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REVIEW

Interventions that improve health-related quality of life in patients with myocardial infarction

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Abstract

Purpose Patients with myocardial infarction (MI) often report lower health-related quality of life (HRQoL) than those without MI. Interventions can affect HRQoL of these patients. The purpose of this review was to identify effective strategies for improving HRQoL among individuals with MI.

Methods Three electronic databases were searched and limited to articles peer-reviewed and published in English between 1995 and 2015. We screened titles and abstracts of the retrieved articles for studies that examined effectiveness of interventions to improve HRQoL in patients with MI.

Results Twenty-three studies were found that examined the effects of behavioural interventions—cardiac rehabilitation programmes (CRP), education and counselling programmes, and other psychological and cognitive interventions—to improve HRQoL in patients with MI. The studies included were mainly randomised controlled trials (14 studies) with a wide age range of participants (18–80 years) and a mean age group of 50–70 years. CRPs, including home- and hospital-based CRPs, regular weekly aerobic training programmes, and group counselling mostly resulted in improvement of HRQoL in patients with MI.

Conclusion Most CRPs and other interventions were beneficial to MI patients. Therefore, patients with MI should be encouraged to participate in programmes that can help promote their HRQoL.

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Introduction

Cardiovascular disease (CVD) is the leading cause of death globally [1]; mortality from heart disease increased worldwide between 2000 and 2012 [2]. In particular, myocardial infarction (MI) is a life-threatening event caused by a complete blockage in a blood vessel that supplies blood, oxygen, and nutrients to the heart muscle [3]. The survival of patients with MI has remarkably improved as the result of timely use of thrombolysis and primary percutaneous coronary intervention (PCI) that help restore the flow of the culprit vessels [4]. Yet, these patients frequently experience negative physiological effects such as depression and uncertainty as well as other adverse effects such as a disrupted daily life associated with persistent and/or reoccurring disease symptoms [5]. As a result of MI, patients often report reduced health-related quality of life (HRQoL), which is increasingly recognised as a critical outcome measure in health care [6].

HRQoL is a multidimensional concept that encompasses self-reported measures of physical and mental health [7]. The American Heart Association recommends assessment of HRQoL as an integral part of patient-reported health status assessment in patients with cardiovascular disease [8]. HRQoL has been found to be an independent predictor of death and future cardiac events in patients with MI [5]. In the acute phase of MI, the focus is often placed on physical health; however, after discharge from hospital or considering the long-term effects, HRQoL becomes a significant factor reflecting the impact of the disease on diverse aspects of the patient's life [5]. Patients with MI

and their health care providers often discuss HRQoL to develop a shared view of the disease and treatment outcomes [5, 9]. Some studies [10, 11] suggest HRQoL as an indicator of therapeutic response. This understanding is important to help optimise the management of MI and assist patients to return to a normal active life and to obtain required lifestyle changes.

Health professionals are in a unique position to intervene and support patients as they recover from MI. While medical interventions, thrombolytic therapy, and coronary angioplasty have important roles in survival of patients with MI [12], interventions that improve patients' recovery after discharge also need to be developed and used to help promote patients' overall health status, wellbeing and quality of life (QoL). Currently, there is no comprehensive literature review to examine the evidence on QoL interventions for patients with MI. This study aims to review the effectiveness of behavioural interventions to improve the HRQoL of patients with MI.

Methods

Literature Search

Relevant studies were identified by searching the electronic databases including MEDLINE, CINAHL, and PsycINFO. Key search terms included: health-related quality of life/ quality of life/HRQoL/QoL and myocardial infarction/heart attack/MI. At the stage of screening, only studies that focused on behavioural interventions were included. Search was limited to English-language and peer-reviewed articles published from 1995 to October 2015. Management of patients with MI has significantly improved over the last couple of decades. Thus, the search was limited to the last 20 years to ensure that the interventions were still relevant.

Study Selection

A total of 2523 articles were found from the search, and 1996 were retained after duplicates were removed. Firstly, 1996 articles were screened by titles and abstracts if they reported original data on HRQoL in patients exclusively with MI. 1879 studies were excluded due to irrelevant study subjects, irrelevant dependent variables, and validation studies of measurements. Scientific letters or posters were also excluded, as well as studies of applied qualitative methods were excluded. Articles for which full texts were not available were also excluded. Table 1 describes the inclusion and exclusion criteria of the study. Following the screening of the titles and abstracts, 116 potential articles were selected for further screening. A hand search of the

reference lists of relevant published articles was done and resulted in 16 additional articles. Among 132 studies screened by full texts, 109 studies were excluded due to non-interventional studies or studies on medical procedures such as PCI. Finally, 23 studies on HRQoL of MI patients combined with the effects of a particular intervention were included in the present review (Fig. 1).

Results

Participants and setting

Table 2 summarises the characteristics of each study included in the review. Out of 23 articles, 9 studies were conducted in Europe (the UK, Norway, and the Netherlands, 2 studies each, and Finland, Italy, and Ireland, 1 study each). The remaining studies were carried out in North and South America (2 studies in Brazil, and 1 study in the US), Asia (3 studies in Japan, 2 studies in Iran, and 1 study each in Hong Kong, South Korea, Turkey, and China), and Australia (2 studies). The included studies were mainly randomised controlled trials (RCT; 14 studies), followed by prospective studies. Two of the reviewed studies also considered cost-effectiveness as an outcome measure [13, 14], and one study analysed the cost-effectiveness of the programme in an additional separate article [15]. The reviewed studies included a wide age range of participants (18–80 years), with a mean age group of 50–70 years. More male participants were recruited in most of the studies, and one study targeted male patients exclusively [16]. The reviewed studies recruited between 46 and 2481 participants.

Assessment of HRQoL

A number of QoL measures were used to assess HRQoL in the reviewed studies. These included the Medical Outcomes Study 36-Item Short-Form Health Survey (SF-36), the Sickness Impact Profile (SIP), EuroQol-5D (EQ-5D), the World Health Organization Quality of Life Questionnaire Brief Version (WHOQOL-BREF), the 8-item Life Satisfaction Scale (LSS), a 1–10 ladder technique (Ladder of Life, LOL), the Time Trade-off instrument, and Quality of life, which is a short 10-item visual analogue scale [17], as a generic measurement. SF-36 was one of the most widely used generic tools to measure HRQoL in this patient population [18], used in 11 reviewed studies conducted by Hanssen et al. [19, 20], Hawkes et al. [15], Izawa, Hirano, et al. [21], Izawa, Yamada, et al. [22], Mendes de Leon et al. [23], Uysal and Özcan [24], Wang et al. [18], West et al. [25], Yonezawa et al. [26], Yu et al. [14]. It was a global QoL tool addressing eight domains,

Table 1 Inclusion/exclusion criteria

Inclusion criteria	Exclusion criteria
Subjects exclusively with MI	Scientific letters or posters
English language	Articles for which full texts were not available
Peer-reviewed	Validation studies of measurements
	Qualitative studies
	Studies about medical interventions

including physical functioning, role-physical, bodily pain, general health, vitality, social functioning, role-emotional, and mental health, which were also classified with two psychometrical dimensions—physical component summary (PCS) and mental component summary (MCS) [15]. The measurement was scored from 0 to 100 with lower scores indicating lower HRQoL and higher scores representing better HRQoL [22].

Other studies used disease-specific tools, such as the MacNew Heart Disease HRQoL Instrument (MacNew), the Myocardial Infarction Dimensional Assessment Scale (MIDAS), or the Quality of Life Index (QLI)–Cardiac Version III. Among these specific tools, the MacNew questionnaire was the most commonly used tool to assess HRQoL. MacNew was an improved version of Quality of Life after Myocardial Infarction (QLMI) Questionnaire, consisting of 27 items including physical, emotional, social function domains and five items about symptoms. Each item was scored within a range of 1–7, with higher total scores indicating better HRQoL [27]. In three retrieved studies [18, 24, 28], researchers used both generic and disease-specific QoL instruments.

Interventions to improve the HRQoL of patients with MI

Twenty-three studies were found that examined the effects of behavioural interventions—cardiac rehabilitation programmes (CRP), education and counselling programmes, and other psychological and cognitive interventions—to improve HRQoL in patients with MI. Heterogeneity of the interventions was observed across the reviewed studies; as the result, the studies were grouped and discussed according to the type of intervention. The assessment points of HRQoL of MI patients were mostly comparison between the intervention group and the control group by asking with various patient-reported QoL questionnaires as well as dimensions of HRQoL that were improved after the interventions.
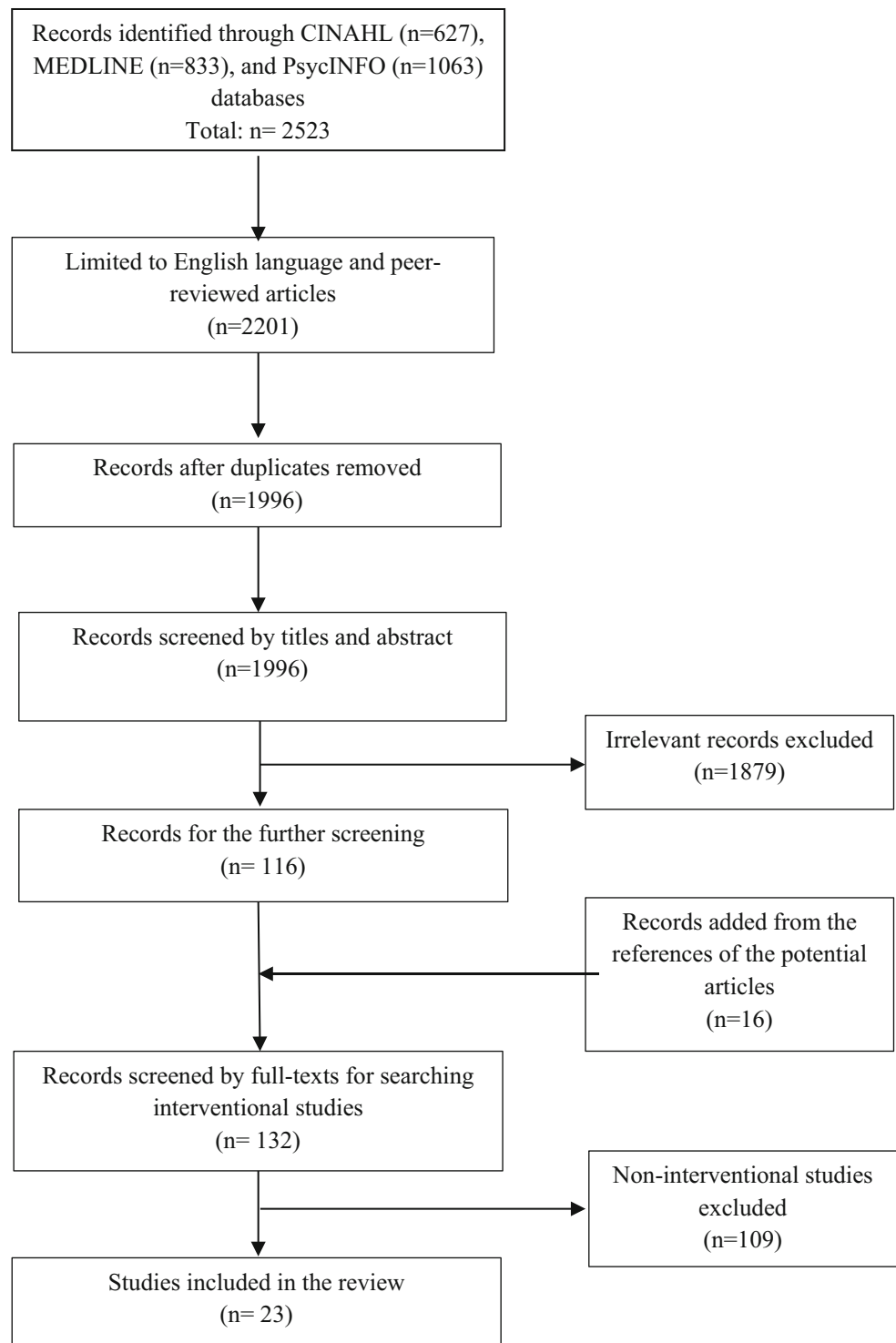
Cardiac rehabilitation programmes

Cardiac rehabilitation programme (CRP) is a comprehensive intervention for improvement of HRQoL in patients who have heart disease. Among the studies reviewed, 11 studies applied CRP, including exercise, education or counselling and monitoring by health professionals, and two studies applied exercise programmes only.

In the present study, CRPs have shown promising results on HRQoL scores of patients with MI. Yu et al. [14] examined the effects of a cardiac rehabilitation and prevention programme on HRQoL of patients with MI, within an age range of 53–75 years. In this RCT, the control group was given standard care without an exercise component. Compared to the control group, participants in the intervention group had significantly higher HRQoL in four domains at the phase 3, and in five domains: the same four domains at the phase 3 plus vitality, at the 2-year follow-up ($p < 0.005$). The control group reported increased physical pain and no improvement in any of the HRQoL dimensions by phase 2. Only four dimensions of SF-36 were slightly improved at the end of the study period [14].

A supervised exercise-based CRP at the hospital seemed to better improve the QoL of MI patients compared to a home-based unsupervised exercise programme. For example, researchers from Korea compared the effectiveness of a supervised exercise-based CRP with a self-administered home-based exercise programme. The study found that patients in the supervised exercise-based group showed greater improvements in overall QoL scores after 8 weeks ($p < 0.0001$) compared to the home-based comparison group [29]. These findings imply that the social support and formal structure offered by the supervised programme played an important role in improving QoL.

Findings of a recent study, conducted by Peixoto et al. [30], were also in line with past studies. A significant improvement was observed particularly in the physical and emotional domains in the intervention group, which underwent a 1-month exercise-based CRP ($p < 0.001$), compared with the control group [30]. Moreover, other 3-month follow-up studies [21, 28] reported positive results in promoting HRQoL among MI patients. In one of these two studies, Japanese participants who completed a CRP had superior HRQoL in four of the eight subscales of the SF-36 ($p = 0.000$, $p = 0.03$) to the control group [21]. In the other study, Iranian patients also scored higher in the physical domain of the MacNew ($p < 0.05$) and the WHOQOL ($p < 0.05$) after completing a 40-session

Fig. 1 A process of article selection

Records identified through CINAHL (n=627),
MEDLINE (n=833), and PsycINFO (n=1063)
databases
Total: n= 2523

↓

Limited to English language and peer-
reviewed articles
(n=2201)

↓

Records after duplicates removed
(n=1996)

↓

Records screened by titles and abstract
(n=1996)

→ Irrelevant records excluded
(n=1879)

↓

Records for the further screening
(n= 116)

← Records added from the
references of the potential
articles
(n=16)

↓

Records screened by full-texts for searching
interventional studies
(n= 132)

→ Non-interventional studies
excluded
(n=109)

↓

Studies included in the review
(n= 23)

hospital-based CRP than participants who did not partici-
pate in the programme [28].

In Marchionni's study, participants who attended either
a hospital- or home-based CRP for 8 weeks showed better
HRQoL than those who did not participate in any of the
programmes. Although both interventions were similarly
effective in a range of $p < 0.001$ to $p < 0.01$, the home-

based intervention was more cost-effective than the hos-
pital-based CRP [13]. Likewise, a 6-week home-based
CRP using a self-help manual, which contained informa-
tion about Tai Chi, Qi Gong and Chinese diet, was effec-
tive in improving the HRQoL of Chinese patients at
6 weeks and 6 months post-MI ($p < 0.05$) compared to the
control group who received only instructions on taking

Table 2 Summary of the studies that examined the effectiveness of an intervention on HRQoL of patients with MI

First Author (year)/Country	Study design	Participants/male %	HRQoL Assessment	Interventions	Counter-intervention	Follow-ups	Key findings
Bagheri et al. [33]/Iran	RCT	62 patients with MI who were referred to hospitals/male = NR	MacNew	A 4-week group counselling programme (2 1-hour sessions/week)	No counselling	1 month (post-intervention)	Improved a total score in the IG ($p < 0.001$) compared to the CG
Benetti et al. [16]/Brazil	Prospective study	87 patients (57.7 ± 6.1 years old) IG I = 29, IG II = 29, CG = 29/male = 100 %	MacNew	I: a 12-week high-intensity physical training (85 % maximum heart rate) II: a 12-week moderate-intensity training (75 % maximum heart rate)	No exercise	After 12 weeks (post-intervention)	QoL improved significantly ($p < 0.05$) in the IG I (from 5.66 to 6.80) and in the IG II (from 5.38 to 6.72), compared to the CG (from 5.30 to 5.15)
Boersma et al. [34]/The Netherlands	Longitudinal study	46 outpatients excluded older than 70 years of age; CABG or angioplasty following their MI/male = NR	MacNew	The 4-month attainment of three mid-level goals shortly after discharge from hospital	None	4 months after MI (post-intervention)	Positive effects on social component of HRQoL ($p = 0.05$)
Choo et al. [29]/Korea	A quasi-experimental design study with a non-randomized, pre-test–post-test control group	60 subjects admitted for a first MI, ≤75 years/male = 81.7 %	QLI–Cardiac Version III	A 8-week supervised exercise-based CRP (3 sessions/week) at the hospital	A self-administered home-based exercise programme	8 weeks (post-intervention)	IG showed significant improvements in health/functioning ($p < 0.0001$) and psycho/spiritual ($p = 0.016$) subscales
Dugmore et al. [17]/UK	RCT	124 patients, IG = 62, CG = 62/male = 98.4 %	Quality of life—a short 10-item visual analogue scale	12-month regular weekly aerobic training programme (3 times/week)	No formal exercise	12 month (post-intervention)	Improved QoL scores. Good prognosis group: IG = 85.9 versus CG = 66.7 ($p < 0.001$)/poor prognosis group: IG = 80.8 versus CG = 59.4 ($p < 0.001$)
Hanssen et al. [19]/Norway	A prospective RCT	288 patients (IG = 156, CG = 132) and aged less than 80/male = 80.9 %	SF-36	A 6-month telephone follow-up intervention about common problems or queries and risk factor modification	One visit to a physician 6–8 weeks after discharge and subsequent visits to their general practitioner	6 months (post-intervention)	Significantly improved the HRQoL in the PCS score ($p = 0.039$) in the IG compared to the CG, but no effects on the MCS score ($p = 0.447$)

Table 2 continued

First Author (year)/Country	Study design	Participants/male %	HRQoL Assessment	Interventions	Counter-intervention	Follow-ups	Key findings
Hanssen et al. [20]/Norway	A prospective RCT	288 patients admitted to the hospital with a diagnosis of AMI, excluded CABG/male = 80.9 %	SF-36	A 6-month telephone follow-up intervention about common problems or queries and risk factor modification	One visit to a physician 6–8 weeks after discharge and subsequent visits to their general practitioner	18 months after discharge (after a year of the intervention)	No long-term effects in the overall physical domain ($p = 0.250$) and the overall mental domain ($p = 0.280$)
Hawkes et al. [15]/Australia	A parallel group, prospective RCT	430 adult MI patients/male = 74.6 %	SF-36	Telephone-delivered secondary prevention programme including ten health coaching sessions over 6 months	Usual care	6-month follow-up (post-intervention)	Significant improvement in mental component ($p = 0.02$), social functioning ($p = 0.04$, and role-emotional ($p = 0.03$) subscales
Hevey and Wilczkiewicz [35]/Ireland	Not reported	89 patients (expressive writing = 43; control = 46)/male = 76 %	MacNew	Expressive writing for 20 min per day for 3 consecutive days	Objective writing	After 3 months (post-intervention)	Higher total HRQOL ($p < 0.05$)
Izawa et al. [21]/Japan	Prospective observational study	124 AMI patients; outpatient CR group (n = 82) and a non-CR group (n = 42)/male = 77.4 %	SF-36	8-week CRP covered individual education and exercise therapy (2/week)	No CRP	3-month follow-up (after a month of the intervention)	Significant improvements in the physical functioning ($p = 0.000$), role-physical ($p = 0.000$), general health ($p = 0.03$), and vitality ($p = 0.03$) subscales
Izawa et al. [22]/Japan	Observational study	109 AMI patients (89 men, 20 women; mean age 63.5 ± 10.1 yrs)/male = 81.6 %	SF-36	A supervised 5-month recovery-phase CRP including exercise therapy based on cardiopulmonary exercise testing and muscle strength testing	No CRP, no exercise	6-month follow-up (after a month of the intervention)	Physical functioning, role-physical, bodily pain, general health, vitality, role-emotional, and mental health subscales were significantly higher in the IG compared with the CG ($p < 0.001$)
Marchionni et al. [13]/Italy	RCT	270 outpatients older than 45 years/male = 67.8 %	Italian-SIP	2-month Hosp-CR; 40 exercise sessions (3/week), 2-month Home-CR; overall 4–8 supervised exercise sessions at home.	No CRP	8-month and 14-month follow-ups (after 6 and 12 months of the intervention)	Hosp-CR and Home-CR were similarly effective. SIP total score: age 45–65 group: $p = 0.029$/age 66–75 group: $p = 0.318$/> 75 group: $p = 0.017$

Table 2 continued

First Author (year)/Country	Study design	Participants/male %	HRQoL Assessment	Interventions	Counter-intervention	Follow-ups	Key findings
Mendes de Leon et al. [23]/USA	RCT	2481 patients with AMI/1296 completed at 6 months/male = 56.3 %	SF-36, the 8-item LSS, a 1–10 ladder technique (LOL)	Psychosocial intervention included 11 individual sessions delivered over 6 months	Usual care	After 6-month (post-intervention)	Significant differences in the SF-12-MCS, the LSS, and the LOL scores, but not in the SF-12-PCS
Oranta et al. [32]/Finland	RCT	103 MI patients < 75 age/male = 70.9 %	EQ-5D	Interpersonal counselling consisting of starting (sessions 1–2), encouragement (3–4), and ending phase (5–6) (not reported about the time of the intervention)	Usual care	6 and 18 months after discharge	No significant improvement in the IG in any of dimensions compared to the CG. Only improved in patients under 60 years ($p < 0.001$ at 6 months, $p = 0.004$ at 18 months)
Peixoto et al. [30]/Brazil	RCT	88 patients ranged between 18 and 70 years of age/male = 70.5 %	MacNew	Stage 1: an educational programme to both groups Stage 2: IG—an unsupervised progressive exercise programme (4 sessions/week) for a month.	Usual care	30 days after discharge (post-intervention)	Physical ($p < 0.0001$) and emotional domains ($p < 0.001$) improved in the IG
Roncella et al. [36]/The Netherlands	RCT	94 patients admitted patients aged ≤ 70 years/male = 89.4 %	MacNew	STP including 3–10 individual sessions and 5 group sessions over 6 months	No STP	1-year follow-up (after 6 months of the intervention)	Improved physical domain ($p = 0.03$), and trended towards enhanced QoL in the social domain ($p = 0.06$) and global QoL ($p = 0.07$)
Uysal and Özcan [24]/Turkey	Controlled clinical trial	90 patients/male = 77.8 %	SF-36, MIDAS	Individual training for an hour before discharge and counselling programme in the fourth and eighth weeks following discharge	No telephone counselling and training	3-month follow-up (after a month of the intervention)	Improvement in all dimensions of MIDAS ($p = 0.000 \sim 0.04$) and SF-36 ($p = 0.000 \sim 0.02$) except bodily pain ($p = 0.15$)
Varnfield et al. [31]/Australia	RCT	60 post-MI patients recruited to each group/male = 83.5 %	EQ-5D	A 6-week smartphone-based home service delivery (CAP-CR)	A 6-week traditional centre-based CRP	After 6 weeks (post-intervention), 6 months (after 18 months of the intervention)	The median scores of HRQoL improved significantly in the IG ($p < 0.001$) at 6 weeks, but not at 6 months

Table 2 continued

First Author (year)/Country	Study design	Participants/male %	HRQoL Assessment	Interventions	Counter-intervention	Follow-ups	Key findings
Wang et al. [18]/China	RCT	133 outpatients with MI/male = 83.5 %	SF-36, Chinese MIDAS	A 6-week home-based CRP.	Usual care	3- and 6-month follow-ups (after 6 weeks and 18 months of the intervention)	Significantly improved in physical functioning ($p < 0.01$), role functioning ($p < 0.05$), vitality ($p < 0.05$), and mental health ($p < 0.05$) subscales
West et al. [25]/UK	Prospective RCT	1813 patients following AMI/male = 73.5 %	SF-36	CRP—exercise training, health education about heart, heart disease, risk factors and treatment, counselling for recovery and advice for long-term secondary prevention over 6–8 weeks	Usual care	1 year (after about 10 months of the intervention)	No significant differences between IG and CG in any of eight domains of SF-36
Yonezawa et al. [26]/Japan	Not reported	109 outpatients (57 ± 7 years) who completed a phase I CR programme after AMI/male = 82.6 %	SF-36	Phase II CRP—supervised exercise training and counselling for an hour once a week. (5 months)	No CRP	6 months after the AMI (after a month of the intervention)	The bodily pain ($p < 0.05$) and social functioning ($p < 0.05$) subscale scores improved in the IG
Yousefy et al. [28]/Iran	Experimental study	121 patients with AMI in past 6–12 months, ≥30 years old/male = 68.8 %	MacNew, WHOQOL-BREF	The hospital-based CRP consisted of 40 exercise sessions over 2–3 months (3 sessions/week)	No CRP	3-month follow-up (post-intervention)	Improved physical functioning; MacNew physical: IG = 73.10 versus CG = 59.13 ($p < 0.05$) WHOQOL physical: IG = 3.51 versus CG = 2.94 ($p < 0.05$)
Yu et al. [14]/Hong Kong	RCT	269 patients with recent AMI or after elective PCI at a CR centre/male = 76 %	SF-36	A 8-week cardiac rehabilitation and prevention programme including exercise	Standard care without exercise	8 weeks (phase 2; post-intervention), 6 months (phase 3), 2 years (phase 4)	Significant improvement in QoL; physical functioning, physical role, bodily pain, and emotional role and vitality ($p < 0.005$)

AMI acute myocardial infarction, *CABG* coronary artery bypass graft surgery, *CAP-CR* Care Assessment Platform of Cardiac Rehabilitation, *CG* control group, *CRP* cardiac rehabilitation programme, *EQ-5D* EuroQol-5D, *Home-CR* home-based cardiac rehabilitation, *Hosp-CR* hospital-based cardiac rehabilitation, *HRQoL* health-related quality of life, *IG* intervention group, *LOL* Ladder of Life, *LSS* Life Satisfaction Scale, *MacNew QLMI* MacNew Quality of Life after Myocardial Infarction Questionnaire, *MCS* mental component summary, *MI* myocardial infarction, *MIDAS* Myocardial Infarction Dimensional Assessment Scale, *NR* not reported, *PCI* percutaneous coronary intervention, *PCS* physical component summary, *PI* psychosocial intervention, *QLI* Quality of Life Index, *QoL* quality of life, *RCT* randomized, controlled trial, *SF-12* The 12-Item Short-Form Health Survey, *SF-36* Medical Outcomes Study 36-Item Short-Form Health Survey, *SIP* Sickness Impact Profile, *STP* short-term humanistic–existential psychotherapy, *WHOQOL-BREF* World Health Organization Quality of Life Questionnaire Brief Version

medications, information leaflets about cardiac risk factors, a healthy diet, and smoking cessation, and a follow-up appointment [18]. Varnfield et al. compared the effectiveness of a 6-week CRP using the smartphone-based Care Assessment Platform Cardiac Rehabilitation (CAP-CR) programme with traditional centre-based CRP. They found that patients in the CAP-CR had higher HRQoL median scores as measured by EQ-5D ($p < 0.001$). In addition, the CAP-CR group had a low dropout rate with 80 % of participants completing the programme compared to 47 % of the centre-based CRP group [31].

There were two studies that followed up participants, using the SF-36 over a 6-month period [22, 26]. In Izawa, Yamada, et al.'s study [22], the CRP group had significantly higher QoL than the control group in seven domains of the SF-36 at 6 months ($p < 0.001$); no improvement was observed in social functioning, however. In Yonezawa et al.'s study, the CRP led to significant differences only in bodily pain and social functioning (both $p < 0.05$) at 6 months [26]. Comparison of the intervention group with the control group among Japanese patients after MI revealed the contrast of the social functioning subscale between these two studies.

A regular weekly aerobic training programme, alone, to the intervention group resulted in greater improvements in HRQoL in patients after MI ($p < 0.001$) compared with the control group [17]. Changes in HRQoL scores seemed to be affected by the intensity of exercise. Benetti et al. [16] conducted a prospective case–control study and assigned patients into either a 12-week high-intensity physical training or a 12-week moderate-intensity training. Patients in both groups showed significant improvement in HRQoL from baseline ($p < 0.05$), yet the higher-intensity training resulted in slightly superior HRQoL than the moderate-intensity training and the control group [16]. However, different from the earlier mentioned studies, a study by West et al., which evaluated the long-term effects of an 8-week CRP, failed to show a significant difference between the intervention group and the control group in a 1-year follow-up [25].

Patient education and counselling

Three studies used patient education and counselling to improve HRQoL in post-MI patients [15, 19, 20]. Hawkes et al. examined the effects of a telephone-delivered secondary prevention programme over 6 months including three weekly sessions, three fortnightly sessions, and four monthly sessions. The programme significantly improved the mental component ($p = 0.02$), the social functioning ($p = 0.04$), and role-emotional ($p = 0.03$) subscales of the SF-36 [15].

To assess the long-term effects of an education and counselling intervention via telephone, Hanssen et al. [20] applied weekly phone calls for the first 4 weeks and subsequent calls at 6, 8, 12, and 24 weeks after discharge from MI. The phone follow-ups aimed to help patients solve their common problems or queries after discharge from hospital and to assist patients with their risk factor modification. The results of this RCT showed that the telephone follow-up intervention was effective in increasing HRQoL of patients at a 6-month follow-up compared to the control group [19]. However, the positive effects of the telephone follow-up intervention on HRQoL disappeared at an 18-month follow-up [20].

More recently, the effects of six-session face-to-face interpersonal counselling on HRQoL scores of MI patients were examined [32]. The intervention included a brief introduction by a trained nurse to the framework of the interpersonal counselling, strategies about role transition, and management of therapeutic gains and depressive symptoms. This study found no significant difference in mean HRQoL scores between patients who received interpersonal counselling and the control group. The interpersonal counselling, however, only had a moderate effect on HRQoL of a subgroup of patients aged less than 60 years at either follow-up point [32]. On the other hand, in the study by Uysal and Özcan [24], individual patient education plus counselling positively affected HRQoL of patients after MI. Visual materials were used to provide 1-hour individual training on healthy life after MI in the programme, which was delivered before discharge from hospital. The intervention also included two sessions of telephone counselling on cardiovascular risk-reducing strategies and addressing the patients' queries in week 14th and 18th following discharge from hospital. The study found greater improvements in HRQoL of patients who participated in the programme ($p \leq 0.000$) [24]. It is not, however, clear whether the authors had controlled for cardiac rehabilitation participation as a covariate factor. In line with other counselling interventions, group counselling has also shown promising effects on HRQoL scores. In a study, group counselling resulted in greater HRQoL scores ($p < 0.001$) at a 1-month follow-up compared to the control group [33].

Other psychological and cognitive interventions

Additional intervention programmes included goal attainment, expressive writing, psychosocial intervention, and short-term humanistic-existential psychotherapy. For example, Boersma et al. [34] assessed the effect of the attainment of three self-selected mid-level goals on HRQoL of patients with MI. These goals were related to

health promotion, social activities, and open domain for the coming year. The goal attainment intervention had a positive effect on the social dimension of HRQoL of MI patients ($p = 0.05$) [34]. Furthermore, there was a unique study, which used language as a means of intervention. Over a period of the study, the intervention group were asked to express their thoughts and feelings about their MI in writing, while the control group were asked to write objectively about their daily events, as they occurred during the year before heart attack. Patients in the expressive writing group showed superior overall HRQoL scores to the control group ($p < 0.05$). This intervention was cost-effective as it costed only for pens, paper, and envelopes, and had 68 % of response rate [35].

Psychological interventions were also applied to MI patients in the ENRICHD clinical trial [23] and the STEP-IN-AMI trial [36]. The counselling programmes are usually similar to education or questioning and answering; on the other hand, the psychosocial intervention of ENRICHD trial was composed of cognitive behavioural therapy for MI patients who had at least one previous episode of major depression, pharmacotherapy for patients with severe depression, and training of strategies to help with social skill deficits and automatic thoughts or self-talk. The study found significant differences in the mental components of the SF-36 between the intervention group and the control group (2.2; 95 % confidence interval 1.2–3.2); however, no differences were found in the physical components (0.8; 95 % confidence interval −0.5 to 2.0) [23]. In consistent with the above study, a short-term humanistic-existential psychotherapy (STP) used in the STEP-IN-AMI trial enhanced the physical dimension of the MacNew instrument ($p = 0.03$). The intervention consisted of three to ten 1-hour individual sessions, which focused on patient personal history, body language insights, and relaxation techniques, as well as five group sessions over 3 months. The group sessions included information about MI, cardiac risk factors, lifestyle changes, music-guided breathing and muscular relaxation, comprehension of body signals, elements of oneiric language, and attention to specific partner/relationship issues. The study found that the physical domain of HRQoL was significantly improved in the intervention group compared to the control group. Also, positive trends in the social domain and overall HRQoL in the favour of the intervention were found [36].

Discussion

Overall, the studies included in this review showed promising results in improving HRQoL of MI patients. The studies included heterogeneous behavioural interventions, with cardiac rehabilitation programmes being the most

commonly reported [28, 29]. Patients who participated in either hospital-based or home-based CRP showed higher HRQoL than those who did not participate in any CRP [13, 28]. This finding is in line with other studies which demonstrated positive effects from CRP on HRQoL of patients with coronary heart disease [37, 38]. Supervised hospital-based CRPs were shown to be superior to unsupervised home-based programmes. However, if supervised, home-based CRPs showed only little difference with hospital-based cardiac rehabilitations [13, 39]. The positive effects of CRPs on HRQoL of MI patients were found to be independent from the cost and duration of these programmes [32]. Similarly, a systematic review that compared home- versus hospital-based CRPs suggested that home-based CRPs are safe and effective on many patient and disease outcomes of cardiac patients including quality of life [40]. Moreover, a study that conduced cost analysis on CRPs found that hospital-based CRP costed an average US$21,298, while the cost for home-based CRP and no programme was estimated to be US$13,246 and US$12,433, respectively [13]. Therefore, home-based CRPs may be a better option for some patients.

In addition, the available evidence suggests that exercise is an important element of CRPs, which positively affects HRQoL of patients with MI [16, 39]. Similarly, a systematic review revealed that most of the exercise-based cardiac rehabilitation programmes promised improvements in QoL of patients with coronary heart disease including patients with MI [37]. In particular, Tai Chi exercise had positive effects on post-menopausal female patients with coronary heart disease, as this exercise is designed similarly to walking exercises with low–moderate intensity [41]. Therefore, it is important that cardiac rehabilitation programmes be based upon moderate-intensity exercise. However, the effects of exercise intensity on HRQoL in patients with MI need further investigation. While Benetti et al. [16] demonstrated a superior effect from high-intensity exercise, a more outdated study conducted by Worcester et al. [42] suggested no significant difference in HRQoL scores between patients who participated in low-intensity and high-intensity exercises. In their study, Worcester et al. [42] described the high-intensity exercise programme as consisting of three 1-hour sessions per week delivered by a teacher of physical education and a doctor, while the low-intensity exercise programme included two 1-hour sessions per week of light calisthenics and intermittent exercise [42]. To sum up, although there is no strong evidence to support or reject the effects of exercise intensity on HRQoL, exercise is crucial for successful interventional programmes.

Other behavioural interventions including patient education and counselling, psychological, and cognitive interventions also showed potential to improve QoL of

patients with MI. Goal setting and goal attainment [34], telephone individual patient counselling [32], group counselling [33], and expressing writing [35] were found to positively affect QoL of MI.

The studies reviewed mainly used a generic tool to assess HRQoL in the target patient population. This is in line with the overall fact that specific instruments are less likely to be used than generic tools [29]. Generic tools have the advantage of being applied to a wider range of individuals from full health to death. This feature enables comparison of QoL scores across diseases and the normal population. Nevertheless, disease-specific measurements are apt for assessing HRQoL in a specific population [43]. These tools are more sensitive to treatment effects among a specific population group [44]. Although it is found that the SF-36 and the Mac New Quality of Life Questionnaire were found to be the most commonly used generic and disease-specific tools, respectively, for measuring HRQoL of patients with MI [45], the disease-specific instruments can better reflect the effects of interventions on HRQoL in this patient population. Thus, their use should be encouraged in studies that aim to follow the changes in HRQoL of MI over time or evaluate the effects of a particular intervention or treatment.

The findings of this review indicate that interventions usually improve some, not all, dimensions of the HRQoL, suggesting that a combination of interventions may be necessary to improve multiple dimensions of HRQoL. Additionally, there is a need for development of interventions that can result in a sustainable improvement in HRQoL of patients with MI. Long-term supportive programmes, as opposed to one-off interventions, might lead to a superior and long-lasting improvement in HRQoL of MI patients.

In this review, the studies evaluated CRP and other interventions with a range of duration from 1 to 18 months. Most interventions lasted a short term up to 6 months and usually showed positive effects on HRQoL of participants with MI [19]. Likewise, in a systematic review about QoL among CHD patients, most of the exercise-based cardiac rehabilitation programmes promised improvements with duration of programmes ranging from 1 to 12 months, where the frequency differed from one to seven sessions per week of 20–90 min length [37]. The included studies mostly examined the short-term effects of behavioural interventions on HRQoL of patients with MI and found positives results. The long-term effects of these interventions are unclear, however. Future studies should focus on evaluating the long-term effects of the cardiac rehabilitation programmes, counselling, and other behavioural interventions on HRQoL of patients with MI.

The effects of behavioural interventions on quality of life of MI patients were predominantly studied on male participants. This is consistent with the fact that the incident rate of MI is higher in males than in females [46]. However, several studies reported that female patients showed more impaired HRQoL than their male counterparts within the first year after MI [47–50]. It is necessary to understand the reasons why women report poorer HRQoL than men and whether particular dimensions of HRQoL are more affected in women. This understanding is required to develop and test targeted invitations aiming to reduce gender disparities in the experience of QoL in patients with MI.

Since HRQoL is subjective, studies rely on self-report measurements and must be aware of potential bias based on self-assessment [13, 51]. In addition, there were several limitations such as the small sample size, the considerable proportion of excluded patients, and the absence of a blinded condition. For instance, the effectiveness of expressive writing has not yet been widely proved, and thus, assessment of various interventions should be conducted with a larger sample size of the patient population.

Limitations

Despite our comprehensive methods, it is difficult to ascertain how many studies we did not include in this review. Additionally, limiting our search strategy to English-language articles and excluding grey literature may have resulted in under-representation of research from regions outside English-speaking countries.

This narrative review cannot quantify the effect size of QOL interventions for patients with MI. Therefore, the review is not able to recommend what is the best intervention to improve QoL in these patients. A rigorously conducted meta-analysis is needed to determine the precise effects of the available interventions [52].

Conclusion

Most CRPs and other behavioural interventions improved the HRQoL of patients with MI. Interventions that help increase patients' functional and psychosocial wellbeing should be introduced before long after discharge from hospital to promote patients' overall health and quality of life.

Implications

Patients with MI should be encouraged to participate in programmes that can help promote their HRQoL.

Compliance with Ethical Standards

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