Research article

Peer-support interventions and related outcomes in patients with myocardial infarction: A systematic review

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A B S T R A C T

Objective: Myocardial infarction (MI) is one of the main causes of disability and death worldwide. Peer-support can ameliorate the psychological and physical morbidities associated with heart diseases. The aim of this study was to determine whether peer-support interventions could improve the psychological and behavioral health outcomes commonly experienced by MI patients.
Methods: In this systematic review, international databases (PubMed, Web of Science, and Scopus) were searched to gather related publications up to March 2023. Eligible papers were those addressing the outcomes of peer-support interventions in individuals with a history of MI.
Result: Twelve clinical trials published in English with a Jadad score of 3 or 4 (out of 5) were included in the final review. These studies used four approaches to deliver peer-support interventions: face-to-face, telephone-based, educational videos, and group discussion. The results showed that peer-support could have a positive effect on depression, anxiety, quality of life, sexual performance, self-care, and medication adherence.
Conclusion: Considering the serious impacts of MI on life, these patients need empowerment training. Peer-support can be used as a complementary supportive method to reduce MI patients' psychological complications and improve their behavioral outcomes.

1. Introduction

Nowadays, cardiovascular diseases (CVDs) account for important causes of global disease burden and death due to non-communicable diseases [1]. Although reperfusion interventions reduce myocardial infarction (MI)-related mortality [2], this condition is still a life-threatening disease globally and the most common cause of CVD-related death [3]. Myocardial infarction can ensue with acute physical complications such as ventricular tachycardia, ventricular fibrillation, pericarditis, left ventricular wall thrombosis, infarction recurrence, cardiac shock, and death [4]. Cardiac damage, independent of the cause, not only leads to physical disabilities but also affects the patient's psychological and social health, and MI is no exception to this rule [5]. Regarding the fact that the impacts of MI complications extend to all aspects of patients' lives, these patients experience a deterioration of quality of life (QoL) and high levels of anxiety, depression, fatigue, sleep disorders, stress, and helplessness [6]. More than 40 % of MI patients may present with the symptoms of depression and anxiety from the first week to up to one year after a heart attack, with the time of onset of these events varying among individuals [7]. Furthermore, psychological complications, such as anxiety, depression, and anger, also affect the outcomes of cardiovascular events following MI, restricting patients' daily activities, job performance, and social relationships [8]. Depression symptoms affect the self-care behaviors of patients during the first month post-MI [9]. Overall, MI considerably affects the individual's health dimensions, including clinical (e.g., pain, symptoms, etc.) and functional (physical and psychosocial functioning, self-care abilities) outcomes [10].

The self-care behaviors of MI patients are influenced by their physical restrictions and complications, as well as psychological

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problems (such as depression), leveraging their chance of re-hospitalization [7]. Also, uncontrolled or unsuccessful manipulation of stressful and challenging events lowers these patients' self-efficacy [11]. Therefore, effective behavioral interventions seem necessary to manage and boost the health of MI patients, and peer-education is one of the key approaches in this area [12]. Peer-support involves people with lived experiences of dealing with a particular situation, so they can help others manage the same circumstance [13]. Prior studies have specified that peer-support can be an effective health management strategy [10,13] in patients with different types of diseases, such as asthma [14], diabetes [15], cancer [16], depression [17], and cerebral infarction [18]. Evidence also indicates that peer-support interventions delivered via different strategies have been highly effective in managing the health outcomes of MI patients [8,10,19,20]. According to our literature review in authentic scientific databases, we found no systematic review of various strategies to deliver peer-support interventions and the beneficial role of peer-support interventions in managing MI outcomes. So, it seems necessary to conduct a systematic review in this area to explore various types of peer-support interventions and their impacts on the health consequences of MI patients before this strategy can be universally accepted as an official and evidence-based practice. The aim of this study was to review different types of peer-support interventions and divulge their impacts on the health outcomes of MI patients.
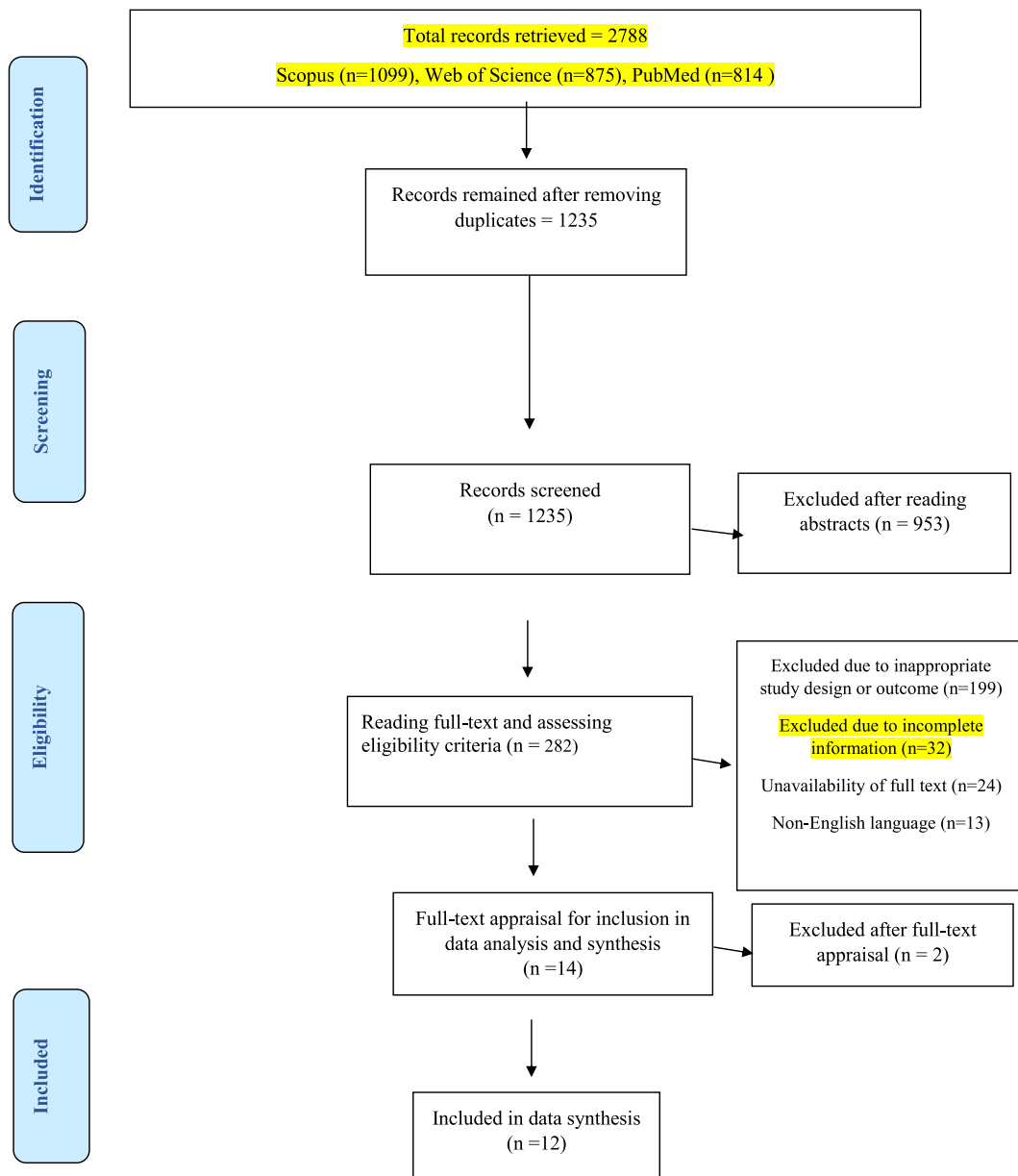

Fig. 1. PRISMA flow diagram.

2. Methods

2.1. Study design

This systematic review was conducted based on the PRISMA guideline [21]. The PROSPERO database and the Cochrane Library were searched to find previous systematic reviews in this field if any.

2.2. Key questions

Consistent with the PICO (i.e., Patient, Intervention, Comparison, and Outcome), this study aimed to assess the health outcomes of peer-support interventions in MI patients.

2.3. Search strategy

A systematic literature search based on the research question was conducted in the electronic databases of Web of Science, PubMed, and Scopus to gather publications up to March 2023. The databases were searched using a combination of the keywords of 'myocardial infarction', 'peer education', and 'peer support'. We used the following search syntax in PubMed: (((((((cardiac surgery) OR (Acute Coronary Syndrome)) OR (Myocardial Infarction)) OR (percutaneous coronary)) OR (Coronary Angiography)) OR (CABG))) OR (coronary artery bypass graft surgery)) AND (((((((((peer-led intervention)) OR (peer consulting)) OR (peer)) OR (peer support)) OR (peer education)) OR (peer approaches)) OR (Peer Group-Based))). This search strategy was developed with the help of a health information librarian. To further expand the scope of the search process, a manual search was conducted inside the references of the eligible studies retrieved. We also looked into gray literature sources, including policy documents, clinical guidelines, and cross-references from bibliographies.

2.4. Inclusion and exclusion criteria

Inclusion criteria were (1) English language, (2) being an interventional study (i.e., RCT), (3) assessing the impacts of peer-education interventions, and (4) enrolment of MI patients. Letters to the editor, brief reports, conference papers, qualitative studies, reviews, and studies without a control group were excluded from the review.

2.5. Study Selection

Every step of the systematic review process, including title/abstract and full-text screening, was performed independently by two of the authors. In the case of disagreements, discussions were held with the participation of a third author to resolve differences and reach a consensus regarding the eligibility of a study (Fig. 1).

2.6. Methodological quality appraisal

The quality of studies in terms of the appropriateness of the research process and structure was checked using the Enhancing the Quality and Transparency of Health Research Network (EQUATOR) tool [22]. For the quality assessment of the RCTs included in this systematic review, we used the Jadad scale. This scale includes three items that evaluate randomization, the double-blinding process, and responsiveness (dropouts and withdrawals). The range of the Jadad score is from 0 to 5, where a score of <3 identifies low-quality studies, while a score of 5 reflects the highest quality [23]. Also, Hawker et al.'s criteria were used to assess the studies in terms of structure, objectives, methods, processes, conclusions, and references [24]. Finally, the authors held group discussions to decide regarding the inclusion or exclusion of the studies based on the scores obtained during quality appraisal.

2.7. Data extraction and analysis

A data extraction tool was prepared by the authors to draw the information required, including the last name(s) of the first author (s), year of publication, location and type of the study, type of the intervention, the study's objectives, the target population, sample size, and the data related to the effects of peer-education on the health outcomes of MI patients. Due to distinct differences between the selected studies in terms of objectives, outcomes, and methods, we were unable to pool their results via quantitative synthesis and meta-analysis, so we reported our findings in a narrative manner.

3. Results

3.1. Search outcomes

A total of 2788 articles were retrieved by searching the selected electronic databases using the keywords mentioned, including 814 studies from PubMed, 875 from Web of Science, and 1099 from Scopus. After removing duplicates and screening titles, abstracts, and full texts, 12 studies were finally retained and further assessed in the present systematic review (Fig. 1). The evaluators appraised the

Table 1
Characteristics of the studies included.

Authors, Publication year, Country	Design	Participants, sample size, age (years)	Model of the peer-support intervention	Outcome measurement tool	Follow-up duration	Post-intervention findings	Jadad score
Abbasi et al., 2020, Iran [25]	RCT	MI, 70, 30–60 y	One-on-one face-to-face	SQOL	4 w	Peer-support significantly improved sexual quality of life (P = 0.009 for men and P = 0.016 for women) at 1-month compared to the control group.	3
Varaei et al., 2017, Iran [27]	RCT	CABG, 60, 40–70 y	One-on-one face-to-face	CSE	5 d, 3 y	Peer-group support significantly increased cardiac self-efficacy (P= <0.001 at 5 d and P= <0.038 at 3 y) compared to the control group.	3
Varaei et al., 2016, Iran [26]	RCT	CABG, 60, 40–70 y	One-on-one face-to-face	(a) CSE (b) RR	5 d, 4 w, 8 months	(a) Peer-support significantly increased cardiac self-efficacy (P= <0.001 at 5 d, 4 w, and 8 m) (b) and decreased the rate of readmissions (p = 0·011 at 8 m) compared to the control group	3
Habibzadeh et al., 2018, Iran [28]	RCT	Coronary angiography, 120, 35–80 y	Group face-to-face, Combined peer-and-video intervention group	STAI	30 min before surgery	Intervention groups showed a significant reduction in anxiety (p= <0.01) immediately after the intervention compared to the control group; no significant difference in anxiety level was noticed regarding the type of the intervention used.	4
Dehghan et al., 2020, Iran [29]	RCT	Coronary angiography, 60, 30–70 y	Group face-to-face	(a) DASS-21 (b) TCSPL	After the training, immediately before catheterization	(a) Peer-support significantly reduced anxiety (p= < 0.05), but no significant differences in depression and stress were observed after the intervention compared to the control group. No significant differences were observed regarding (b).	3
Parent et al., 2000, Canada [20]	RCT	CABG, 70, 40–69 y	One-on-one face-to-face	(a) STAI (b) JSEES (c) JAC	4 d, 5 w	(a) Peer-support significantly reduced anxiety (P < 0.05 at 4 d and 5w) (b) and increased cardiac self-efficacy (P = 0.001 at 4 d and P = 0.015 at 5w) compared to the control group. (c) Peer-support group showed a significant increase in self-reported efficacy (P = 0.000 at 4 d and P = 0.015 at 5 w) compared to the control group.	3
Esmaeili et al., 2015, Iran [31]	RCT	CABG, 100, 40–80 y	One-on-one face-to-face	STAI	1 h before the surgery	Peer-support group significantly reduced anxiety (P = 0.0001) compared to the control group.	3
Nematian Jelodar et al., 2015, Iran [30]	RCT	CABG, 100, 40–80 y	One-on-one face-to-face	DASS-21	One hour before the surgery	Peer-support significantly reduced stress (P < 0.001) compared to the control group.	3
Parry et al., 2009, Canada [33]	pilot RCT	CABG, 95, 61–77 y	One-on-one telephone	(a) QOL (b) MPQ	9 w	(a) Peer support non-significantly improved physical functioning (physical component score) (t [89] = –1.6; P = 0.12) and role functioning (t [93] = –1.9; P = 0.06). (b) Peer group members declared milder pain (t [93] = 1.30; P = 0.20) compared to the control group.	3

Table 1 (*continued*)

Authors, Publication year, Country	Design	Participants, sample size, age (years)	Model of the peer-support intervention	Outcome measurement tool	Follow-up duration	Post-intervention findings	Jadad score
Golaghaie et al., 2019, Iran [32]	RCT	CABG, 70, 40–80 y	One-on-one face-to-face	AMLC	1 and 2 months	Peer-support significantly increased total adherence (P = 0.002 at 1 m and 2 m) compared to the control group.	3
Ebrahimi et al., 2019, Iran [8]	RCT	MI, 70, 30–60 y	One-on-one face-to-face	(a) QOL (b) SCB	4 w	(a) Peer-support significantly increased the quality of life (P = 0.0001 at 4w) and (b) self-care behaviors (P = 0.003 at 4w) compared to the control group.	3
Colella, 2018, Canada [34]	RCT	CABG, 185, ≥35 y	One-on-one telephone	(a) BDI (b) SSS (c) HSU	Discharge, 4 and 12 w	(a) Peer-support significantly reduced depression (P = 0.05 at discharge and P = 0.08 4w) compared to the control group. (b) No significant difference was noticed. (c) Peer-support group significantly reduced health services utilization (family physician; P = 0.02, and emergency room; P = 0.04) at 12w after the intervention compared to the control group.	3

Note: RCT: Randomized controlled trials, MI: Myocardial infarction, CABG: Coronary Artery Bypass Graft, SQOL: Sexual Quality of Life, CSE: Cardiac Self-Efficacy, STAI: State-Trait Anxiety Inventory, BDI: Beck Depression Inventory, SSS: Social Support Scale, QOL: Quality of life (SF-36v2), MPQ: McGill Pain Questionnaire, DASS-21: Depression, Anxiety, Stress Scale-21, JSEES: Jenkins Self-Efficacy Expectation Scales, JAC: Jenkins Activity Checklists, TCSPL: Tolerance Comfort Satisfaction Pain levels HSU: Health Services Utilization, SCB: Self-care Behaviors, RR: Readmissions Rate, AMLCA: Adherence to Medication and Lifestyle Changes, W: Week, Y: Year, D: Day, P: P-value.

quality of all the selected studies in terms of methodology. Gray literature and the reference lists of the selected studies were also looked up to identify additional possibly related studies.

3.2. General characteristics of studies

The 12 studies finally included in this review had been conducted on 1060 MI patients. Nine out of the 12 finally included studies were from Iran [8,25–32], and three were from Canada [20,33,34]. The total sample size in these studies ranged from 60 to 185, and four out of twelve studies had a sample size equal to or greater than 100. The ages of the participants ranged from 30 to 80 years (Table 1).

Table 2
Quality analysis of the included studies based on the Jadad quality scale.

Authors	Was the study randomized?	Was the method of randomization described and appropriate?	Was the study double-blind?	Was the blinding method described, and appropriate?	Was there a description of withdrawals and dropouts?	Total
Abbasi et al., 2018 [25]	1	1	0	0	1	3
Varaei et al., 2016 [27]	1	1	0	0	1	3
Varaei et al., 2017 [26]	1	1	0	0	1	3
Habibzadeh et al., 2018 [28]	1	1	0	1	1	4
Dehghan et al., 2020 [29]	1	1	0	0	1	3
Parent et al., 2000 [20]	1	1	0	0	1	3
Esmaeili et al., 2015 [31]	1	1	0	0	1	3
Mohammadpourhodki, 2018 [35]	1	0	0	0	1	2
Mohammadpourhodki, 2019 [19]	1	0	0	0	1	2
Nematian Jelodar et al., 2015 [30]	1	1	0	0	1	3
Parry et al., 2009 [33]	1	1	0	0	1	3
Ebrahimi et al., 2019 [8]	1	1	0	0	1	3
Colella, 2018 [34]	1	1	0	0	1	3
Golaghaie et al., 2019 [32]	1	1	0	0	1	3

3.3. Quality appraisal

The language of all studies was English, and all were RCTs whose quality was assessed using the Jadad scale with a score range of 3–5 (Table 2).

3.4. Types of peer-support interventions

In all studies, a trained peer provided peer-education to the participants in the intervention group. The members of the control group received routine care in all studies. There was no report on the content of the educational program in some of the studies; however, most of them used a standard evidence-based program tailored to the needs of MI patients, addressing the key components of pharmaceutical therapy, physical activity, dietary regimens, stress management, follow-up care, and symptom management (dyspnea, fatigue, and chest pain). The number of participants in the intervention group varied in different studies. The most popular peer-support model was one-on-one face-to-face education [8,20,25–27,30–32], and only one study employed group-based face-to-face peer education [29]. Two of the studies conducted peer education via telephone [33,34]. In one study, a group-based combinational model of peer support was employed by displaying educational videos [28]. The frequency of contact between peers and patients differed in various studies from unknown [25] to once [29,31], twice [8,26,27], thrice [20], six weeks [34], and eight weeks [33], depending on the length and type of the intervention (Table 3).

3.5. Major outcomes of the intervention

A wide spectrum of health behavioral and psychological outcomes were reported, among which anxiety [20,28,29,31] and self-efficacy [20,26,27] were the most prominent outcomes reported. In some studies [20,26,27], the comparison of the peer-support group with the control group showed a significant increase in the cardiac self-efficacy score (P-values of <0.01, <0.001, and <0.038, respectively(. In another study [32], peer-support significantly increased overall adherence compared to the control group (P-value = 0.002). In studies by Parent et al. [20] and Ebrahimi et al. [8], peer-support was reported to significantly boost self-reported activities and self-care (P-values of 0.015 and 0.003, respectively). In the studies reviewed, health behavioral outcomes such as rehospitalization [27] and the use of health services [34] revealed statistically significant differences between the control and intervention groups (P-values of 0·011 and 0.02, respectively). Among the most common psychological/social health outcomes assessed in these studies were depression, anxiety, stress, life quality, sexual life quality, and social support. In a study [34], peer-support significantly decreased depression compared to the control group. In other studies [20,28,29,31], peer-support was noted to significantly decrease anxiety score (P-values of <0.05, <0.01, <0.05, and 0.0001, respectively). Also, investigating the effects of peer education on the outcomes of MI patients showed that this intervention positively influenced patients' quality of life (P-value = 0.0001) [8] and sexual life quality (P-value <0.05) [25]. On the other hand, some of the studies reviewed reported that peer education had no considerable effect on depression [29], stress [29], social support [34], tolerance [29], relaxation [29], satisfaction [29], and pain perception [29] (Table 3).

4. Discussion

In this systematic review, where 12 randomized clinical trials were scrutinized, we identified three different models for delivering peer education to MI patients, including one-on-one face-to-face, one-on-one telephone-based, and group-based face-to-face strategies. The goal of the present systematic review was to characterize and appraise various types of peer-support interventions and investigate their effects on the health outcomes of MI patients. Similar to previous studies assessing the impact of peer-support interventions on the health outcomes of the patients experiencing cardiac events [9,10], our results were somehow inconclusive as well. The results of the present study suggested that peer-support interventions could improve physiological, psychological, and behavioral health outcomes in MI patients. Overall, peer-support interventions, as inexpensive and flexible educational strategies, seem to be well-accepted by patients experiencing cardiac events [8,31]. Nevertheless, most of the studies reviewed did not explicitly and completely report their protocols or specify if they used a standard design and framework. Standardization is necessary so that researchers and caregivers can correctly understand these interventions, perceive their value, and employ them for managing MI patients. None of the studies investigated conducted a comparison of the effectiveness of different types of peer support interventions. Overall, these studies indicated that, regardless of the manner of peer-support provision, communication with peers and sharing similar experiences help MI patients cope with the physical, social, and emotional consequences of their disease.

The results of the studies reviewed showed that peer-support interventions could improve the quality of life, self-care, self-efficacy,

Table 3
Classification of the outcomes of myocardial infarction in survivors Participating in a peer-support program.

	Outcomes	Studies
Health behavioral outcomes	Self-reported activity, Adherence to medication, Self-care behaviors	[8,20,32]
Psychological and psychosocial	Sexual quality, Anxiety, Depression, Stress, Quality of life, Pain	[20,25,28–31,33,34]
Self-efficacy and empowerment	Cardiac self-efficacy	[20,26,27]
Health services utilization	Health services use, Readmission	[26,34]

and sexual life quality in MI patients. In these studies, peers educated patients on the necessity of stress management, being physically active, adherence to medications, and giving priority to marital relationships. The shared experiences and a sense of comfort and intimacy between peers and patients allow patients to vocalize their concerns and receive solutions in plain language, strengthening the psychological and social aspects of patients' quality of life. Therefore, peer-support not only provides patients with useful information in terms of a healthy lifestyle and daily life problem-solving tips but also helps them achieve self-efficacy for accomplishing such activities [18], which ultimately can improve their self-care and life quality. Similarly, a review conducted by Haines et al. (2018) indicated that peer-support interventions could reduce psychological morbidities and increase social support in patients requiring critical care [36]. Wu et al. (2012) mentioned that peer-support did not significantly improve self-efficacy and self-care in patients with heart disease [37]. For peer-based interventions to be effective, it is essential to appropriately design the program. Walker and Avis (1999) denoted various reasons for the failure of peer-based interventions, such as the inadequate training of peer educators, as well as the lack of clarity around boundary and control issues [38].

Overall, the results of most of the studies investigated suggested that peer-support interventions could also improve depression, anxiety, and stress in MI patients. For explanation, it can be noted that peer-support programs are based on the lived experiences of peers, providing the opportunity to nurture a sense of closeness and empathy between patients and peers, encouraging patients to accept their peers' advice. Therefore, this method can help manage the symptoms of stress, anxiety, and depression in patients with cardiac disorders. The effectiveness of such interventions in alleviating psychological symptoms can further be explained by the conceptual framework of peer-support. In fact, one of the deterministic features of peer support is emotional empowerment, which can help individuals boost or recover their self-esteem, which subsequently mitigates mood disorders [18]. However, a study reported that a 45-min peer-support group session held prior to coronary angiography led to no desirable effects on stress, depression, relaxation, satisfaction, and pain [29]. Some key differences between these studies, such as variabilities in peer-support models, the duration of peer-education, and the duration of follow-up, may justify the discrepancies between their results. In one study, where peer-support could improve depression symptoms, the intervention was delivered one-on-one via telephone for six weeks [34]. More research is required to ascertain the optimal mode of delivering peer-support. In an RCT investigating the effectiveness of a face-to-face phone-based support model, no significant change was observed in perceived social support. Overall, since such models of peer-support are commonplace in society, well-designed studies with long follow-up durations are needed to confirm their impact on health outcomes. In a review, peer mentoring was introduced as the best method to achieve the desired health outcomes [36]. Overall, peer-support models delivered in a group-based face-to-face manner for a reasonable period of time seem to be more effective in augmenting perceived social support.

Patients' psychological readiness, adaptation, and motivation to receive peer-support were assessed in none of the RCTs reviewed. Psychological problems or unwillingness to receive peer-support adversely affect health outcomes while the patient's eagerness and feeling of need for support can have a positive effect on the desired outcomes [39]. The studies included in this review did not consider these parameters, so more studies are needed to address this issue.

This study followed a systematic, explicit, and detailed approach to describe the RCTs enrolled. In these studies, various types of peer-support interventions were employed to improve the health outcomes of MI patients. During quality appraisal, we precisely assessed the quality of each study using validated tools and comprehensively explored various types of peer-support methods employed by the studies, as well as their health consequences. Similar to other studies, this systematic review also embraced some limitations.

In this review, 9 of 12 selected RCTs had been conducted in Iran. It should be noted that accessibility to some databases is limited in Iran; nevertheless, we tried to conduct a comprehensive search to cover all authenticated databases. In addition, some studies were excluded in the quality appraisal step and based on the entry and exit criteria. Considering that 9 out of 12 finally selected articles were conducted in Iran, it seems that this topic is particularly important in our country, which may be due to a shortage of human resources in Iran's health system, overshadowing patient education. This is because a limited number of manpower cannot spend enough time training patients. So, researchers are always looking for cost-effective solutions that do not require costly measures (such as employing new staff) but can resolve concerns over patient education. Accordingly, the structure of Iran's health system and the economic shortcomings entangling this system mandate devising such effective strategies. Also, although the PRISMA guideline was followed, the protocol of the study was not registered in the PROSPERO database. None of the studies reviewed compared the effectiveness of different types of peer-support strategies (i.e., face-to-face, telephone-based, group-based), and regarding the high methodological and instrumental heterogeneity among the studies, it was not applicable to conduct a meta-analysis. Only papers published in English were included, leading to the exclusion of some possibly qualified studies in other languages. Despite these limitations, this systematic review precisely and strictly scrutinized the findings of the selected studies and provided a comprehensive view on the current knowledge about peer-support and its effects on the health outcomes of MI patients.

5. Conclusion

Peer-support can upgrade health behaviors and reduce psychosocial complications in MI patients. The most popular way of delivering peer-support was through a one-on-one face-to-face approach; however, due to the need for prolonged support and communication, one-on-one telephone-based strategies can also offer favorable results. Special attention should be paid to the standardization of peer-support interventions in terms of the peer-to-patient ratio, training content, training duration, and the presentation method. Based on the findings of the present systematic review, it is suggested to conduct more interventional studies to investigate and compare the effectiveness of mixed methods of delivering peer-support, especially in MI patients. The studies included in this systematic review were only from two countries (i.e., Canada and Iran), so it is advisable to conduct similar studies in other countries as

well. Finally, in parallel with quantitative experiments, it is recommended to conduct qualitative studies in this area to more deeply divulge the experiences of patients and peers.

Practical implications

Peer-support can provide a viable strategy to deliver the training required to patients with MI. Our findings suggest that peer-education through meetings yields desirable improvements in the physiological, psychological, and behavioral health outcomes of MI patients. There is a need for more appropriately designed studies to precisely divulge the effects of such interventions.

Data availability statement

Data will be made available on request.

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CRediT authorship contribution statement

Abbas Heydari: Writing – review & editing, Writing – original draft, Validation, Supervision, Resources, Project administration, Methodology, Investigation, Data curation, Conceptualization. **Zahra-Sadat Manzari:** Writing – review & editing, Writing – original draft, Visualization, Validation, Resources, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Reza Mohammadpourhodki:** Writing – review & editing, Writing – original draft, Validation, Resources, Project administration, Methodology, Investigation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.heliyon.2024.e25314.

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