

IMPACT OF MENTAL HEALTH ON POST-OPERATIVE RECOVERY IN CARDIAC PATIENTS: A MULTI-DISCIPLINARY APPROACH

^{*1}Zarina Naz, ²Atif Mughal,

^{*1}MSN, MHPE Scholar, National University of Medical Sciences, Rawalpindi, Pakistan.

²Department of Allied Health Sciences, The Superior University, Lahore.

^{*1}zarina_nazsalim@yahoo.com, ²M.atifmughal54@gmail.com,

Corresponding Authors: *

Zarina Naz

DOI:

Received 23 Oct, 2025	Accepted 27 Nov, 2025	Published 01 Dec, 2025
--------------------------	--------------------------	---------------------------

ABSTRACT

The increased awareness of the mind-heart relationship has changed the concept of cardiac recovery. The previous evidence demonstrates that the psychological disorders like depression, anxiety, and post-traumatic stress disorder (PTSD) are not the indirect complications but the primary outcome determinants following cardiac surgery. Patients with psychological suffering have a slow recovery, more complications, and they are more likely to readmission. However, the integration of mental health in the cardiac care is still not sufficient because of stigma, lack of training, and systemic challenges. This review demonstrates the need to have a multidisciplinary model that brings together cardiologists, psychologists, nurses, and social workers to deal with both physical and emotional aspects of healing. Early screening of mental health through standardized methods such as PHQ-9 and GAD-7 have been seen to increase adherence and reduce the hospital stay. Besides, new digital interventions, such as mobile-based CBT, tele-counseling, wearable monitoring, further expand the availability of mental health support to institutions outside the hospital and at a lower cost. The evidence suggests that an immediate change is needed to incorporate psychological evaluation and treatment into the cardiac pathways. An all-inclusive cardiac care system should not only fix the failing heart but also the troubled mind - since healing can be achieved only when the two hearts beat in tune.

Keywords: Cardiac Surgery, Post-operative Recovery, Mental Health, Depression, Anxiety, Psychological Resilience, Stress Management, Digital Health Intervention, Rehabilitation.

1. INTRODUCTION

Cardiovascular diseases (CVDs) are the number one cause of death in the world with cardiac operation that includes coronary artery bypass grafting (CABG), valvular diseases and repairing some heart malformations being the intervention of necessity to save lives. Over the last 20 years, the positive outcome of surgical procedures, anesthesia, and peri-operative services has resulted in a significant decrease in mortality rates and therefore these procedures became safer and more accessible [1]. The success of contemporary cardiac surgery is noted by the increase of survivability, though, being alive is not the marker of successful treatment anymore. The success of contemporary cardiac surgery is noted by the increase of survivability though, being alive is not the marker of successful treatment anymore. Defining recovery following cardiac surgery as multidimensional comprising physical, psychological and social well-being in recent years has become part of how the recovery is understood. There is an emerging body of research point to the weight of psychological disorders notably depression, anxiety and post trauma stress disorder (PTSD) on post-surgical patients [2]. According to meta-analyses and large-scale studies investigated that, 20-40 percent of cardiac surgery survivors acquire clinically significant psychological distress, which has a direct impact on their quality of life and long term outcomes [3]. Mechanisms of the interaction that exist between recovery and mental health inside the body have also been made clearer biologically. Depression and anxiety are linked with the pro-inflammatory cytokine, including interleukin-6 (IL-6) and C-reactive protein (CRP), dysregulated hypothalamic-pituitary-adrenal (HPA)-axis, and deregulated endothelial activity [4, 5]. The changes that occur to the human body slow down the recovery of wounds, undermine immunity, and increase the chances of cardiovascular complications. In parallel, psychological suffering decreases the adherence to medications and participation in the rehabilitation programs, adding to the physical dangers [6, 7].

Although such associations are recently being reported during the world, the weight of such associations is specifically alarming in low- and middle-income countries. As an illustration, the South-Asian literature lists such high rates as prevalence of depression of up to 30% in CABG patients during six-month post-surgery, which is even higher than average in the West [8, 9]. These discrepancies indicate institutional barriers such as stigma, lack of mental health services and disjointed healthcare provision that holds any form of intervention. This regional lens highlights the importance of developing culturally sensitive and context specific strategies [10, 11]. Although this is growing because of evidence based demand, mental health during the cardiac care pathways is under-prioritized. Screening using validated tools, such as the Patient Health Questionnaire (PHQ-9) and the Generalized Anxiety Disorder scale (GAD-7), has proven to be effective in identifying those at risk, but their routine use has been inconsistent [12]. Biomedical recovery remains a priority of most surgical programs although only emotional and psychological aspects are overlooked. Also, there are gaps in longitudinal studies evaluating the long-term outcome of early psychological interventions; especially where resources are limited [13]. To close these gaps, this review summarizes the evidence available on interplay between mental health and post-operative recovery in heart patients up-to-date. In particular, it aims at

- Investigating the prevalence and effects of depression, anxiety, and post-traumatic stress disorder after cardiac surgery,
- Studying the biological and behavioral mechanisms underlying the relation between mental suffering and the recovery success,
- Exploring evidence-based, multidisciplinary, approaches towards integrating mental health into regular cardiac care.

With its promotion of a patient-centered and holistic approach, the review highlights the changing realization that effective postoperative recovery after cardiac surgery

requires a restoration of a functional state in, not just in heart, but also in the mental strength of the patient and in the overall condition [14]. Figure 1.1 shows that most

cardiac surgery patients experience psychological distress, mainly **anxiety (40%)** and **depression (30%)**, while 15% face **PTSD** and only 15% report no major distress.

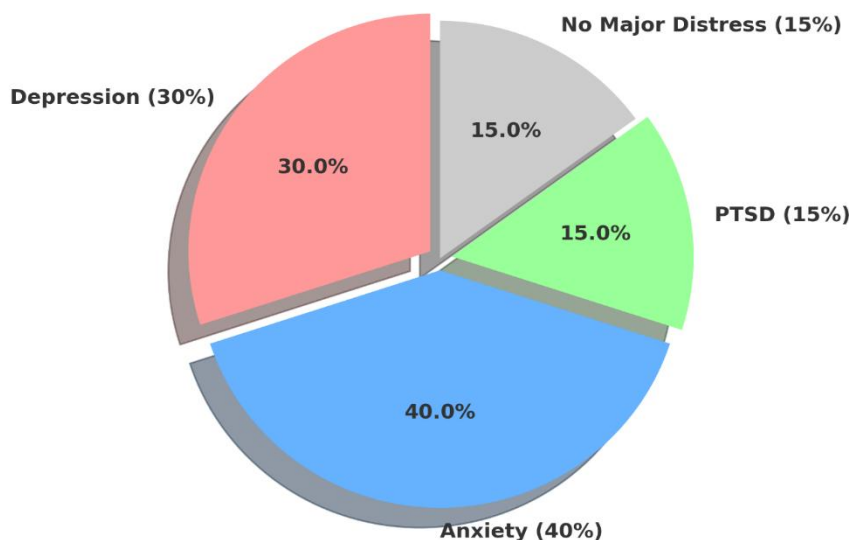


Figure 1: Prevalence of Psychological Distress Among Cardiac Surgery Patients

2. History of Cardiac Surgery & Post Surgery Complications

In the past several decades, cardiac surgery has evolved, as a life-threatening experimental treatment, into a well-developed life-saving treatment. Coronary artery bypass grafting (CABG), valve repair or replacement, and transcatheter aortic valve implantation (TAVI) have greatly decreased deaths and improved the possible treatments of the elderly and high-risk patients [15]. The most recent statistics show that in high-income nations, the 30-day mortality rates of CABG reduced to less than 2%, which indicates a gradual decline in mortality rates due to the rise in the efficiency of surgical procedures, anesthesia, and postoperative treatment [16-18]. Such developments highlight how cardiac surgery has evolved to be not the last option anymore but an elaborate yet a commonality. Her despite these accomplishments, patients still are susceptible to early post-operative complications. Arrhythmias (especially post-operative atrial fibrillation (POAF)) occur in up to 30-40 percent of patients and are associated with a higher risk of stroke and a longer stay in the hospital [19, 20]. Hemodynamic instability, wound infections, respiratory difficulties, thromboembolic events (particularly in diabetic or

immunocompromised patients) are also other frequent problems [21]. Neurocognitive dysfunction and post-operative delirium have also been commonly reported especially in older patients who have undergone a long period of cardiopulmonary bypass and such symptoms include memory loss, confusion, as well as temporary changes in personalities [22, 23]. Though survival rates have been boosted in the short term, most patients experience continued difficulties several months or even years after surgery. The daily functioning of up to 25-30 percent of patients is still impaired by chronic fatigue, chronic pain, and decreased physical endurance after technically successful surgery [24]. Mental illnesses such as depression, anxiety, and post-traumatic stress disorder (PTSD) have become one of the greatest obstacles to rehabilitation and a healthy quality of life [25]. It is indicated by longitudinal studies that depressed patients' post-CABG are less likely to undergo rehabilitation and spend more time in the ICU, which points to the high connection between the mental health and the recovery after surgery [26, 27]. With these complications, the modern-day cardiac practice has slowly evolved beyond the preoccupation with mere survival to a model of complete recovery. This strategy puts focus

on the physical, psychological, cognitive, and social well-being as critical aspects in long-term results [28]. Multidisciplinary rehabilitation teams (including cardiologists, surgeons, psychologists, physiotherapists, and social workers) are becoming widely known to reduce complications and improve the quality of life [29].

3. Mental Health Disorders in Cardiac Patients

The relationship between psychological functioning and cardiovascular disease is clinically important and what's more, bidirectional. The experience over the last five years indicates that depression, anxiety, and post-traumatic stress disorder (PTSD) constitute the primary psychological problems experienced by the patients who undergo such operations as CABG and valve replacement. These conditions promote a poor adherence to treatment, a delayed healing and an increase in morbidity and mortality [30, 31]. The most common condition is Depression, occurring 20-30 percent of cardiac patients in the post-major surgery period [32]. It is even said to be three times more prevalent in individuals with cardiovascular disease than in the masses [33]. Additional risks of complications and potentially death during the first year of post-surgery are also promoted by biological effects, including higher levels of inflammatory components (IL-6, CRP), dysregulation of the HPA-axis, and autonomic disregard [34]. **Anxiety** disorders are prevalent in 25-40 per cent of all post-operative patients, which tends to increase such physical symptoms as palpitations or chest pain, which in turn aggravates recovery [35]. According to a longitudinal study, increased anxiety levels in the post-CABG period were linked to an increased length of stay in the ICU and increased atrial fibrillation [36]. Long term anxiety maintains sympathetic overstimulation, increased cortisol levels and decreased immunity, slowing down wound healing [7]. The development of **PTSD** is also more seen in cardiac patients with 12-15 percent occurring within one year of surgery [37]. It is frequently associated with traumatic

events like ICU hospitalization or mechanical ventilation [38]. Symptoms get in the way of rehabilitation, and a 2023 meta-analysis stated that a 30% higher risk of recurrent cardiac events occurs within 2 years from a patient affected [39]. **Systemic inflammation**, autonomic dysfunction and platelet hyperactivity are common risk factors of psychological distress. More vulnerable groups include patients with the pre-existing psychiatric condition, low socioeconomic status, weak social support, or critical cardiac condition. The young patients, women, and those with weak support networks are the most affected [40].

Mental health is the determinant of recovery following cardiac surgery. Depression, anxiety, and post-traumatic stress disorder (PTSD) not only have effects on the psychological well-being but also determine wound healing, length of hospital stay, medication adherence, and general survival [41]. Several studies established that mental distress, in the absence of treatment, has a strong negative effect on the recovery process even with successful technically performing surgeries [42]. Abnormal release of cortisol, systemic inflammation and impaired immune response are closely related to depression and anxiety. This biological imbalance slows down wound healing and exposes one to the risk of developing a surgical site infection [43]. Depressed patients were almost twice as likely to become infected and have delayed wound healing as non-depressed patients [44]. Anxiety is an additional condition that worsens the recovery process due to continuous sympathetic stimulation that elevates blood pressure and decreases oxygen supply to tissues [45]. Consequently, psychologically distressed patients tend to have a longer hospital stay, on average, 35 days, and face a higher risk of having complications such as arrhythmia or respiratory instability, which demand ICU rehabilitation [46]. One of the most important interconnections between mental health and the outcome of the surgery is the adherence to medication prescriptions and rehabilitation programs. Depressed patients have a reduced adherence to medication by

30-40 percent [47] and anxiety predisposes avoidance behavior because of the fear of side effects. Likewise, attendance in cardiac rehabilitation (CR) programs is significantly low among the distressed patients [48]. According to a longitudinal study one-half of patients with depressive symptoms had completed CR sessions, versus 75% who did not. Such non-compliance and non-interaction lower the physical stamina in the long-term, postpones the social acclimatization, and diminishes the survival advantage [49]. In addition to these direct pathways, mental health has a large influence on the quality of life and prognosis. Fourthly, fatigue and functional limitations are still reported in nearly 30% of cardiac surgery patients six months after surgery, and depression was the best predictor [50]. In addition, study verified that depression almost doubles the chances of dying within five years of cardiac surgery and anxiety and PTSD elevate the risk of repeated cardiac events [51]. In sum, the evidence has highlighted that mental health should be part of the contemporary cardiac care. Psychosocial support and screening tools such as PHQ-9 and GAD-7 need to be incorporated into recovery practices so as to enhance recovery, improve rehabilitation as well as guarantee long-term survival. Mental health management is not thus an added procedure, but rather an essential part of full post-operating recovery [52].

4. Screening and Assessment Tools in Cardiac Patients

The study underscored the need to detect the presence of psychological distress among cardiac patients early enough. Validated screening tools are not only used in the detection of depression, anxiety, and PTSD but also used to predict operational results, readmission, and restoration [53]. The PHQ-9 has emerged as the standard of measuring depression in cardiac patients. One multi-center study involving 2,000 post-bypass patients followed them for 6 months and

found that high PHQ-9 scores doubled the risk of major adverse cardiac events. Likewise, a study noted a 30 percent rise in readmission rates to hospitals and reduced rehabilitation attendance by patients scoring high [54]. Generalized Anxiety Disorder-7 (GAD-7) is a popular scale of assessing anxiety after surgery. In a European study, patients scoring above 10 on GAD-7 were at risk of developing a 40% increase in ICU complications and increased stays (2021). In addition to risk prediction, it assists in the differentiation of anxiety symptoms (such as palpitations) and cardiac events to avoid unnecessary invasive tests [55]. Post-traumatic stress disorder may develop as a result of cardiac operation and ICU. The PCL-5 checklist is now proved in this population. A study conducted in the United States (2020) demonstrated that 15 per cent of patients receiving CABG developed PTSD in one year, and a meta-analysis published in Frontiers in Psychiatry revealed that PTSD symptoms enhanced recurrent cardiac events by 30%. Repeated screening is the most effective screening method, whether before surgery (to identify high-risk patients), during hospitalization (to identify acute distress), and after discharge (to identify delayed PTSD). According to the American Heart Association (2022), screening a single time only detects a quarter of the cases. In spite of the good evidence, it has been concluded that only 37 percent of cardiac centers across the world use the tools regularly because of time constraints, staffing gaps, and mental health stigma [56].

This table shows that **psychological distress significantly affects cardiac recovery outcomes**, with higher GAD-7 and PHQ-9 scores linked to increased ICU complications (40%) and readmission rates (30%). It also highlights that only 37% of cardiac centers regularly use screening tools, and 15% of CABG patients develop PTSD within a year.

Table 4.1: *Relationship Between Psychological Screening and Cardiac Outcomes*

Metric	Value (%)	Source / Context
Increase in ICU Complications (High GAD-7)	40%	Risk for patients scoring above 10 on the GAD-7.

Cardiac Centers Using Tools Regularly	37%	Percentage of cardiac centers worldwide that regularly use screening tools.
Readmission Rate Rise (High PHQ-9)	30%	Increase in hospital readmission rates for patients scoring high on the PHQ-9.
Increased Recurrent Cardiac Events (PTSD)	30%	Higher risk of recurrent cardiac events for patients with PTSD symptoms.
Cases Detected by Single Screening	25%	The percentage of cases detected if screening is performed only once.
Patients Developing PTSD Post-CABG	15%	Percentage of patients developing PTSD one year after receiving CABG.

5. Multi-Disciplinary Approach in Cardiac Care

The recovery period following a cardiac surgery is not a pure physical process, but a mental and social one. There is solid evidence that in the past five years, the use of a multi-disciplinary approach (MDA), incorporating cardiologists, surgeons, psychiatrists, psychologists, nurses and social workers, leads to better results in terms of recovery, complications and quality of life [57].

- **Cardiologists/Surgeons:** In addition to physical therapy, they incorporate mental health referrals in treatment. study that indicated that psychiatric collaboration decreased readmission rates by 20 percent [52].
- **Psychiatrists and Psychologists:** The psychiatrists are in charge of diagnosing and safe administration of drugs, and psychologists offer CBT and mindfulness programs. Studies showed these interventions increased completion rates of rehabilitation by 25% [58].
- **Nurses:** Since they are the first-line nurses, they detect emotional distress and support screening instruments (PHQ-9, GAD-7). Psychoeducation programs led by nurses decreased anxiety among patients by almost forty percent during the initial two weeks of the post-surgical period [59]
- **Social Workers:** Discuss social determinants including support in the family, employment and economic security. A study

demonstrated that patients with a social worker were better emotionally stable and had higher return-to-work [60]

According to recent trials, the effects of integrated care are apparent:

- A 2021 German randomized controlled trial integrating cardiology and psychiatry minimized the depressive symptoms and enhanced adherence by 15 percentage [61].
- According to American Heart Association (2022) hospitals that implemented MDA structures had a reduced hospital stay (1.5 days on average) and lower mortality rates within 30 days [62].
- In a 2020 study conducted in the UK, integration care models have been found to save 18% in healthcare costs due to a decrease in readmission and emergency visits [63]

Although proven beneficial, MDA also has a range of challenges that include shortage of mental health professionals, budgetary issues, and interdisciplinary ineffective communication. These need institutional commitment, policy support and cross-disciplinary training to address them [64].

The figure 5.1 showcases the positive impact of multidisciplinary care, with Nurses achieving the largest single improvement: a 40% reduction in Anxiety (Anxiety). Additionally, Psychiatrists & Psychologists boost Rehab Completion by (Rehab Completion), highlighting the strong, measurable benefits across different disciplines.

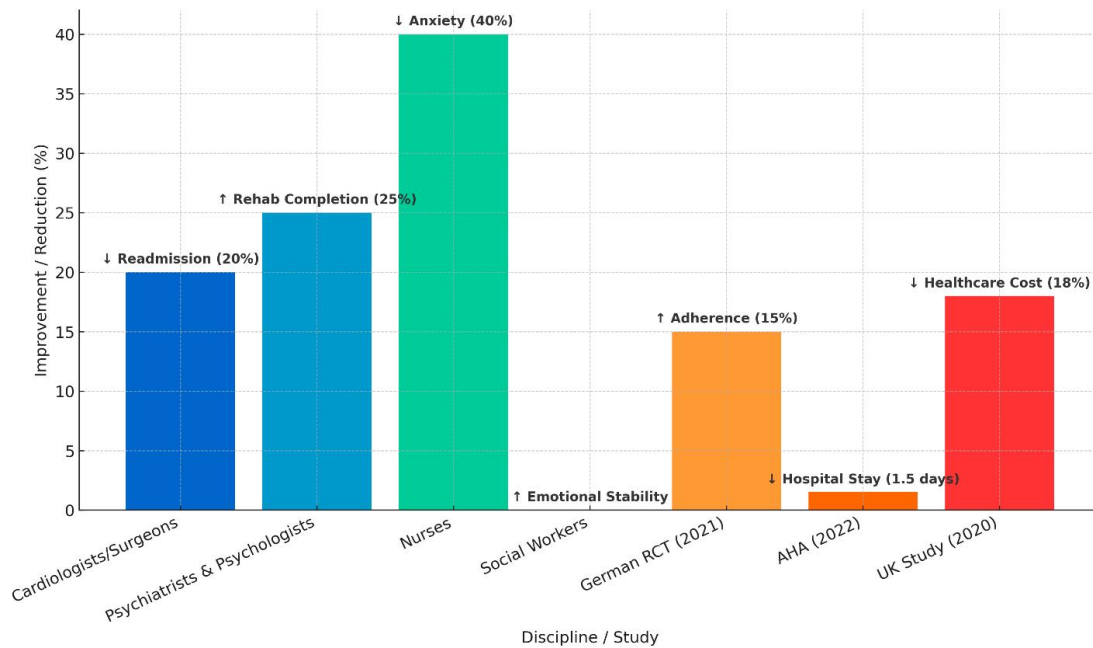


Figure 5.1: Impact of Multi-Disciplinary Approach (MDA) in Cardiac Care

6. Interventions and Management Solutions

The combination of medical, psychological, lifestyle, and digital interventions is necessary to enhance recovery following cardiac surgery. The evidence contained that depicts that integrated strategies decrease readmission, enhance adherence, and increase quality of life [57]. Selective serotonin reuptake inhibitors (SSRIs) like sertraline and escitalopram are the safest that can be used to achieve post-surgical depression and anxiety. In a recent multicenter study, cardiologists and psychiatrists had a reduction of 18% in adverse drug reactions when working together to prescribe. SADL and CBT has reduced the depression symptoms by 28% and mindfulness-based stress reduction (MBSR) has reduced anxiety and physiological stress markers in conjunction with medication. These treatments also enhance attendance of cardiac rehabilitation [65, 66]. The current cardiac rehabilitation has been integrated with psychological services other than exercise and diet programs. According to studies, this integrated model reduces the readmission rates up to 15% and enhances patient satisfaction. Exercise interventions in the form of a structured exercise plan lessen the depressive symptoms and nutrition counseling and family-based support enhance adherence to and emotional stability

[67]. Interventions via telehealth and mobile-based technologies, which have grown especially in the time of COVID-19, remain important. Virtual counseling, the establishment of online peer-support groups and remote mood monitoring make it more accessible and cost-effective. Mobile Depression Monitoring Apps in Individuals with a Major Depressive Episode. A Canadian randomized trial found people using mobile depression monitoring apps had a greater reduction in symptoms and more adherence than a follow-up in-person only [68].

7. Challenges and Barriers in Integrating Mental Health into Cardiac Care

The mental health stigma does not allow the patients to express their depression, anxiety, or PTSD symptoms openly. According to studies it is observed that the prevalence of depressive symptoms in cardiac patients remains mostly unreported, postponing the intervention and deteriorating recovery outcomes [69]. Reduced care is limited by the lack of trained mental health professionals in cardiac units. Survey cardiac centers only 25% of the centers offered specialized psychological services and most hospitals focused on physical recovery because of staff and time limitations [70]. Psychological care is not a well-funded and insurances do not cover it in most health systems. A study

demonstrated that uninsured patients were more likely to drop out of treatment twice. Inconsistency of detection of distress is also caused by the absence of standardized screening procedures (e.g., PHQ-9, GAD-7) [71]. The culture usually down-plays mental illness as it is considered to be normal stress and not a clinical issue. The language barrier also decreases the effectiveness of the screening tools and it becomes difficult to communicate effectively with the patient and the provider [72].

9. Discussion and Future Directions

There has been strong evidence on the strong association between mental health and heart recovery. Depression, anxiety, and post-traumatic stress disorder (PTSD) are not emotional states; they have direct influence on the biological processes including inflammatory pathways, hypothalamic-pituitary-adrenal (HPA) axis regulation, and vascular functioning. These biological imbalances lead to delayed recovery of wound, poor immunity as well as increased risk of cardiovascular complications. Moreover, psychologically distressed patients are not so inclined to adhere to the prescriptions of their medications, attend rehabilitation services, and continue to implement healthy lifestyle changes, which further postpones the recovery process. Mental health should therefore be treated as a necessity and not as an option in the pursuit of complete post-operative recovery [52]. Mental health is not given a priority in the routine cardiac practice, even though there is a great deal of scientific evidence. One of the biggest obstacles is stigma, in which most patients are reluctant to report on psychological symptoms because they are afraid of stigma. Low and middle-income countries have reported even greater levels of untreated depression and anxiety than high-income areas, and they lack healthcare equality, resources, and cultural obstacles. Besides, absence of uniform screening procedures implies that most of the conditions go undiagnosed. In even the well-equipped hospitals, attention is mostly paid to the physical recovery and emotional well-being is not taken into account [73]. Positively,

multidisciplinary care models are recording positive results. Interdisciplinary teams consisting of cardiologists, psychiatrists, psychologists, nurses, and social workers, in addition to lowering the readmission rates, also enhance the adherence to the treatment, emotional stability, and patient satisfaction. Psychoeducation led by nurses, cognitive behavioral therapy (CBT), and mindfulness-based interventions were shown to be effective in alleviating anxiety and depression, whereas social support programs also enhance the recovery. Nonetheless, access to this holistic care is not evenly distributed, and it is impossible to generalize these strategies to all institutions unless the institutional and policy level supports it [74]. In the future, a number of avenues can be used to enhance the incorporation of mental health in the heart care. To begin with, it is recommended to introduce regular application of validated screening instruments such as PHQ-9 and GAD-7 at the stages of pre-surgical, in-patient, and post-discharge. It is also necessary that the frontline workers, particularly nurses and cardiologists, are trained on how to detect psychological distress in the first place. Second, the digital innovations are scalable and cost-effective solutions. Mobile-based CBT, teletherapy, and wearable monitoring devices have demonstrated good outcomes in decreasing symptoms of depression and adherence, especially in the COVID-19 period and during and after the pandemic. The development of these tools in low resource environments would have the potential to enhance access [52]. Third, there is a need to focus more research on personalized care models that integrate both biological markers (inflammatory cytokines or cortisol) and psychological measurement to respond to tailored interventions. These models would not only enhance the results but also give a more accurate idea of the interaction of the mental and physical health. Lastly, the health policies should change to offer insurance coverage of psychological therapy and the inclusion of mental health in the usual cardiac procedures. Social support would also be very important in

maintaining the recovery and as such community and family-based interventions must be expanded. Working together in a way that brings together clinical practice, policy, digital innovation, and community engagement, future cardiac care can be on a trajectory to a truly holistic care paradigm. It is only under those circumstances that patients will not only recover physically but also get the psychological resilience, higher quality of life and long-term health sustainability [75].

10. CONCLUSION

Mental health has become one of the most definitive variables that define recovery outcomes following the cardiac surgery. The recent evidence has a significant connection between depression, anxiety, and PTSD and a long healing period, increased complications, and readmission to hospitals. Nevertheless, the psychological care continues to be underrepresented in the normal cardiac practice and thus patients face the risk of failure to fully recover. To transform this, cardiac care should incorporate proven screening instruments such as PHQ-9 and GAD-7 as routine protocols to help in early detection of the at-risk individuals. Frontline staff training and multidisciplinary models, i.e. cardiologists, psychologists, nurses and social workers working hand-in-hand can change the way patients are treated by lowering readmission rates and increasing compliance with rehabilitation. Also, electronic health services include tele-counseling, cell phones, and peer-support networks that offer affordable means of extending psychological care outside the hospital environment. In the future, the future of cardiac recovery is in adopting a holistic one whereby the mind is as important as the heart. The government needs to increase insurance coverage on psychological treatments, whereas research needs to be aimed at customization of the interventions through biological markers integration with mental health measurements. It is only through these gaps that we can ascertain that patients are not merely surviving another surgery, but they

are also recovering their strength, self-esteem and quality of life.

11. REFERENCES

1. Vervoort D, Pezzella AT. Global cardiac surgery and the global burden of disease. *Global Cardiac Surgery Capacity Development in Low and Middle Income Countries*: Springer; 2021. p. 101-6.
2. Mccann WD, Hou X-Y, Stolic S, Ireland MJ, editors. Predictors of psychological distress among post-operative cardiac patients: A narrative review. *Healthcare*; 2023: MDPI.
3. Chen X, Li D, He L, Yang W, Dai M, Lan L, et al. The prevalence of anxiety and depression in cardiac arrest survivors: A systematic review and meta-analysis. *General hospital psychiatry*. 2023;83:8-19.
4. v. Wintzingerode F, Göbel UB, Stackebrandt E. Determination of microbial diversity in environmental samples: pitfalls of PCR-based rRNA analysis. *FEMS microbiology reviews*. 1997;21(3):213-29.
5. Hou R, Westbury L, Fuggle N, Cooper C, Dennison E. Immune-endocrine biomarkers associated with mental health: a 9-year longitudinal investigation from the Hertfordshire Ageing Study. *Brain, Behavior, and Immunity*. 2022;101:146-52.
6. Hussey G, Young T. The impact of psychological factors on wound healing. *Wounds Int*. 2020;11(4):58-62.
7. Basu S, Goswami AG, David LE, Mudge E. Psychological stress on wound healing: a silent player in a complex background. *The international journal of lower extremity wounds*. 2024;23(3):365-71.
8. Walker ZJ, Xue S, Jones MP, Ravindran AV. Depression, anxiety, and other mental disorders in patients with cancer in low-and lower-middle-income countries: a systematic review and meta-analysis. *JCO global oncology*. 2021;7:1233-50.
9. Correa-Rodriguez M, Abu Ejheisheh M, Suleiman-Martos N, Membrive-Jiménez

- MJ, Velando-Soriano A, Schmidt-RioValle J, et al. Prevalence of depression in coronary artery bypass surgery: A systematic review and meta-analysis. *Journal of clinical medicine*. 2020;9(4):909.
10. Rameez S, Nasir A. Barriers to mental health treatment in primary care practice in low-and middle-income countries in a post-covid era: A systematic review. *Journal of Family Medicine and Primary Care*. 2023;12(8):1485-504.
11. Prajapati R, Liebling H. Accessing mental health services: A systematic review and meta-ethnography of the experiences of South Asian service users in the UK. *Journal of racial and ethnic health disparities*. 2022;9(2):598-619.
12. Waheed A, Afridi AK, Rana M, Arif M, Barrera T, Patel F, et al. Knowledge and behavior of primary care physicians regarding utilization of standardized tools in screening and assessment of anxiety, depression, and mood disorders at a large integrated health system. *Journal of primary care & community health*. 2024;15:21501319231224711.
13. Stinner D, Hendrickson SB, Vallier HA. Trauma system support to facilitate recovery. *Journal of Orthopaedic Trauma*. 2022;36:S6-S9.
14. Gregory AJ, Noss CD, Chun R, Gysel M, Prusinkiewicz C, Webb N, et al. Perioperative optimization of the cardiac surgical patient. *Canadian Journal of Cardiology*. 2023;39(4):497-514.
15. Doenst T, Schneider U, Can T, Caldonazo T, Diab M, Siemeni T, et al. Cardiac surgery 2021 reviewed. *The Thoracic and Cardiovascular Surgeon*. 2022;70(04):278-88.
16. Ojha U, Marshall D, Hammond-Haley M, Saliccioli J, Shalhoub J, Hartley A. Global variations in coronary revascularisation and acute myocardial infarction mortality between 2006-2020: a longitudinal, population-level analysis of 16 high-income nations from the OECD database. *European Heart Journal*. 2024;45(Supplement_1):ehae666. 3630.
17. Patel A, Ngo L, Woodman RJ, Aliprandi-Costa B, Bennetts J, Psaltis PJ, et al. Institutional variation in early mortality following isolated coronary artery bypass graft surgery. *International Journal of Cardiology*. 2022;362:35-41.
18. Chaney MA. Outcome after cardiac surgery: the devil is in the details. *Journal of Cardiothoracic and Vascular Anesthesia*. 2022;36(1):91-2.
19. Gaudino M, Di Franco A, Rong LQ, Piccini J, Mack M. Postoperative atrial fibrillation: from mechanisms to treatment. *European heart journal*. 2023;44(12):1020-39.
20. Shah S, Chahil V, Battisha A, Haq S, Kalra DK. Postoperative atrial fibrillation: a review. *Biomedicines*. 2024;12(9):1968.
21. Noreen N, Farhana WT, Yaqub KM, Lakho M, Saeed MA. Influence of Perioperative Hemodynamic Instability and Glycemic Control on Postoperative Complications in Patients Undergoing Major Abdominal Surgery. *Pakistan Journal of Medical & Health Sciences*. 2023;17(10):226-.
22. Raberi VS, Qazi MSK, GhorbaniNia R, Kahourian O, Zadeh RF. Postoperative delirium and dementia in patients undergoing cardiac surgery: a review of randomized controlled trials. *Galen Medical Journal*. 2023;12:e3045.
23. Kapoor MC. Neurological dysfunction after cardiac surgery and cardiac intensive care admission: A narrative review part 1: The problem; nomenclature; delirium and postoperative neurocognitive disorder; and the role of cardiac surgery and anesthesia. *Annals of Cardiac Anaesthesia*. 2020;23(4):383-90.
24. Barrie K, Cornick A, Debreuil S, Lee E, Hiebert B, Manji R, et al., editors. Patients with a prolonged intensive care unit length of stay have decreased health-related quality of life after cardiac surgery. *Seminars in thoracic and cardiovascular surgery*; 2019: Elsevier.

25. Teixeira C, Rosa RG, Sganzerla D, Sanchez EC, Robinson CC, Dietrich C, et al. The burden of mental illness among survivors of critical care—risk factors and impact on quality of life: a multicenter prospective cohort study. *Chest*. 2021;160(1):157-64.
26. Holcomb RM, Zil-E-Ali A, Gonzalez R, Dowling RD, Shen C, Aziz F. Depression Is Associated With Non-Home Discharge After Coronary Artery Bypass Graft. *Journal of Surgical Research*. 2023;290:232-40.
27. Jobson MC, Rajendran A. Depression, Anxiety and Cardiac Surgery in the Indian scenario: a review. *Indian Journal of Mental Health*. 2020;7(3).
28. Ullah A, Kumar M, Sayyar M, Sapna F, John C, Memon S, et al. Revolutionizing cardiac care: a comprehensive narrative review of cardiac rehabilitation and the evolution of cardiovascular medicine. *Cureus*. 2023;15(10).
29. Smoor RM, van Dongen EP, Daeter EJ, Emmelot-Vonk MH, Cremer OL, Vernooij LM, et al. The association between preoperative multidisciplinary team care and patient outcome in frail patients undergoing cardiac surgery. *The Journal of Thoracic and Cardiovascular Surgery*. 2024;168(2):608-16. e5.
30. Szczepanowski R, Wójta-Kempa M, Pawlak A, Kolasa J, Uchmanowicz I, Czapla M, et al. Depressive and anxiety disorders in the cardiologic conditions: psychological interventions. *Medical Research Journal*. 2022;7(4):333-9.
31. Mazza M, Biondi-Zoccai G, Lisci FM, Brisi C, Sfratta G, Rossi S, et al. The Brain-Heart Axis: An Umbrella Review on Impact of Psychiatric Disease on Incidence, Management, and Outlook of Cardiovascular Disease. *Life*. 2024;14(8):919.
32. Vu T, Smith JA. The pathophysiology and management of depression in cardiac surgery patients. *Frontiers in Psychiatry*. 2023;14:1195028.
33. Leung TJ, Nijland N, Gerdes VE, Loos BG. Prevalence of periodontal disease among patients at the outpatient clinic of internal medicine in an academic hospital in the Netherlands: a cross-sectional pilot study. *Journal of Clinical Medicine*. 2022;11(20):6018.
34. Plas M, Rutgers A, van der Wal-Huisman H, de Haan JJ, Absalom AR, de Bock GH, et al. The association between the inflammatory response to surgery and postoperative complications in older patients with cancer; a prospective prognostic factor study. *Journal of Geriatric Oncology*. 2020;11(5):873-9.
35. Storer B, Kershaw KA, Braund TA, Chakouch C, Coleshill MJ, Haffar S, et al. Global prevalence of anxiety in adult cardiology outpatients: A systematic review and meta-analysis. *Current problems in cardiology*. 2023;48(11):101877.
36. Kayhan SA, Güner E, Hanedan MO, Çolak ET, Mataraci I. Relationship between preoperative anxiety and atrial fibrillation after coronary artery bypass graft surgery. *Journal of Nursing Research*. 2022;30(1):e187.
37. Jacquet-Smailovic M, Tarquinio C, Alla F, Denis I, Kirche A, Tarquinio C, et al. Posttraumatic stress disorder following myocardial infarction: a systematic review. *Journal of Traumatic Stress*. 2021;34(1):190-9.
38. Wu VKS, Fong C, Walters AM, Lele AV. Prevalence, clinical characteristics, and outcomes related to ventilator-associated events in neurocritically ill patients. *Neurocritical Care*. 2020;33(2):499-507.
39. Dibben GO, Faulkner J, Oldridge N, Rees K, Thompson DR, Zwisler A-D, et al. Exercise-based cardiac rehabilitation for coronary heart disease: a meta-analysis. *European heart journal*. 2023;44(6):452-69.
40. Lawn RB, Murchland AR, Kim Y, Chibnik LB, Tworoger SS, Rimm EB, et al. Trauma, psychological distress and markers of systemic inflammation among US women: A longitudinal study.

- Psychoneuroendocrinology. 2022;145:105915.
41. Biondi F, Aprossoff J, Dowell G, Taylor T, Yoon S, Kertsman E, et al. Identifying Selected Mental Health, Physical, and Social Determinants of Extended Length of Stay After Elective Cardiac Surgery. *Journal of Cardiovascular Nursing*. 2025;10.1097.
 42. Tigges-Limmer K, Sitzler M, Gummert J. Perioperative psychological interventions in heart surgery: Opportunities and clinical benefit. *Deutsches Ärzteblatt International*. 2021;118(19-20):339.
 43. Decker AM, Kapila YL, Wang HL. The psychobiological links between chronic stress-related diseases, periodontal/peri-implant diseases, and wound healing. *Periodontology* 2000. 2021;87(1):94-106.
 44. Theodore DA, Goodwin RD, Zhang Y, Schneider N, Gordon RJ, editors. History of depression and increased risk of sternal wound infection after cardiothoracic surgery: a novel and potentially modifiable risk factor. *Open Forum Infectious Diseases*; 2019: Oxford University Press US.
 45. Boehm LM, Bird CM, Warren AM, Danesh V, Hosey MM, McPeake J, et al. Understanding and managing anxiety sensitivity during critical illness and long-term recovery. *American Journal of Critical Care*. 2023;32(6):449-57.
 46. Garcia M, Moazzami K, Almuwaqqat Z, Young A, Okoh A, Shah AJ, et al. Psychological distress and the risk of adverse cardiovascular outcomes in patients with coronary heart disease. *JACC: Advances*. 2024;3(2):100794.
 47. Khalifeh AH, Hamdan-Mansour AM. Prevalence, barriers, and interventions related to medication adherence among patients with major depressive disorder: a scoping review. *Journal of psychosocial nursing and mental health services*. 2021;59(1):39-51.
 48. Middleton WA, Savage PD, Khadanga S, Rengo JL, Ades PA, Gaalema DE. Anxiety predicts worse cardiorespiratory fitness outcomes in cardiac rehabilitation for lower socioeconomic status patients. *Journal of cardiopulmonary rehabilitation and prevention*. 2024;44(3):162-7.
 49. Graham HL, Lac A, Lee H, Benton MJ. Predicting long-term mortality, morbidity, and survival outcomes following a cardiac event: a cardiac rehabilitation study. *Rehabilitation Process and Outcome*. 2019;8:1179572719827610.
 50. Chou HL, Yang TH, Lin HH, Hsu HL, Chiou AF. Fatigue trajectory and its associated factors in patients after cardiac surgery: A longitudinal study. *Journal of Clinical Nursing*. 2023;32(15-16):4638-48.
 51. Rosson S, Monaco F, Miola A, Cascino G, Stubbs B, Correll CU, et al. Longitudinal course of depressive, anxiety, and posttraumatic stress disorder symptoms after heart surgery: a meta-analysis of 94 studies. *Biopsychosocial Science and Medicine*. 2021;83(1):85-93.
 52. Borkowski P, Borkowska N. Understanding mental health challenges in cardiovascular care. *Cureus*. 2024;16(2).
 53. Levitt E, Syan S, Sousa S, Costello M, Rush B, Samokhvalov A, et al. Optimizing screening for depression, anxiety disorders, and post-traumatic stress disorder in inpatient addiction treatment: A preliminary investigation. *Addictive behaviors*. 2021;112:106649.
 54. Di Matteo R, Bolgeo T, Simonelli N, Dal Molin A, Bassola B, Lusignani M, et al. Psychometric Properties and Measurement Invariance of the Patient Health Questionnaire 9 in an Italian Coronary Heart Disease Population. *Journal of Cardiovascular Nursing*. 2025.
 55. Bolgeo T, Di Matteo R, Simonelli N, Dal Molin A, Lusignani M, Bassola B, et al. Psychometric properties and measurement invariance of the 7-item General Anxiety Disorder scale (GAD-7) in an Italian coronary heart disease

- population. *Journal of affective disorders*. 2023;334:213-9.
56. Roy R, Mayer MM, Dzekem BS, Laiteerapong N. Screening for Emotional Distress in Patients with Cardiovascular Disease. *Current Cardiology Reports*. 2023;25(10):1165-74.
 57. Yeh S-H, Ma J-C, Chou P-L. Enhanced Recovery After Surgery: An Example of Integrated Care for Coronary Artery Bypass Graft Surgery. *Hu Li Za Zhi*. 2024;71(3):93-103.
 58. Zahid MA, Nasir H, Saleh M, Ahmed S. Why we need pain psychologists/pain psychiatrists as integral part of every pain clinic? *Anaesthesia, Pain & Intensive Care*. 2024;28(6):977-81.
 59. Elbashier IM, Ali KM. Effectiveness of Psycho-Educational Program on Psychological Outcomes among Patients Undergoing Cardiac Surgery in Khartoum-2017. *Nur Primary Care*. 2019;3(1):1-5.
 60. Holder N, Holliday R, Ranney RM, Bernhard PA, Vogt D, Hoffmire CA, et al. Relationship of social determinants of health with symptom severity among Veterans and non-Veterans with probable posttraumatic stress disorder or depression. *Social psychiatry and psychiatric epidemiology*. 2023;58(10):1523-34.
 61. Pedersen SS, Andersen CM, Ahm R, Skovbakke SJ, Kok R, Helmark C, et al. Efficacy and cost-effectiveness of a therapist-assisted web-based intervention for depression and anxiety in patients with ischemic heart disease attending cardiac rehabilitation [eMindYourHeart trial]: a randomised controlled trial protocol. *BMC Cardiovascular Disorders*. 2021;21(1):20.
 62. Tsao CW, Aday AW, Almarzooq ZI, Alonso A, Beaton AZ, Bittencourt MS, et al. Heart disease and stroke statistics—2022 update: a report from the American Heart Association. *Circulation*. 2022;145(8):e153-e639.
 63. Yu V, Wyatt S, Woodall M, Mahmud S, Klaire V, Bailey K, et al. Hospital admissions after vertical integration of general practices with an acute hospital: a retrospective synthetic matched controlled database study. *British Journal of General Practice*. 2020.
 64. Abdul S, Adeghe EP, Adegoke BO, Adegoke AA, Udedeh EH. Mental health management in healthcare organizations: Challenges and strategies—a review. *International Medical Science Research Journal*. 2024;4(5):585-605.
 65. Hoge EA, Bui E, Mete M, Dutton MA, Baker AW, Simon NM. Mindfulness-based stress reduction vs escitalopram for the treatment of adults with anxiety disorders: a randomized clinical trial. *JAMA psychiatry*. 2023;80(1):13-21.
 66. Silverman AL, Herzog AA, Silverman DI. Hearts and minds: stress, anxiety, and depression: unsung risk factors for cardiovascular disease. *Cardiology in review*. 2019;27(4):202-7.
 67. Guo M, Gu M, Gu Y, Zhu J, Huo B, Wang D. The impacts of the combination service model of cardiac rehabilitation on patient outcomes: evidence from a hospital experience. *Biotechnology and Genetic Engineering Reviews*. 2024;40(1):92-111.
 68. McIntyre RS, Greenleaf W, Bulaj G, Taylor ST, Mitsi G, Saliu D, et al. Digital health technologies and major depressive disorder. *CNS spectrums*. 2023;28(6):662-73.
 69. Karami N, Kazeminia M, Karami A, Salimi Y, Ziapour A, Janjani P. Global prevalence of depression, anxiety, and stress in cardiac patients: a systematic review and meta-analysis. *Journal of Affective Disorders*. 2023;324:175-89.
 70. Presciutti A, Newman MM, Sawyer KN, Agarwal S, Perman SM. Gaps in the provision of cognitive and psychological resources in cardiac arrest survivors with good neurologic recovery. *Therapeutic Hypothermia and Temperature Management*. 2022;12(2):61-7.
 71. Tunks A, Berry C, Strauss C, Nyikavaranda P, Ford E. Patients' perspectives of barriers and facilitators to accessing support through primary

- care for common mental health problems in England: A systematic review. 2023.
72. Do C, Le TH, Nguyen E, Pak TK. Navigating the discussion of mental illness with Vietnamese Americans. *Journal of Psychiatric Practice*®. 2024;30(2):95-103.
 73. Kohlmann S. Depression screening in patients with coronary heart disease: A narrative review of the current evidence. *Herz*. 2024;49(4):261-9.
 74. Singh A, Riaz R, Verma A, Irfan H, Shaukat A, Nadeem A, et al. Integrating mental health and cardiovascular wellness: synergistic impacts and the promise of comprehensive care models. *Annals of Medicine and Surgery*. 2025;87(8):4963-74.
 75. Castiello T. The Benefits and Challenges of Digitally-Enabled Cardiology. *British Journal of Hospital Medicine*. 2025;86(5):1-6.
 76. Brooks G, Weerakkody R, Harris M, Stewart R, Perera G. Cardiac surgery receipt and outcomes for people using secondary mental healthcare services: Retrospective cohort study using a large mental healthcare database in South London. *European Psychiatry*. 2022;65(1):e67.
 77. Oishe OF, Islam S, Pakrad P, Chikatimalla R, Jain R. Mental Health Sequelae of Cardiac Events: A Comprehensive Review of Biological Mechanisms, Prevalence, and Interdisciplinary Care Approaches. *Cardiology in Review*. 10.1097.

