adapt to stressors and challenges associated with chronic diseases (Tan et al. 2016). Moreover, the salutogenic-based intervention extends beyond the mere focus on individuals health outcomes, encompassing the various contexts and circumstances in which they live. This holistic approach may potentially amplify the intervention's positive effect on enhancing SoC among this population (Suárez Álvarez et al. 2022).

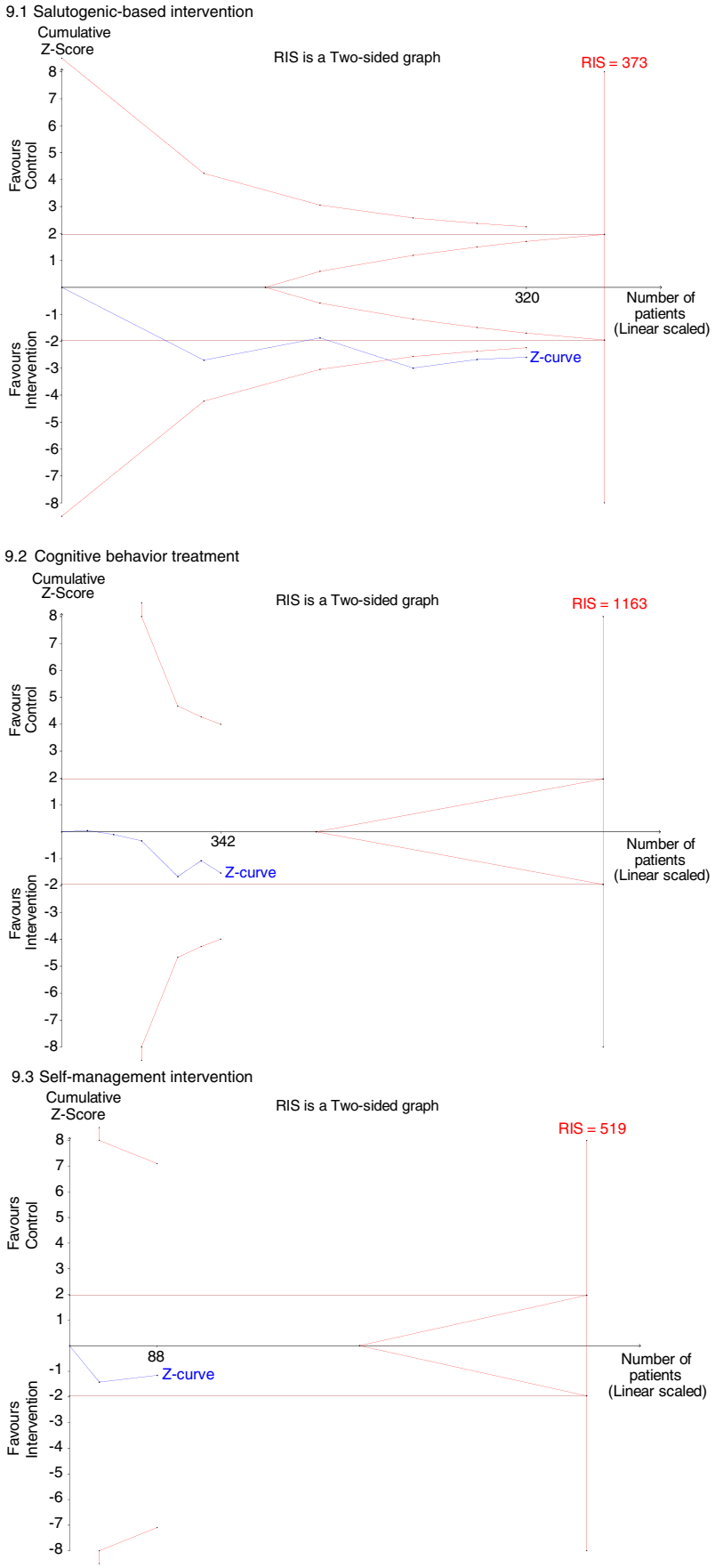

FIGURE 9 | The trial sequential analysis of non-pharmacological interventions on SoC at different intervention categories within-3-month after-intervention. 9.1 Salutogenic-based intervention. 9.2 Cognitive behaviour treatment. 9.3 Self-management intervention. 9.4 Nurse-led health education. 9.5 Exercise training.

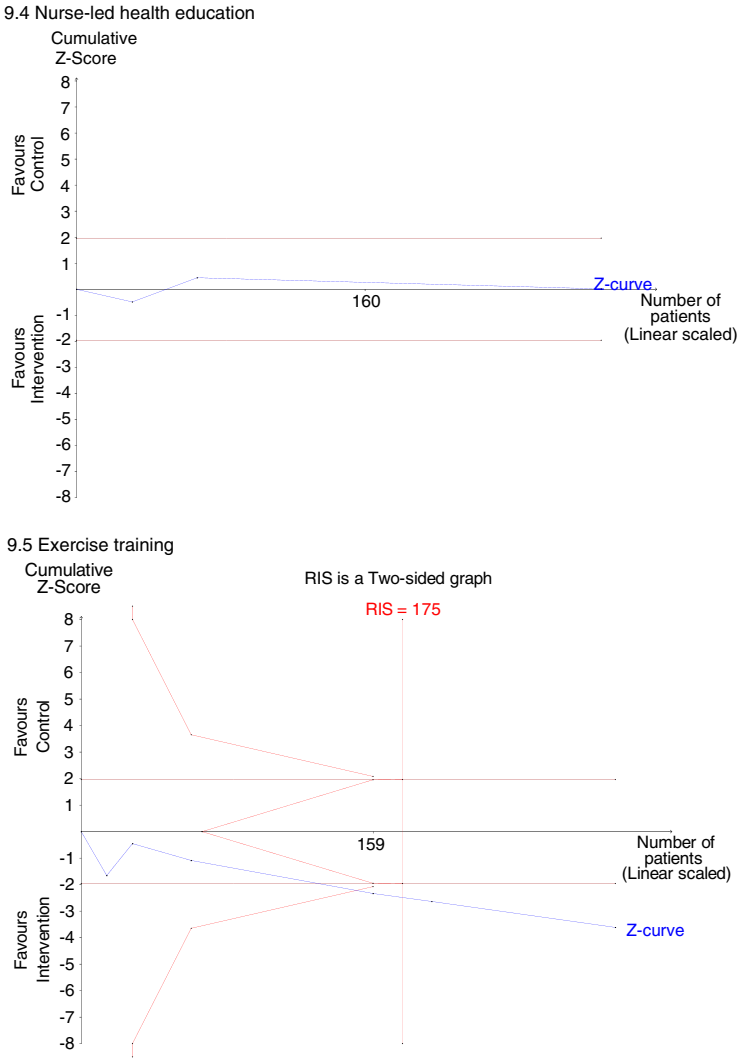

FIGURE 9 | (Continued)

Additionally, our study also found that the positive effects of non-pharmacological interventions on SoC could be maintained up to 3 months post-intervention, which is a significant finding. This result is especially important since many studies only measure SoC immediately after the intervention (Chow et al. 2023), providing limited insight into the long-term effects of these interventions. Thus, our findings suggest that implementing non-pharmacological interventions, particularly salutogenic-based interventions, can have lasting benefits on SoC among older adults and patients with chronic diseases. These results may have important implications for clinical practice, highlighting the potential benefits of incorporating non-pharmacological interventions into chronic disease management programmes.

Another point needed to discuss is the heterogeneity in this systematic review. In particular, moderate heterogeneity ($I^2 = 54\%, 41\%$) remained in the pooled results of the subgroup analyses within-3-month after gradual elimination of studies from sensitivity analysis. However, high heterogeneity was more common in meta-analyses of continuous variables, probably because the inconsistency before primary study results increased, on average increased with the increasing number of studies (Alba et al. 2016). The reasons for its increased variability may be related to the fact that the interventions differ in terms of content, dose and measurement tool. In addition, this systematic review does not limit the type and duration of chronic disease, which may also introduce a part of clinical heterogeneity.

4.2 | Limitations

There are a number of limitations in this systematic review that should be introduced when interpreting the findings.

Firstly, high heterogeneity cannot be given an exact source of heterogeneity in the current meta-analysis, even when subgroup analyses are performed according to different measurement time-points and intervention types. Secondly, nearly half of the included RCTs were rated as 'high risk' or 'some concerns' for two main reasons. (a) The double-blind design was almost impossible due to the nature of non-pharmacological interventions, especially psychological ones, which led to low quality in terms of blinding; (b) this may also be related to 'reporting bias' since the SoC as a psychological outcome

was measurement by subjective instruments. At last, TSA results for some subgroups analysed were less than desirable, e.g. inadequate strength of evidence and insufficient sample size, as a limited amount of RCTs was available on non-pharmacological interventions on SoC among older adults and patients with chronic disease.

4.3 | Implications on Future Research and Practice

Despite the existence of limitations, this systematic evaluation adds literature value through the following two points. First, the study limitations indicate exploration directions and research gaps for future studies, especially in terms of high heterogeneity and insufficient sample size that should be conducted more homogeneous RCTs with high quality and large sample size. Additionally, the majority of clinical trials have predominantly targeted adults who are either elderly or already diagnosed with chronic diseases, resulting in a notable dearth of research focused on the pre-stage of chronic conditions. This oversight underscores a critical research gap, suggesting that future studies should be expressly encouraged to investigate populations at the pre-disease stage. Such an expansion of the research focus would not only enhance our understanding of the early determinants of chronic diseases but also potentially inform preventative strategies aimed at mitigating the progression to diagnosed chronic conditions. Second, this study provides strong evidence that the short-term effects of non-pharmacological interventions can be maintained within 3 months post-intervention, and the effective NPI with most reliable evidence is salutogenic-based interventions. That is, for long-term effects if there is a need to keep improving SoC levels, non-pharmacological interventions should again be given to the target population beyond 3 months. This result has promoted the application of non-pharmacological interventions in older adults and patients with chronic diseases, especially in the election of intervention types and measurement time-points.

5 | Conclusion

Non-pharmacological interventions especially salutogenic-based interventions are effective approach to improve SoC among older adults and patients with chronic diseases compared to controls for 3 months after-intervention. However, for uncertain findings on long-term effects and other types of non-pharmacological intervention (e.g. self-management intervention and exercise training), further high-quality randomised controlled trials with larger sample size, rigorous double-blinded design should be conducted to provide more robust evidence.

Author Contributions

Yaqian Liu, Bohan Zhang, Jed Montayre made substantial contributions to conception and design, or acquisition of data, or analysis and interpretation of data. Yaqian Liu, Jed Montayre, Adowa Owusuaa Koduah, Angela Y. M. Leung involved in drafting the manuscript or revising it critically for important intellectual content. Yaqian Liu, Bohan Zhang, Jed Montayre, Adowa Owusuaa Koduah, Angela Y. M. Leung gave final approval of the version to be published and all authors agreed to submit this paper.

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Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

All results data showcased in this manuscript originate from the original datasets obtained through the literature encompassed in this meta-analysis. Consequently, the original data sets are accessible within the references cited herein.

Peer Review

The peer review history for this article is available at https://www.webofscience.com/api/gateway/wos/peer-review/10.1111/jan.16558.

Statistics

The statistical methods are supervised by a statistical expert in meta-analysis, Dr. Jed Montayre.

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