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The Heart-Mind Connection: A Systematic Review Exploring the Bidirectional Relationship Between Myocardial Infarction and Depression

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ABSTRACT

Background: Myocardial infarction (MI) and depression share a complex, bidirectional relationship with major clinical implications. This systematic review examines their interplay, focusing on prevalence, risk factors, outcomes, and management. Depression affects 17%–59% of post-MI patients and is linked to a 77% rise in all-cause mortality and a 2.25-fold increased risk of recurrent MI. Women and younger individuals are particularly vulnerable, with women facing a 3.5-fold higher risk. Pre-existing depression raises MI risk by 21%, driven by behavioral (e.g., smoking, inactivity) and biological (e.g., inflammation, autonomic dysfunction) pathways.

Methods: Following PRISMA 2020 guidelines, we screened 580 articles from PubMed, Google Scholar, and Cochrane (Oct 2014–Sep 2024); 37 high-quality studies were selected using the Newcastle-Ottawa Scale and AMSTAR 2. Results: Depression worsens cognitive decline post-MI-especially in older adults-and impairs adherence to rehabilitation. SSRIs are associated with increased mortality post-MI, warranting caution. In contrast, CBT, web-based therapy, and cardiac rehab offer positive outcomes.

Conclusion: Depression remains underdiagnosed in up to 70% of MI patients due to symptom overlap and stigma. Regional variation exists, with prevalence up to 45% in Asia. Social factors like isolation and financial stress further raise risk. Integrating mental health screening and collaborative care can enhance survival and quality of life.

Keywords: Myocardial infarction; Heart attack; Coronary heart disease; Depression; Post-MI depression; Mental health

Introduction

Myocardial infarction (MI) remains a leading cause of morbidity and mortality worldwide, with advancements in medical and interventional treatments significantly improving survival rates. However, the psychological burden associated with MI, particularly the prevalence and impact of depression, is often underrecognized despite its profound influence on patient

outcomes. Depression affects 17% to 59% of post-MI patients, depending on assessment tools and demographic factors[1]. Beyond psychological distress, depression plays a critical role in increasing the risk of recurrent cardiac events, reducing treatment adherence, and elevating mortality rates[2]. Conversely, individuals with pre-existing depression have a 21% higher risk of developing MI, suggesting a bidirectional relationship with shared pathophysiological mechanisms[3]. This underscores the need for integrated management strategies to improve overall prognosis.

The link between MI and depression arises from behavioral and biological factors. Patients with depression are more likely to engage in unhealthy lifestyle behaviors, such as smoking, poor diet, and physical inactivity, all of which contribute to cardiovascular risk[4]. Additionally, depression is associated with autonomic dysfunction, chronic inflammation, platelet hyperreactivity, and endothelial dysfunction, further increasing the likelihood of MI and its recurrence[5]. Studies indicate that post-MI depression is linked to a 77% increase in all-cause mortality, highlighting its prognostic significance[6]. Moreover, depressive symptoms impair engagement in rehabilitation programs and adherence to secondary prevention strategies, compounding cardiovascular risk[7]. Despite this, up to 70% of depression cases remain undiagnosed, largely due to symptom overlap with cardiac disease, lack of routine screening, and persistent mental health stigma[8].

Certain subgroups face a higher risk of post-MI depression. Women and younger patients have a greater prevalence of depressive symptoms than older males, likely due to hormonal influences, psychosocial stressors, and coping mechanism differences[9]. Additionally, social determinants of health-including low perceived social support, financial strain, and job loss-further increase the risk of severe depression and negatively impact cardiac recovery[1]. Social neglect significantly worsens depressive symptoms, leading to suicidal ideation and prolonged functional impairment in post-MI patients[1]. These findings emphasize the importance of addressing psychosocial and physiological factors in MI management to enhance long-term outcomes.

Cognitive impairment is another frequently overlooked consequence of MI, with a strong association with depression. Older MI patients are particularly vulnerable to post-MI cognitive decline, linked to cerebral hypoperfusion, cardiogenic micro-embolism, and systemic inflammation[5]. Furthermore, depression exacerbates executive dysfunction, memory impairment, and slowed processing speed, leading to poor medication adherence, impaired decision-making, and lower rehabilitation participation[2]. Notably, women with MI have a 3.5-fold higher risk of developing depression, further increasing their susceptibility to cognitive impairment and disability[1]. However, ejection fraction alone is not a significant predictor of post-MI cognitive impairment or depression, indicating that demographic and clinical factors play a more pivotal role[5].

Challenges in management

Managing post-MI depression presents significant challenges. Antidepressants, particularly selective serotonin reuptake inhibitors (SSRIs), remain controversial due to concerns over drug interactions, QT prolongation, and increased bleeding risk in patients on dual antiplatelet therapy[10]. Some studies report a 75% increase in mortality among MI patients using antidepressants, underscoring the need for cautious pharmacological management[10].

Non-pharmacological interventions have shown promising results. Approaches such as cognitive behavioral therapy (CBT), structured psychosocial support, and supervised cardiac rehabilitation programs significantly improve depressive symptoms and cardiac outcomes[11]. Additionally, digital health interventions, including web-based psychological counseling and telemedicine-based CBT, provide accessible mental health care to post-MI patients facing mobility limitations or limited psychiatric access[12]. These strategies offer a viable alternative to in-person mental health services while enhancing overall patient well-being.

Future directions

Given the profound impact of depression on MI outcomes, integrating routine depression screening into standard post-MI care is gaining traction[3]. Collaborative care models-involving cardiologists, psychiatrists, psychologists, and primary care providers-may provide an effective framework for addressing both cardiovascular and psychological needs[1]. Future research should focus on developing personalized treatment strategies, optimizing the balance between pharmacological and non-pharmacological interventions, and investigating the long-term cardiovascular effects of depression treatment.

The interplay between MI and depression is complex and multifaceted, with significant implications for patient prognosis and healthcare management. Addressing depression in MI patients is critical not only for improving mental health and quality of life but also for reducing cardiovascular morbidity and mortality. Recognizing depression as an integral component of cardiovascular care will facilitate a more comprehensive, patient-centered approach, ultimately leading to better long-term outcomes.

Materials and Methods

This systematic review was conducted following the PRISMA 2020 guidelines[13] to ensure transparency and reproducibility in study selection and data extraction. A comprehensive literature search was performed across three major databases-PubMed, Google Scholar, and Cochrane-to identify relevant studies exploring the interrelationship between myocardial infarction (MI) and depression.

Search strategy

The search strategy followed the PICO (Population, Intervention, Comparison, Outcome) framework to ensure the inclusion of studies relevant to our research question:

- **Population (P):** Patients diagnosed with myocardial infarction (MI) and/or depression.
- **Intervention (I):** Assessment of depression in MI patients and vice versa.
- **Comparison (C):** MI patients with and without depression, depressed individuals with and without MI, or different management strategies.
- **Outcome (O):** Impact of depression on MI prognosis, recurrence, mortality, and quality of life.

A MeSH (Medical Subject Headings) strategy was implemented to refine the search, using terms such as:

- "Myocardial Infarction", "heart attack", "coronary artery disease", "depression", "post-MI depression", "mental health".

Boolean operators (AND, OR) and specific filters were applied to ensure a focused selection of studies.

Inclusion criteria

- Studies published between October 1, 2014, and September 30, 2024.
- Original research articles, cohort studies, case-control studies, case reports, meta-analyses, systematic reviews, and randomized controlled trials.
- Studies examining the prevalence, impact, and management of depression in MI patients or the effect of depression on MI risk.
- Articles published in English and available in full-text format.
- Studies with clearly defined methodologies and statistical analyses related to MI and depression.

Exclusion criteria

- Studies with insufficient data or unclear methodology.
- Editorials, letters to the editor, and conference abstracts.
- Articles focusing on unrelated psychiatric or cardiovascular conditions.
- Studies involving pediatric populations or non-human subjects.
- Duplicate studies identified across multiple databases.

A comprehensive overview of the databases explored, along with the precise search strategies and filters applied, is presented in Table 1 below. This structured approach ensured a thorough, targeted, and high-quality selection of studies, enabling a deeper understanding of the intricate relationship between myocardial infarction and depression **(Table 1)**.

Table 1: Databases and search strategies.

Database(s)	Search Strategy	Filter(s) applied	Number of articles
Pubmed	(Myocardial Infarction OR Heart Attack OR Coronary Artery Disease OR ("Myocardial Infarction"[Majr]) AND ("Myocardial Infarction/complications"[Majr] OR "Myocardial Infarction/drug therapy"[Majr] OR "Myocardial Infarction/etiology"[Majr] OR "Myocardial Infarction/mortality"[Majr] OR "Myocardial Infarction/pathology"[Majr] OR "Myocardial Infarction/physiopathology"[Majr] OR "Myocardial Infarction/prevention and control"[Majr] OR "Myocardial Infarction/psychology"[Majr] OR "Myocardial Infarction/rehabilitation"[Majr] OR "Myocardial Infarction/therapy"[Majr])) AND (Depression OR Post MI Depression OR Mental Health OR ("Depression/complications"[Majr] OR "Depression/etiology"[Majr] OR "Depression/mortality"[Majr] OR "Depression/pathology"[Majr] OR "Depression/physiopathology"[Majr] OR "Depression/prevention and control"[Majr] OR "Depression/psychology"[Majr] OR "Depression/rehabilitation"[Majr] OR "Depression/therapy"[Majr]))	Free full text articles; published between October 1, 2014 and September 30, 2024; only English language, population of age >= 18 years	274
Google Scholar	allintitle: Myocardial infarction AND depression	Published between 2014-2024	298
Cochrane	Abstract title search: Myocardial infarction AND depression	Published between 2014-2024	8

Results

A total of 580 articles were initially retrieved from database searches. After the removal of duplicates, screening based on titles and abstracts was performed to exclude irrelevant studies. The remaining articles underwent a full-text review, applying the inclusion and exclusion criteria. Quality assessment was conducted using standardized tools such as the Newcastle-Ottawa Scale (NOS) for cohort and case-control studies[14], the JBI quality appraisal checklist for case series and case reports[15], SANRA for narrative review articles[16], AMSTAR 2 for systematic reviews and meta-analyses[17], and the Jadad scale for RCTs and non-RCTs[14]. Following this rigorous screening and quality assessment process, 37 high-quality studies were selected for final inclusion in the systematic review.

The PRISMA flowchart in **(Figure 1)** provides a clear visual summary of our rigorous screening process, illustrating each step from the initial database search to the final selection of high-quality studies. Additionally, **(Table 2)** presents a comprehensive overview of the studies included in our systematic review, offering key insights into the relationship between myocardial infarction and depression.

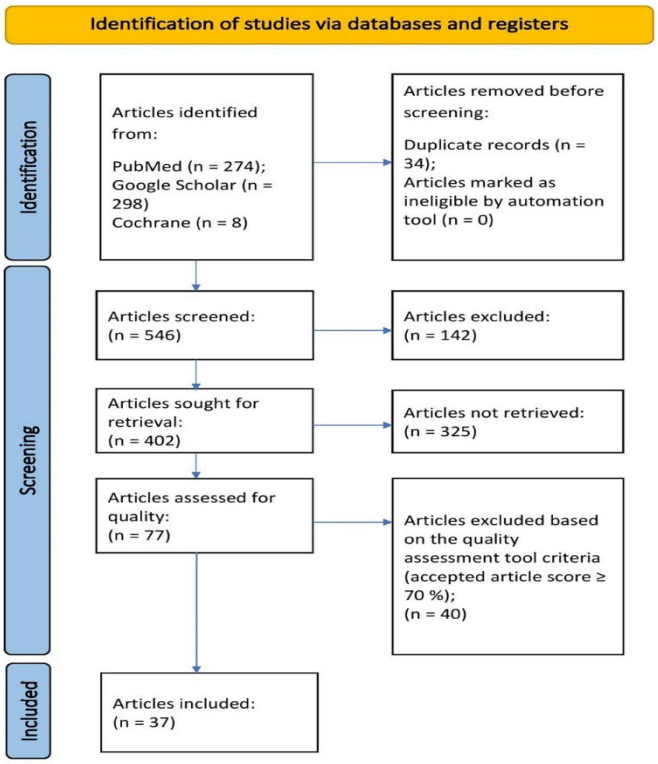

Figure 1: PRISMA Flowchart.

Table 2: Summary of included studies.

Author(s)	Year	Type of Study	Population	Primary Conclusions	Secondary Conclusions
Lin, et al.[18]	2023	Cross-sectional study	565 MI survivors (not specified M/F)	38.1% prevalence of depression in MI survivors, significantly associated with poor quality of life (QOL)	Patients with depression were less likely to consult a doctor regularly and experienced more severe anxiety and fatigue
Van Dijk, et al.[6]	2016	Cohort study (10-year follow-up)	1,112 CAD patients (not specified M/F)	Depression increased the risk of all-cause mortality by 77% in PCI patients	Anxiety was also associated with mortality, but co-occurring depression negated its independent effect
Murphy, et al.[19]	2020	Longitudinal study	911 cardiac patients (not specified M/F)	Anxiety and depression after a cardiac event increased the risk of subsequent events and premature death	Risk factors include financial strain, poor self-rated health, low socioeconomic status, and smoking
Alsuwaidan, et al.[20]	2024	Cross-sectional study	249 post-MI patients (76.6% male)	33.33% prevalence of depression in post-MI patients in Saudi Arabia	Depression was significantly associated with previous CAD, heart failure, and coronary artery bypass graft surgery
Zhamaliyeva, et al.[21]	2023	Randomized controlled trial	145 post-MI patients (not specified M/F)	Educational intervention reduced depression and anxiety in cardiac rehabilitation patients	The structured intervention was effective, with stable benefits over a 12-month follow-up
Jha, et al.[22]	2019	Review article	Not applicable	Screening for depression in cardiovascular patients is essential for management and outcomes	Integrating mental health care into cardiac care can improve patient outcomes
Khan, et al.[23]	2021	Meta-analysis	Various studies (men and women, varied sample sizes)	Women were more likely to suffer from depression post-ACS, with an overall prevalence of 32%	The severity of depression varied based on the assessment method used
Bradley, et al.[24]	2015	Observational study	3572 AMI patients (men and women)	39% of women and 22% of men reported depression at the time of admission for AMI	Depression was more prevalent in younger women and was associated with higher post-AMI mortality
Dhar, et al.[25]	2016	Review article	N/A	Depression increases the risk of cardiac events and mortality	Mechanisms include autonomic dysfunction, platelet activation, and inflammation
Saeed, et al.[26]	2018	Cross-sectional study	375 MI patients (229 males, 146 females)	79.5% of MI patients exhibited some degree of depression, with a r prevalence in females (81.5%) than males (78.2%). Depression was significantly associated with increased post-MI complications.	Smoking did not show a statistically significant correlation with depression. The study emphasizes the need for routine depression screening in MI patients.
Feng, et al.[27]	2019	Meta-analysis	12,315 MI patients (varied M/F)	Pooled prevalence of depression in MI patients was 28.7%	Depression varied based on region, assessment tool, and patient characteristics
Maqsood, et al.[28]	2017	Cross-sectional study	246 MI patients (M/F not specified)	Depression prevalence in MI patients was 27.24%	No significant association between depression and patient age or sex
Kala, et al.[29]	2016	Prospective observational study	79 STEMI patients (21.5% female)	Depression was highest within 24 hours of PCI, declining before discharge but increasing over 12 months	Anxiety followed a similar pattern, indicating the need for long-term monitoring
Murphy, et al.[30]	2023	Comparative study	162 AMI patients (22% SCAD cases)	SCAD-AMI patients had significantly higher anxiety, depression, and distress levels than non-SCAD AMI patients	Prior mental health history was a significant predictor of post-AMI psychological distress
Doi-Kanno, et al.[31]	2016	Literature review	Various MI patients undergoing PCI	Identified 21 risk factors for depression in MI patients post-PCI	Negative perceptions of recovery were more common in PCI patients than in CABG patients
Arzet, et al.[32]	2021	Longitudinal study	95 MI patient's post-revascularization	Lifestyle modification reduced depression prevalence, particularly in PCI patients	CABG patients showed higher depression levels but also benefited from lifestyle changes
Wu, et al.[33]	2016	Meta-analysis	323,709 participants	Depression increased the risk of MI and coronary death by 22%	Effective prevention and treatment of depression may reduce this risk
Cocchio, et al.[10]	2019	Retrospective cohort study	3,985 AMI patients (8.8% antidepressant users)	Antidepressant users had a 75% higher mortality rate post-AMI	Routine health records can help identify high-risk patients
Feng, et al[34].	2016	Population-based cohort study	1,396 MI patients, 13,960 controls	MI patients had a significantly higher risk of anxiety (HR=5.06) and depression (HR=7.23)	Post-MI anxiety increased the risk of recurrent MI by 9.37 times
Kroemeke, et al[35].	2015	Longitudinal study (6 years)	200 MI patients (M/F not specified)	Three depressive trajectories post-MI: chronic, rising, and low	Negative cognitive appraisal and emotion-focused coping predicted worse long-term depression outcomes

Smolderen, et al[9].	2015	Cross-sectional study	3572 patients with AMI (67.1% women)	Women had significantly higher rates of depression at AMI admission (39% vs. 22% in men)	Depression was more prevalent in those with lower socioeconomic status and more cardiovascular risk factors
Smolderen, et al[8].	2017	Cohort study (TRIUMPH registry)	4,062 AMI patients (M/F not specified)	Untreated depression in AMI patients was associated with a 1.91-fold higher 1-year mortality rate	Treated depression had no significant difference in mortality compared to non-depressed patients
Niakan, et al[36].	2015	Cross-sectional study	132 MI patients (M/F not specified)	Depression significantly reduced self-care behavior within the first 30 days post-MI	Increased severity of depression was linked to worse self-care adherence
Wang, et al[37].	2016	Longitudinal study	66 MI patients in Hong Kong	Depression was highest in the first 72 hours post-MI and gradually declined over 3 months	Depression was negatively correlated with quality of life, physical functioning, and treatment satisfaction Depression was negatively correlated with physical limitation and disease perception during the whole study period.
Sarika, et al[38].	2023	Cross-sectional study	111 MI patients (M/F not specified)	35.1% of MI patients had extremely severe depression, and 27.9% had moderate stress	Patients with anterior and inferior wall MI had the highest rates of depression
Džubur, et al.[39]	2021	Observational study	120 AMI patients (70 males, 50 females)	49.17% of post-MI patients experienced depression	Depression was strongly negatively correlated with physical functioning and quality of life
Smolderen, et al.[40]	2017	Cohort study (VIRGO study)	Young AMI patients (66.8% women)	Untreated persistent depression after AMI led to worse 1-year health outcomes	Women were less likely to receive depression treatment post-AMI
Sharif, et al.[41]	2024	Review article	Various MI patients	Depression is linked to poor cardiac outcomes, with a 2 to 2.5-fold increased risk of complications	Neurobiological and environmental factors contribute to post-MI depression
Humphries, et al.[12]	2021	Randomized controlled trial	239 post-MI patients (33% female)	Internet-based cognitive behavioral therapy (iCBT) did not significantly reduce depression compared to standard care	iCBT did reduce cardiac-related anxiety but did not impact cardiovascular event rates
Kokcu, et al.[11]	2019	Randomized controlled trial	130 MI patients (M/F not specified)	Web-based training significantly reduced anxiety and depression levels post-MI	Patients in the intervention group showed better adherence to health behaviors
Alexandri, et al.[42]	2017	Cross-sectional study	148 first-episode MI patients (59% male)	52% had high anxiety levels, 38% had high depression levels	Socio-demographic and clinical factors influenced anxiety and depression post-MI
Flygare, et al.[2]	2023	Nationwide registry study	45,096 post-MI patients (M/F not specified)	Prior diagnosis of anxiety or depression increased mortality risk by 86% and reinfarction risk by 14%	Screening for only current symptoms is insufficient; psychiatric history should be considered
Manoj, et al.[4]	2018	Case-control study	100 MI cases, 100 controls (M/F matched)	Depression, anxiety, and stress were significantly higher in MI patients than controls	Depression had an odds ratio of 2.79 for MI risk, while anxiety had an odds ratio of 6.42
Lu, et al.[3]	2020	Mendelian randomization	807,553 individuals for depression, 60,801 CAD cases, 43,676 MI cases	Genetic liability to depression increased MI risk by 21%	Type 2 diabetes and smoking mediated part of the depression-MI risk
Mal, et al[7].	2019	Retrospective study	53 MI patients (58.5% male)	53% had anxiety and 59% had depression two weeks before their MI	Psychological health should be integrated into cardiovascular risk assessment
Hasanović, et al[1].	2017	Case report	Single MI patient (male)	Social neglect significantly worsened post-MI depression and led to suicidal ideation	Adequate social support is crucial for recovery and reintegration into the workforce
Dikić, et al.[5]	2021	Prospective study	82 post-MI patients (60 males, 22 females)	Cognitive impairment was more common in older MI patients, while depression was more common in females	Ejection fraction did not significantly predict cognitive impairment or depression

Discussion

The bidirectional relationship between depression and myocardial infarction

Depression and myocardial infarction (MI) share a deeply interconnected, bidirectional relationship that significantly influences patient prognosis and overall quality of life. Depression is increasingly recognized as a significant and independent risk factor for MI and cardiovascular mortality[3,4,8,33,34]. Studies estimate that 17% to 59% of MI survivors develop depression, which not only affects psychological well-being but also worsens cardiovascular outcomes[1]. A study by Alsuwaidan, et al. found that 33.3% of post-MI patients had depression, with 9% experiencing moderate depression and 2.4% reporting

severe depression[20]. Depressed MI patients have a 77% increase in all-cause mortality and a 2.25-fold higher risk of recurrent MI compared to non-depressed individuals[18,33]. Conversely, depression itself predisposes individuals to MI through behavioral, neurohormonal, and physiological mechanisms, including chronic inflammation, endothelial dysfunction, and platelet activation[3,25]. A study by Mal et al. reported that depression alone increased the incidence of CAD by 64% (OR = 1.64), with 58.49% of patients experiencing depression before developing MI[7]. Understanding this intricate interplay is essential for developing comprehensive prevention, management, and intervention strategies.

Pathophysiological mechanisms connecting depression and MI

- **Inflammatory pathways and cytokines:** Chronic systemic inflammation is a fundamental mechanism linking depression and MI. Depressed patients exhibit elevated levels of inflammatory biomarkers such as C-reactive protein (CRP), interleukin-1 (IL-1), interleukin-6 (IL-6), and tumor necrosis factor-alpha (TNF-α). These inflammatory mediators contribute to atherosclerosis progression, plaque instability, and increased cardiovascular events[8,25]. Persistent inflammation predisposes individuals to MI and hampers post-MI recovery, leading to prolonged hospitalization, increased morbidity, and heightened mortality rates.
- **Neurohormonal dysregulation:** HPA Axis, Catecholamines, and Cortisol - Depression disrupts the hypothalamic-pituitary-adrenal (HPA) axis, resulting in chronic cortisol elevation and sympathetic nervous system overactivation[19,22]. Elevated cortisol contributes to increased blood pressure, insulin resistance, and endothelial dysfunction, amplifying cardiovascular risk. Excessive catecholamine release heightens platelet aggregation, fostering a pro-thrombotic state that raises the likelihood of initial and recurrent MI[6]. Post-MI patients without depression had significantly lower afternoon cortisol levels than morning levels, whereas patients with depression for over three months exhibited flattened cortisol secretion patterns, which have been linked to cognitive impairment and increased depressive symptoms[41].
- **Endothelial dysfunction and platelet activation:** Depressed individuals exhibit increased platelet reactivity, oxidative stress, and impaired endothelial function, elevating thrombosis and atherogenesis risk[20,25]. Hyperactive platelet responses in depressed patients accelerate clot formation and coronary artery occlusion, compounding cardiovascular risk. Additionally, increased platelet serotonin levels in depression contribute to thrombus development, worsening overall cardiovascular outcomes[3,18].

Psychosocial and clinical predictors of post-MI depression

Several psychosocial, demographic, and clinical factors influence the likelihood of developing depression following MI[27,30,31]. Doi-Kanno et al. identified 21 risk factors associated with post-MI depression, categorized into six major domains:

- **Personal characteristics & Personality traits:** Female gender, unmarried status, Type D personality, and negative illness perceptions increase depression risk[30,31].
- **Disease history:** A history of depression, anxiety, angina, MI, PCI, CABG, diabetes, or stroke significantly raises post-MI depression risk[27,33].
- **Medical procedures & Hospital stay:** Shorter hospital stays (<5 days) correlate with higher depression risk, possibly due to inadequate recovery time and limited patient education[29,31].
- **Lifestyle factors & Risk behaviors:** Depression often coexists with unhealthy behaviors such as smoking, physical inactivity, and poor dietary habits, exacerbating cardiovascular risk[19,20,42]. Flygare, et al. demonstrated that pre-existing psychiatric conditions significantly increase post-MI mortality (HR = 1.86, $p < 0.001$) and reinfarction risk (HR = 1.14, $p < 0.01$), highlighting the need for lifestyle modifications[2].
- **Physical functioning:** Reduced physical activity and functional disability post-MI significantly predict higher depression scores[30,32].
- **Stress, Coping mechanisms and Social isolation:** Maladaptive coping strategies exacerbate stress-induced cardiovascular responses[6]. Social isolation further delays recovery, increases suicide risk, and raises cardiovascular complication rates[1,8,39]. Implementing psychosocial support mechanisms can improve post-MI outcomes.

Impact of depression on MI Outcomes

Depression significantly worsens post-MI prognosis. Studies reveal that MI patients with comorbid depression experience a 2.71-fold increase in cardiac mortality compared to non-depressed counterparts[18]. Additionally, depression is linked to prolonged hospital stays, diminished quality of life, and greater likelihood of recurrent cardiovascular events[22,24]. Beyond mortality, self-care behavior significantly deteriorates in post-MI patients with depression[36-38]. Niakan, et al. observed that 72% of patients adhered to self-care recommendations (medication adherence, diet control, exercise, smoking cessation) at day 15 post-MI, but this number dropped to 15.9% by day 30[36]. A retrospective cohort study in the Veneto Region found that antidepressant (AD) users prior to AMI had a significantly higher risk of post-hospitalization mortality (adjusted OR = 1.75, 95% CI: 1.40-2.19)[10]. These findings reinforce the need for integrated mental health interventions in cardiac care.

Global variability in post-MI depression prevalence

Depression prevalence in MI patients varies substantially across different populations, regions, and assessment methods[27,28]. Feng, et al. conducted a meta-analysis of 19 studies across 10 countries, finding a pooled depression prevalence of 28.7% (95% CI: 22.39–35.46%), with individual study estimates ranging from 9.17% to 65.88%[27].

Subgroup analyses revealed significant regional differences:

- **North America:** 25.97% (95% CI: 17.96–34.88%)
- **Europe/UK:** 23.50% (95% CI: 17.75–29.78%)
- **Asia:** 45.03% (95% CI: 24.89–66.07%)

Asian populations exhibited significantly higher depression rates, potentially due to sociocultural differences in healthcare access, stigma, and stress[27,33]. Women, patients with diabetes, and individuals with lower socioeconomic status were at greater risk, emphasizing the need for region-specific mental health and cardiac rehabilitation interventions[28,30].

Effect of MI on mental health: Prevalence of post-MI depression

Post-myocardial infarction (MI) depression is highly prevalent, affecting approximately 20% to 50% of survivors, with women and older adults being particularly vulnerable[5,24,37,40]. Women presenting with acute myocardial infarction (AMI) were 2.28 times more likely than men to exhibit depressive symptoms. Furthermore, young women with AMI had a 60% higher likelihood of experiencing major depression than their male counterparts, even after adjusting for sociodemographic, clinical, and illness severity factors[9,40].

A study by Kroemeke identified three distinct depressive trajectories among MI survivors over a six-year follow-up period. More than half (55.7%) exhibited moderate depressive symptoms one-month post-MI, which initially declined at six months but resurged six years later (increasing subgroup). Patients in the chronic trajectory group (29.1%) displayed high depressive symptoms within the first month, which intensified at six months before gradually declining after six years. The smallest subgroup (15.2%) had relatively low depression levels initially, which remained stable after six months[35].

The increase in depressive symptoms post-MI may stem from additional life stressors, such as job loss or financial strain, or from pre-existing depressive symptoms worsening over time. Alternatively, the decline in symptoms observed in some patients may indicate a return to their baseline emotional state before the cardiac event, which was not assessed in the study. The consistently high depression levels in the chronic trajectory group suggest that these individuals may have experienced poor mental health even before MI[35]. Additionally, a study by Alsuwaidan, et al. reported that only 9.2% of post-MI patients had a prior depression diagnosis, highlighting the underdiagnosis of depression in cardiac patients[20]. Post-MI recovery is further complicated by symptoms such as cognitive impairment, emotional distress, and anxiety, underscoring the need for timely psychological assessment and intervention[24,37].

Screening and diagnosis of depression in MI patients

Routine depression screening is crucial for early intervention in MI patients. Commonly used diagnostic tools include the Patient Health Questionnaire-9 (PHQ-9) and the Hospital Anxiety and Depression Scale (HADS), with a two-step approach using PHQ-2 followed by PHQ-9 improving early detection rates[22].

Patients with PHQ-9 scores ≥10 exhibited higher rates of cardiovascular comorbidities and risk factors, including prior AMI, percutaneous coronary intervention, coronary artery bypass grafting, congestive heart failure, hypertension, diabetes, hypercholesterolemia, recent smoking history, prior stroke or transient ischemic attack, obesity, higher Killip class, and chronic lung disease. They also presented with more AMI symptoms than those with lower depressive symptom scores[9]. However, several barriers hinder diagnosis, including symptom overlap with cardiac conditions (e.g., fatigue, sleep disturbances, appetite loss), patient reluctance to disclose symptoms, and physician hesitancy in addressing mental health concerns[22,39].

Management strategies and treatment approaches

- **Pharmacological interventions:** Selective serotonin reuptake inhibitors (SSRIs), such as sertraline and escitalopram, are generally considered safe for cardiovascular patients[23]. However, some studies indicate that post-MI antidepressant use may be associated with a 75% higher mortality rate, necessitating cautious prescribing and close patient monitoring[8,23].
- **Non-pharmacological approaches:**
  - **Cognitive behavioral therapy (CBT):** Effective in alleviating post-MI depression[23].
  - **Cardiac rehabilitation programs:** Improve both mental health and cardiovascular outcomes[21].
  - **Mindfulness-based stress reduction:** Enhances treatment adherence and reduces stress-related cardiovascular risk[19].
  - **Digital interventions:** Web-based programs significantly reduce depression and anxiety scores ($p < 0.001$)[11]. However, engagement with digital mental health interventions remains a challenge, as evidenced by a study conducted by Humphries et al., where only 60% of participants completed the entire program [12].

Limitations

This systematic review has several limitations that must be acknowledged. The included studies exhibit heterogeneity in design, sample size, population characteristics, and methodologies for assessing depression and myocardial infarction (MI) outcomes, limiting direct comparability. Variability in depression assessment tools, ranging from self-reported questionnaires to structured clinical interviews, may have introduced inconsistencies. Potential publication bias is another concern, as studies with significant findings are more likely to be published, potentially overestimating the impact of depression on MI prognosis. Additionally, many studies were cross-sectional or had short follow-up periods, restricting the ability to establish long-term causal relationships. Confounding variables such as socioeconomic status, healthcare access, medication adherence, and underlying psychiatric conditions may also influence the observed associations. Moreover, this review was limited to studies published in English and retrieved from selected databases, possibly excluding relevant research. The lack of standardized depression interventions across studies further complicates conclusions regarding the most effective treatment strategies. Generalizability is another challenge, as findings may not apply to all MI patients, particularly those from diverse ethnic or socioeconomic backgrounds. Depression remains underdiagnosed in cardiac patients due to overlapping symptoms with MI, potentially leading to an underestimation of its prevalence and impact. Finally, while this review discusses possible biological mechanisms linking depression and MI, most included studies focused on epidemiological associations rather than mechanistic insights. Future research integrating biomarker analysis and neuroimaging will be essential for a deeper understanding of this relationship and for developing targeted screening, prevention, and treatment strategies.

Conclusion

The relationship between depression and MI is bidirectional and significantly impacts prognosis. Despite a strong body of evidence linking depression to worse MI outcomes, screening and treatment remain inadequate.

Key clinical takeaways include:

- Depression increases MI risk, independent of traditional cardiovascular risk factors.
- Pre-existing psychiatric conditions predict worse MI outcomes, even in asymptomatic patients.
- Digital interventions and structured rehabilitation programs effectively reduce depression and improve recovery.
- Collaborative care models, integrating cardiology and mental health services, yield the best long-term outcomes.

Future research should prioritize

- Tailored interventions for post-MI depression, especially in high-risk groups (women, older adults, socially isolated individuals).
- Optimizing depression screening protocols for MI patients.
- Developing better engagement strategies for digital and community-based mental health interventions.

By addressing both the cardiovascular and psychological needs of MI patients, healthcare providers can improve survival rates and enhance long-term quality of life.

Summary of work done by the contributors

Heet N. Desai conceptualized and designed the study, defined intellectual content, conducted the literature search, acquired and analyzed data, performed statistical analysis, prepared and edited the manuscript, reviewed it, and acted as guarantor. Pooja Wali, Kesha Desai, Rashi Bilgaiyan, and Rutvik Raval contributed to the literature search, data acquisition, manuscript editing, and review.

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Conflict of Interest

None of the authors have any conflicts of interest to declare.

Data Availability Statement

No new data were created or analyzed in this study. Data sharing is not applicable to this article.

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