ESC European Society of Cardiology

European Journal of Cardiovascular Nursing (2022) **00**, 1–9
https://doi.org/10.1093/eurjcn/zvac071

REVIEW ARTICLE

Technology-delivered motivational interviewing to improve health outcomes in patients with chronic conditions: a systematic review of the literature

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Received 8 February 2022; revised 26 July 2022; accepted 28 July 2022; published 9 August 2022

Aims Provide an overview of remote motivational interviewing (MI) interventions for chronically ill patients, and understand their degree of effectiveness on different health outcomes.

Methods and results A systematic review with meta-analysis was conducted using the following databases: PubMed, CINAHL, PsychInfo, and Web of Science. Eligibility criteria included studies that administered remote MI alone or in combination with other remote approaches. A narrative synthesis and two meta-analyses were performed. Fifteen studies met the inclusion criteria. MI administration almost exclusively occurred by telephone and individual sessions. Eight studies reported treatment fidelity aspects, and four declared adopting a theoretical framework. Most targeted outcomes were therapeutic adherence, physical activity, depression, quality of life, and mortality. Risk of bias varied markedly, with the largest source resulting from selection process and intervention performance. The two meta-analyses indicated a significant effect of MI on depression [standardized mean difference = –0.20, 95% confidence interval (CI): –0.34, –0.05, $Z = 2.73$, $P = 0.006$, $I^2 = 0\%$], and no effect of MI on glycosylated haemoglobin (mean difference = –0.02, 95% CI: –0.48, 0.45, $P = 0.94$, $I^2 = 84\%$).

Conclusion Remote MI can be a promising approach for improving depression in chronic disease patients. However, studies are inconclusive due to risks of bias, heterogeneity, and lack of reporting of interventionist's training, treatment fidelity, and theoretical frameworks' use. More studies with solid designs are needed to inform clinical decision-making and research.

Registration PROSPERO: CRD42021241516.

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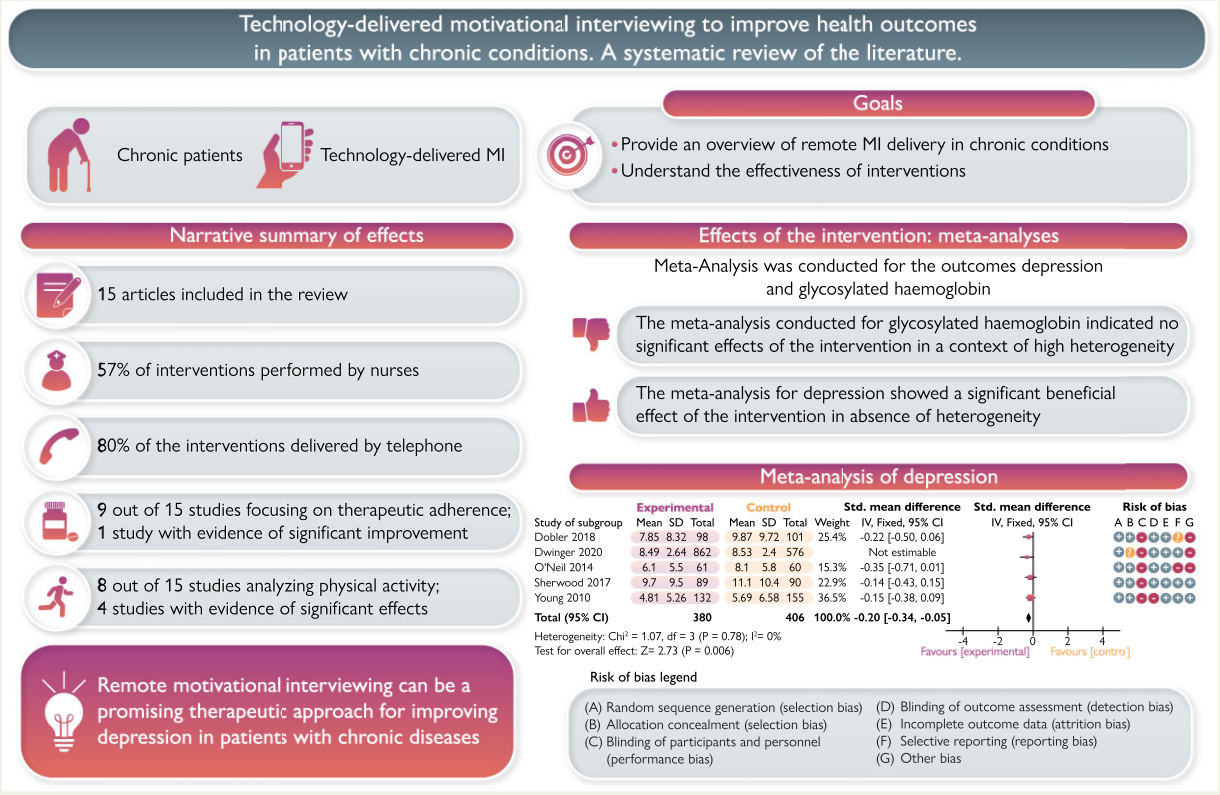
Graphical Abstract



Keywords Chronic disease • Educational intervention • Remote motivational interviewing • Self-management • Telehealth

Novelty

- Motivational interviewing delivered remotely can be promising to treat depressive symptoms in patients with chronic diseases
- More trials with solid designs and high-quality reporting are needed to test the effectiveness of remote motivational interviewing on chronic diseases patients.

Introduction

According to the World Health Organization, chronic diseases are conditions lasting for more than 12 months and have in common the characteristics of slow progression, long duration, and incurability.[1] Chronic diseases are considered a real epidemic; in the USA, ~50% of the population is affected by a chronic condition, and >80% of the healthcare costs are attributable to their care.[2]

Chronic diseases are likely to reduce several outcomes, including quality of life,[3] physical functioning (e.g. impairments in activities of daily living), and general well-being.[4] Not surprisingly, chronic diseases are also associated with increased hospitalizations[5] and mortality rates,[6] which makes them a clinical and public health priority.

Self-management of individuals has proved as a key strategy for reducing the burden of chronic diseases.[7] Chronic disease self-management involves the practices of adhering to healthy lifestyles (e.g. dietary practices and physical activity), the process of monitoring for signs and symptoms, and the response to them when they occur.[8]

Consistent evidence supports self-management as a strategy to improve clinical outcomes; a few studies have shown that self-management can reduce utilization of healthcare services,[9] hospital readmissions, mortality,[10] and symptoms.[11] Adequate self-management can also improve psychosocial outcomes, such as quality of life and depression.[12,13] Given the importance of self-management in improving outcomes of chronic diseases, researchers, and clinicians have been focusing on interventions for promoting patient self-management. Among the psychoeducational interventions, motivational interviewing (MI) looks particularly promising.[14–16]

Motivational interviewing is a person-centred approach that reinforces intrinsic motivation and self-efficacy for behaviour change.[17] It is characterized by four sequential processes: (i) engaging, that is the accomplishment of mutual trustworthiness and respect between the interventionist and the patient; (ii) focusing, which entails the identification of behavioural goals that will be accomplished and will guide the subsequent sessions; (iii) evoking, or the exploration of the patient motivation or readiness to change; and (iv) planning, that is the development and sharing of a plan of action that starts when the patient is ready to engage in change. The sessions are characterized by a building process of empathy and collaboration and the use of cognitive strategies that include open-ended questions, affirming, and reflective listening.[18] MI is sometimes believed to be a form of cognitive-behavioural therapy,[17] but this latter approach differs from MI in that it prevalently tries to identify and restructure distorted ways of thinking, rather than focusing on improving intrinsic motivation and the process of behaviour change.[19]

Many healthcare providers are adopting MI as a means of behaviour change promotion. Since its origins in 1995, during which it was used to support patients with drug addiction, MI has extended to a wide variety of issues, from promoting safe sexual practices to reducing obesity and binge drinking; a recent systematic review of reviews reports that MI is particularly effective in stopping, or preventing unhealthy behaviors.[20] The improvements also translate into more distal health outcomes such as quality of life,[21] use of healthcare services,[22] and mortality.[23]

Motivational interviewing has been designed to be offered through face-to-face sessions. However, during the last decades, MI has also been provided by telephone or video calls.[24] Remote MI looks promising in the context of modern healthcare, as it broadens the possibility of expanding access to care for older people and the range of populations to treat.[25] This has been particularly timely during the coronavirus pandemic, which has led to reorganizing the healthcare systems to avoid direct access to hospitals and outpatient settings.[26]

Given the importance of remote MI for managing chronic diseases, collecting an updated 'status of the art' on this topic is paramount. So far, no recent systematic reviews offer such an overview; to our knowledge, the most recent systematic review dates back to 2014[25] and only dealt with qualitative aspects without attempting to synthesize the MI effectiveness (i.e. meta-analysis) quantitatively. The present systematic review and meta-analysis intend to fill these gaps by (i) providing a comprehensive overview of MI interventions delivered remotely, to enhance health outcomes in patients with highly impacting chronic diseases and (ii) understanding the extent of effectiveness of remote MI on health outcomes.

Methods

The present systematic review was conducted following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines and is registered at PROSPERO (identification number: CRD42021241516).

Search strategy

A comprehensive bibliographic search was conducted on PubMed (via MEDLINE), CINHAL (via EBSCO), PsycINFO (via EBSCO), and Web of Science (via EBSCO) from inception to October 2021 for randomized controlled studies adopting MI via technology/telehealth. The search strategy included combinations and synonyms of free text and Medical Subject Headings (MESH) terms. To identify additional studies, we also examined the reference lists of retrieved articles. The search strings used for each database are included in Supplementary material online, Figure S1.

Study selection

Studies were included if they fulfilled the following criteria: (i) randomized controlled trials, (ii) inclusion of adult patients affected by at least one of the 10 chronic diseases (alone or in combination; see below), (iii) intervention regarded the administration of remote MI alone or combined with other remote counselling techniques, (iv) intervention oriented at improving any possible health outcome (e.g. self-management behaviours, symptoms, mortality), (v) written in English language, and (vi) full text was available.

We chose ten chronic diseases from the list issued by the Office of the Assistant Secretary from Health (OASH),[27] which are known to share significant morbidity and mortality worldwide: hypertension, heart failure, coronary artery disease, heart arrhythmias, stroke, arthritis, asthma, chronic kidney disease, chronic obstructive pulmonary disease, diabetes mellitus, and osteoporosis.

Data extraction

The references obtained from the search string of each database were exported to Endnote v.x6, where duplicates were removed. The results were then uploaded to Rayyan,[28] where two independent reviewers (M.B. and G.G.) conducted the initial screening of titles and abstracts. Subsequently, the remaining studies were examined in full text, and data extraction was performed. Non-conformities and disagreements regarding the inclusions of the studies were resolved by consensus between the two evaluators; otherwise, the conflicts were resolved by a third reviewer (P.I.).

Data extraction was performed in Microsoft ACCESS® 2007 2016 via a tool built on purpose by the research team. The following information was extracted: author and study setting, way of recruitment of participants, type of interventionist, type and duration of training, study groups, sample characteristics, duration of follow-up, outcomes assessed, individual or group type of sessions (individual or group), number of sessions and duration of the intervention, intervention components, type of technology involved, measures of treatment fidelity, use of a behaviour change theory to guide the intervention, and involvement of caregivers.

Methodological quality assessment

We assessed the methodological quality of the included studies by means of the Cochrane Risk of Bias Tool.[29] Six sources of bias were evaluated according to this tool: generation sequence allocation, allocation concealment, blinding procedures, incomplete outcome data, selective reporting, and other sources of bias. The instrument can be found online at http://handbook.cochrane.org/.

Statistical analysis

Rev-Man v.5[30] was used to perform the meta-analyses. Data including author, year of publication, sample size, and standard deviation for each randomization group were imputed in the software. A meta-analysis was conducted only for the outcomes with consistent measurements across the studies. Whenever statistical pooling was not possible, we provided a narrative synthesis of the findings. To determine the overall effect of MI on the continuous outcomes, we extracted either the mean difference (MD) or standardized MD (SMD); we specifically used the SMD if the outcome was not measured with the same scale, otherwise we used the MD. Effect sizes were represented as Cohen's *d*, with

values <0.5 denoting a small effect size, values from 0.5 to 0.8 indicating a moderate effect size, and values ≥ 0.8 suggesting a large effect size.[29]

We chose fixed effects models if heterogeneity (computed by calculating I^2 statistics) was absent; otherwise, random-effects models were implemented.[31] We used the following cut-offs to assess the extent of heterogeneity of the studies: (i) <25% = no heterogeneity; (ii) 25–50% = low heterogeneity; (iii) 50–75% = moderate heterogeneity; and (iv) 75% = high heterogeneity.[32] Significance was determined by a χ^2 test for Q, with a *P*-value <0.05, indicating significant heterogeneity. In the case of moderate-to-high levels of heterogeneity, possible reasons were explored qualitatively and quantitatively; subgroup analyses were planned only in the case of a sufficient number of studies per group (>10).[33] Leave-one-out sensitivity analyses were also planned in case one or more studies exhibited serious risks of bias.[34] For each meta-analysis, forest plots are presented.

Results

Search results

The literature search generated 4982 files, with further three potential articles identified from the citations of the retrieved paper. Duplicate removal led to the exclusion of 1807 papers, and a further 3649 records were excluded by title and abstract screening. Sixty-three potentially relevant full-text articles were assessed for eligibility, leading to a total of 15 articles included in the review. *Figure 1* shows the flow chart of the study selection process.

Study characteristics

Fifteen studies involving a total of 16 647 patients (intervention group: 9335 vs. control group: 7312) were included in this systematic review. The sample was primarily males (55.4%) with an average age of 58.4 years. Eight studies were conducted in the USA,[35–42] three in Germany,[43–45] two in Australia,[46,47] one in Canada,[48] and one in Norway.[49]

The sample was recruited from communities in 12 studies[35–40,44–49] and outpatient clinics in three studies.[41–43] Diabetes,[37,41–46,48,49] coronary artery disease,[35,38,44,47,48] and heart failure[39,44,45] were the most prevalent diseases exhibited. Additional characteristics of the included studies are shown in Supplementary material online, Table S2.

Intervention details

Ten studies[35,37,38,40–43,46,48,49] delivered MI as a free-standing intervention, whereas four[39,44,45,47] integrated the sessions with other techniques (e.g. coping skills training, cognitive restructuring, and goal setting).

In almost all studies, MI was administered via telephone[35,37–40,42–47,49]; in two studies, administration occurred via video,[36,48] and in one study, both via video and telephone.[41] MI was delivered via group sessions in one study, only.[48] Eight studies encompassed nurses as interventionists[38,41,42,44–46,48,49]; two studies employed psychologists,[39,47] and a further two employed health educators.[35,40]

The most common MI components reported were relational in type: 'develop discrepancy', described in *n* = 5 studies, 'explore ambivalence' described in *n* = 5 studies, and 'strengthening commitment to change', reported in *n* = 7 studies. The most common technical component, 'open-ended questioning' was described in *n* = 3 studies. Three studies did not describe any MI component.[39,43,47]

Only four studies[38,41,43,48] declared whether the interventionist completed a period of pre-intervention training. Description of treatment fidelity was reported in eight studies.[38,40–42,44,45,47,48] Only four[39,46,48,49] adopted a behaviour change theory guide the interviews, and none of the studies involved caregivers in the intervention.

Outcomes

Nine studies examined therapeutic adherence,[35–40,43–45] eight focused on physical activity,[35,39,42–44,46,48,49] six included depression,[39,42–44,47,49] six considered quality of life,[35,39,41,44,47,49] and three regarded mortality.[38,39,45]

Other outcomes were disease-specific parameters, duration of work inability, time to readmission to hospital, health service utilization, anxiety, stress, vital signs, diet weight, smoke, falls, and fractures. For a more detailed list of outcomes and associated studies, see Supplementary material online, Table S2. Types of questionnaires were prevalently self-reported, although the authors also utilized objective and direct measures for some measures (e.g. therapeutic adherence and physical activity).

Methodological quality of the studies

Overall, the studies presented a marked variability in risk of bias across the domains (see Supplementary material online, Figure S1). In five studies, the sequence of allocation was appropriately created and concealed.[39,42,43,47,48] Although there was no evidence of bias in these two domains, most studies did not report sufficient information to judge the risk.

Blinding of the participants was often not addressed, given the nature of the intervention. Only Solomon *et al.*[40] managed to blind the patients to treatment arm allocation as a result of implementing enhanced care. Regarding the attrition bias domain, almost all studies declared the source of missing data and how these were handled. The analyses were as per intention to treat in ten studies.[37,39,40,42–45,47–49] Seven studies[38–42,47,48] had a significantly low amount of missing data (<10%); therefore, they were not treated, while four studies[37,39,46,48] addressed them with multiple imputations.

Selective reporting was an issue for five studies[38,41,46–48] because registration of any protocol was not mentioned. Other risks of bias were found in Dwinger *et al.*[44] and Harter *et al.*,[45] where enrolment of patients occurred after randomization due to ethical reasons linked to health insurance; this resulted in unbalanced groups and selection bias. Finally, in Dobler *et al.*,[43] the authors did not check the fidelity of MI in any of their counsellors' sessions; this might have led to performance bias.

Effects of the intervention

Meta-analyses

Due to inconsistency in measurements across studies, meta-analysis was feasible only for depression and glycosylated haemoglobin outcomes. The meta-analysis for depression initially included five studies[39,42–44,47] where the fixed effects model (*Figure 2A*) did not show a significant effect of the intervention in absence of heterogeneity [SMD = –0.08, 95% confidence interval (CI): –0.16, 0.00, $Z = 1.87$, $P = 0.06$, $I^2 = 21\%$; *Figure 2A*].

A sensitivity analysis was subsequently conducted by excluding the study by Dwinger *et al.*,[44] which was affected by important selection bias and exhibited unbalanced groups. The results of this fixed effects

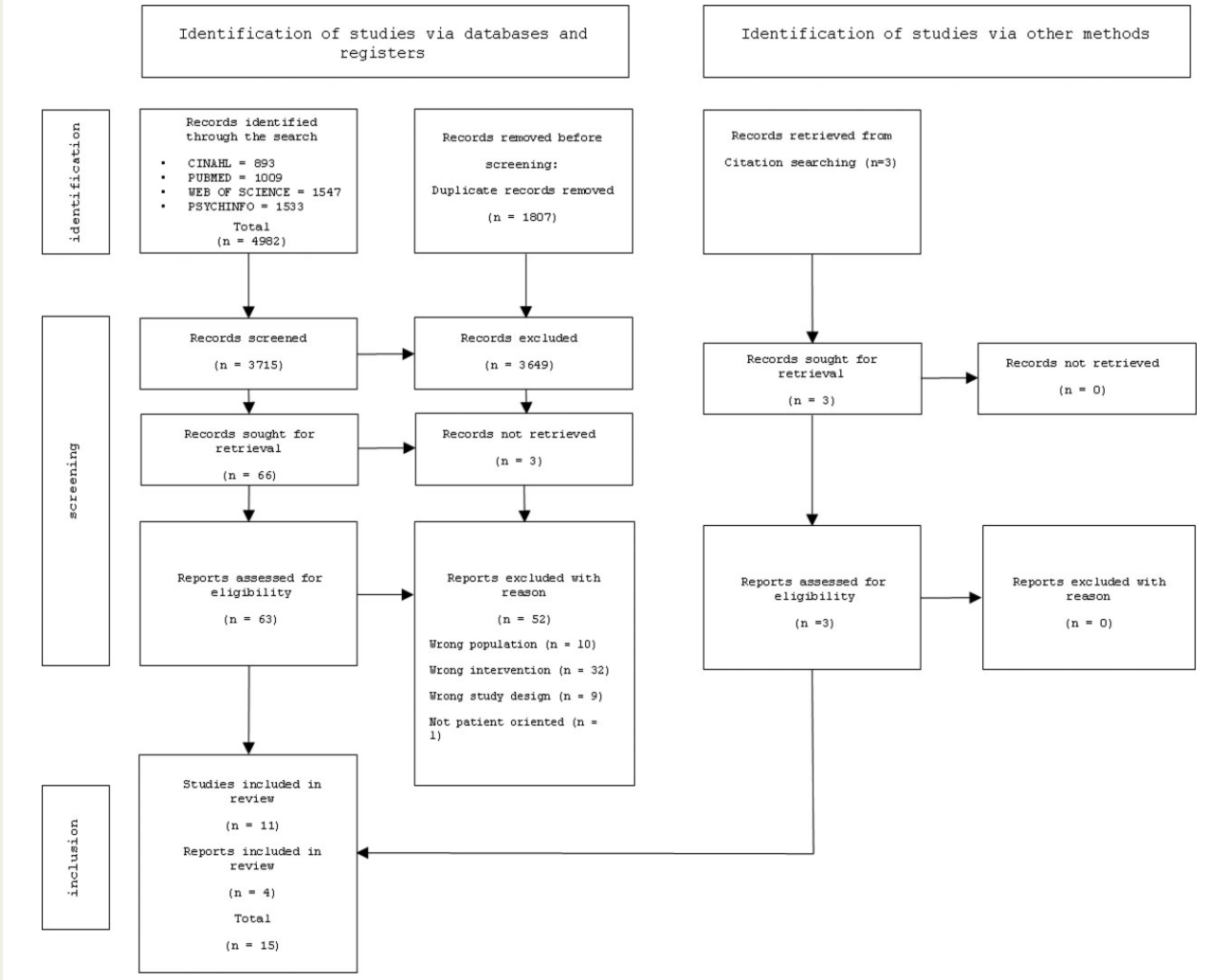


Figure 1 Flow chart of the study selection process.

model (*Figure 2B*) showed a significant beneficial effect of the intervention in absence of heterogeneity (SMD = –0.20, 95% CI: –0.34, –0.05, $Z = 2.73$, $P = 0.006$, $I^2 = 0\%$). The largest effect size was obtained by O'Neil *et al.*,[47] which implemented a telehealth programme on patients with acute coronary syndrome by integrating a cognitive-behavioural intervention with a cardiovascular prevention programme.

The meta-analysis conducted for glycosylated haemoglobin included four studies,[37,43,46,49] and the random-effects model indicated no significant effects of the intervention in a context of high heterogeneity (MD = –0.02, 95% CI: –0.48, 0.45, $P = 0.94$, $I^2 = 84\%$; *Figure 3*). Given of the poor number of studies selected, subgroup analyses were not possible.

Narrative summary of effects

A total of nine studies examined therapeutic adherence. Among them, only Palacio *et al.*,[38] found evidence of significant improvement. The authors administered MI in patients with new coronary stents and found that adherence to antiplatelet medications was adequate in 64% in the intervention group, compared with 50% in the control group.

Physical activity was analysed in 8 out of 15 studies, and only four showed a significant effect.[42,43,46,48] Dobler *et al.*[43] administered a counselling intervention in diabetic patients and found that regular physical activity after 12 months rose by 26% in the intervention group compared with 10% in the control group. Eakin *et al.*[46] also studied diabetic patients and registered an increase in moderate-to-vigorous physical activity at 18- and 24-month follow-ups. Nolan *et al.*[48] administered telehealth lifestyle counselling to patients with coronary artery disease, and adherence to planned exercise was significantly higher immediately after treatment and after 6 months of follow-up. Finally, Young *et al.*[42] registered a rise in the number of steps per week in the intervention group 3 months after a nurse coaching intervention for diabetic patients.

Quality of life was analysed in six studies[35,39,41,44,47,49] but only Sherwood *et al.*[39] registered significant improvements after administering a coping skills training intervention on heart-failure patients. Mortality was analysed by three studies,[38,39,45] but only two of them found significantly decreased rates. Harter *et al.*[45] analysed patients with various chronic diseases and found significant differences between the health coaching group and control group in terms of

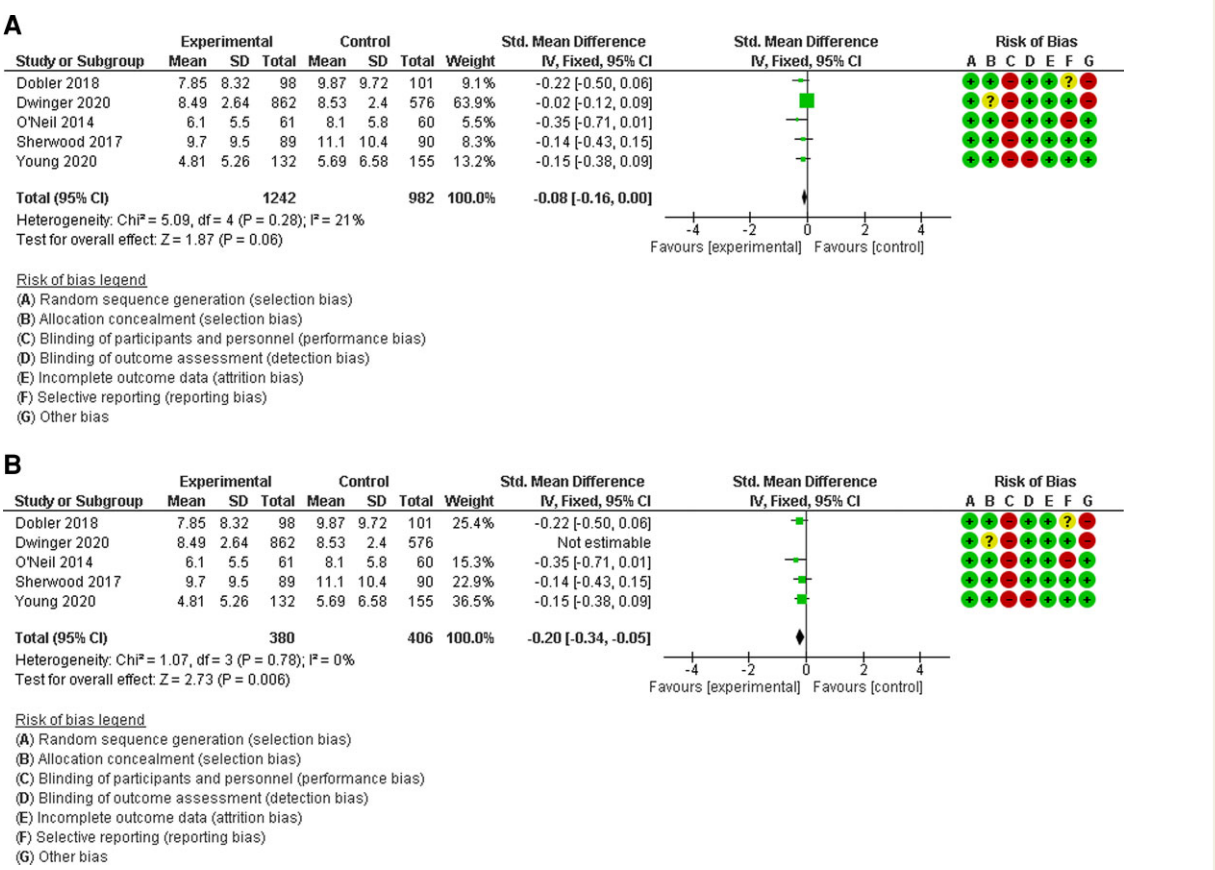


Figure 2 (*A*) Meta-analysis of depression. (*B*) Meta-analysis of depression (sensitivity analysis).

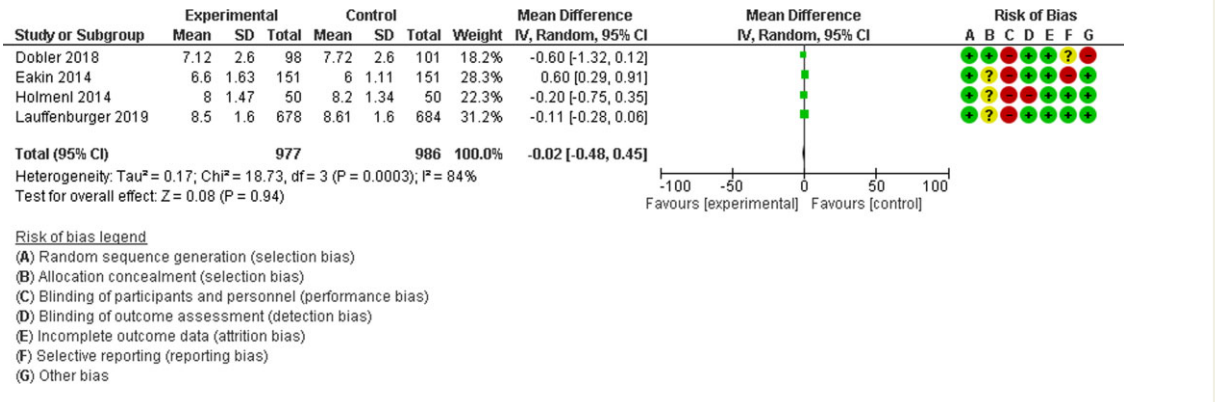


Figure 3 Meta-analysis of glycosylated haemoglobin.

death rates on the chronic campaign. Sherwood *et al.*[39] found that heart-failure patients randomized to the coping skill training exhibited a reduction in the composite endpoint of disease-related hospitalization or death during the three-year follow-up period. Anxiety was analysed inthree3 studies[39,42,44]; however, none showed significant improvements. The effects of MI on the remaining outcomes are reported in see Supplementary Material online, Table S2.

Discussion

The present systematic review aimed to offer a comprehensive overview of remote MI interventions delivered to patients with chronic diseases and understand its effectiveness on health outcomes. We found high heterogeneity across the studies, which were related to intervention components, methodological aspects, outcomes

measured, and risk of bias. We also used a meta-analysis to understand the effectiveness of the interventions on a few outcomes (i.e. depression and glycosylated haemoglobin).

Regarding the characteristics of the interventions reported, we found some aspects worth discussing. First, we observed that MI was prevalently administered via telephone; although this approach has been widely successful in enhancing outcomes, it is recently argued whether video calls should be preferred over the phone as a means of intervention delivery. Tang *et al.*[50] found higher acceptability of video-administered MI in a study on families of young children conducted during the COVID pandemic. Interventionists felt the families were more distracted on the phone and provided shorter answers. Conversely, during video calls, families were more concentrated, dedicated to the conversation, and focused on thinking through behaviour change objectives. The educators could also see non-verbal communication with online video calls, which was not possible during a phone visit.

Second, we found only one study that delivered the intervention in a group format. In general, in educational studies, the arguments for favouring group sessions include the reduction of costs and the value of group learning. In comparison, individual interventions are supported on the basis that they can be more easily tailored to the patient's needs. Comparison of effectiveness between the two modalities is scarce due to many other differences. However, in the case of MI, the group format may compromise its effectiveness, as different group members will be more likely to be at various stages of change, or exhibit different behavioural needs, with subsequent intervention effects more likely to be diluted.

Third, we noticed a relatively low number of studies reporting aspects of treatment fidelity, such as the absence of reporting on the type and length of interventionists' pre-training or description of how the authors guaranteed adherence to the treatment protocol. Lack of treatment fidelity reporting is still common, as evidenced by the literature; as proof of this, a systematic review by Kechter *et al.*,[51] on mindfulness-based trials found that within 202 articles retrieved, only 25 (12%) described fidelity aspects. Low rates also emerged in the review by Brogan *et al.*,[52] who found that out of 42 articles, only 9 (21%) explicitly reported fidelity processes. Notably, the lack of treatment fidelity we found was paralleled by a general lack of reporting of MI components.

Our systematic review indicates that most studies did not adopt a behaviour change theory to guide the interviews. This is critical because as Glanz *et al.* pointed out,[53] interventions in the field of health education will be better designed if guided by one or more behaviour change theories. Theories are thought to improve the quality and effectiveness of complex interventions when compared with empirically driven approaches.[54] Clearly, much still needs to be done to fix this critical point because lack of theory use is widespread in health research.[55,56]

We also found that the authors never involved caregivers in the interventions. This was quite surprising, given the broad literature highlighting the importance of caregiver contribution to the self-care process of chronic diseases.[57,58] The theory of dyadic illness management, developed by Lyons and Lee,[59] emphasizes that patients and caregivers navigate illness together, share their experiences, and consequently become interdependent; therefore, the two members should not be treated individually in health behaviours' education. In addition, the mechanism of MI, which includes enhancement of self-efficacy, would be advantageous for the caregivers, as higher caregiver self-efficacy has been associated with positive outcomes in patients.[60,61]

In this review, we were able to examine the effect of MI on two outcomes, given reasons for heterogeneity in measures and instruments adopted. The meta-analysis on depression initially revealed a non-significant effect of the intervention. However, after the study by Dwinger *et al.*,[44] it was excluded due to a high risk of selection bias, and we found that MI had a significant positive effect on depression. This is consistent with other studies conducted in different contexts,[62,63] reinforcing the potential application of MI to depressed individuals with chronic diseases. Nevertheless, these results should be interpreted with caution because, in two studies, MI was associated with other techniques that may have distorted the pooled effect size.

The meta-analysis on glycosylated haemoglobin yielded non-significant effects of the intervention in a context of high heterogeneity of the studies. This conflicts with the evidence of a recent systematic review,[64] which found that diabetes self-management had a beneficial effect on glycosylated haemoglobin. Possible reasons for this finding can be the heterogeneity in intervention contents (i.e. MI alone or in combination with other approaches), intervention doses (ranging from 3 to 27 contacts), sample size (ranging from 151 to 1400), and control group diversities (i.e. no active intervention or provision of written and verbal advice on physical activity). This latter aspect may have mainly contributed to mask potential positive outcomes of the intervention.

The present systematic review has some limitations. First, some essential studies might have been excluded because of language barriers, with possible bias in the results. Second, the participants' mean age was about 58 years old; thus, we cannot draw conclusions about younger populations. Third, we chose to exclude asymptomatic conditions and diseases with possibly reduced benefit from self-management interventions; therefore, we do not know whether our overview of interventions and effects have been distorted (e.g. overestimated) by selection bias. Fourth, in some of our studies,[39,44,45,47] we found that other intervention components were used, above and beyond MI (e.g. relaxation training, cognitive restructuring, activity trackers); these approaches were aimed at boosting the effect of the counselling interviews; therefore, the pooled effect size we obtained by including also these studies may not entirely reflect the effectiveness of MI.

Despite the limitations, this review also has important implications. Our meta-analysis has suggested that remote MI can be a potential therapeutic approach for improving depression in patients with chronic diseases. This is important because depression is widespread in these individuals.[65] Moreover, the revision has uncovered critical issues in reporting and bias risks, raising awareness among researchers that much still needs to be done to improve the methodological quality of the trials in this field.

Conclusion

Remote MI can be a potential therapeutic approach for improving depression in patients with chronic diseases. However, the studies are inconclusive due to several risks of bias, heterogeneity, and lack of reporting of interventionist's training, treatment fidelity, and use of theoretical frameworks. More trials with more robust designs

and higher quality reporting are needed in the field of chronic diseases to inform clinical decision-making and research.

Supplementary material

Supplementary material is available at *European Journal of Cardiovascular Nursing* online.

Funding

None declared.

Conflict of interest: None declared.

Data availability

The data analysed during the current study is available from the corresponding author on reasonable request.

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