

Impact of Anxiety on Medication Adherence in Cardiovascular Disease: A Comprehensive Review

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ABSTRACT

Cardiovascular Diseases (CVD) are a major cause of illness and death worldwide. Medication adherence is vital for managing these diseases. Psychological factors, especially anxiety, greatly affect adherence in this group. This review collects current evidence on the connection between anxiety and medication adherence in cardiovascular patients. A wide literature search was done to gather information on anxiety rates, biological and social factors, assessment tools, and treatment strategies. Anxiety is common among CVD patients and harms medication adherence through emotional and thinking processes. Important demographic and clinical factors influence this connection. Psychological and technology-assisted treatments show promise in improving adherence and patient outcomes. Regular anxiety screening and care models that combine mental health and cardiovascular services are crucial for improving medication adherence. Future research should focus on culturally appropriate interventions and using digital health tools to boost adherence and quality of life for CVD patients.

Keywords: Anxiety, Cardiovascular Disease, Cognitive Behavioral Therapy, Medication Adherence, Patient Compliance.

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INTRODUCTION

Overview of Cardiovascular Diseases (CVD)

CVD represent a primary cause of global mortality and a significant healthcare challenge, with projections indicating an increase in crude prevalence from 598 million in 2025 to 1.14 billion by 2050. Ischemic heart disease continues to be the most common form of CVD, followed closely by peripheral artery disease. Despite medical advancements, total mortality is anticipated to escalate from 20.5 million in 2025 to 35.6 million by 2050, primarily due to the aging population. Age-standardized mortality rates are forecasted to decrease by 30.5%, signifying enhancements in medical care. Key risk factors include high systolic blood pressure, dietary risks, and elevated cholesterol levels. Geographic and gender disparities underscore the necessity for region-specific interventions and customized preventive strategies to address the increasing global burden of CVD (Chong *et al.*, 2025).

Importance of Medication Adherence

Medication adherence is crucial for managing chronic diseases. It affects disease control, hospitalization rates, and quality of life. Psychological factors such as motivation, thinking, stress, and social support greatly influence adherence. By contrast, issues like distress, side effects, and forgetfulness can make it harder. We can improve adherence and outcomes by addressing these issues with behavioral and psychological methods like cognitive-behavioral therapy, motivational interviewing, and patient education. Since adherence is influenced by biological, psychological, and social factors, care that combines medical, psychological, and social support is important. In conditions like cardiovascular disease and diabetes, consistent adherence helps prevent complications. Digital tools like mobile apps and wearables can also improve medication management and long-term health outcomes (Sanchis-Gomar and Lippi, 2025; Yazdani and Parsa, 2025; Zeng *et al.*, 2025).

Rationale for Examining the Relationship Between Anxiety and Medication Adherence

Investigating the link between anxiety and medication adherence is essential for improving outcomes in cardiovascular patients. Anxiety affects emotional regulation and cognitive functions, making it difficult for patients to follow complex medication schedules. This leads to lower adherence rates, increasing the risk of negative cardiovascular events and hospitalizations (Ashour *et al.*, 2024; Wells and Kelley).



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Epidemiology of Anxiety in CVD

Prevalence Rates of Anxiety Among Different CVD Populations

Prevalence rates of anxiety among different CVD populations vary significantly, with an overall anxiety prevalence of 23.2% in patients with CVD. Subgroup analyses show higher anxiety rates in patients with heart failure (approx. 24.7%) and coronary artery disease (around 19.8% for depression, but anxiety prevalence is also reported). A cross-sectional study in Nepal found notably higher anxiety prevalence among people with cardiovascular risk status at 62.3%. Factors like female sex, smoke exposure, and accumulation of multiple CVD risk factors were associated with increased anxiety symptoms. Anxiety prevalence varies by region and demographic factors, with disparities linked to ethnic groups and socioeconomic conditions. These findings underline the high comorbidity of anxiety in CVD patients and the need for integrated mental health screening and interventions (Ojha *et al.*, 2025).

Demographic Factors Influencing Anxiety Levels

Demographic factors significantly influence anxiety levels among CVD patients. Studies show that female patients exhibit higher anxiety and depression scores compared to males, potentially due to hormonal fluctuations, social roles, and cultural factors. Age is another crucial factor, with patients over 60 years more likely to have higher anxiety and depression levels than younger groups, possibly linked to isolation and disease burden. Educational status also impacts anxiety, with illiterate and less-educated patients showing higher symptoms compared to those with higher education. Marital status plays a role, too; divorced and widowed individuals are at increased risk of anxiety and depression compared to married patients. Overall, sex, age, education, and marital status are key predictors of anxiety levels in CVD populations, underscoring the need for tailored mental-health interventions (Sisay *et al.*, 2024).

Co-occurrence with Other Psychological Conditions Like Depression

Depression frequently co-occurs with anxiety in cardiovascular disease patients, with studies showing a 20.8% prevalence of depression and 23.2% anxiety among them. The co-occurrence of these psychological conditions worsens clinical outcomes and increases all-cause mortality risk. Meta-analyses indicate strong associations between CVD subtypes, such as coronary artery disease, myocardial infarction, and heart failure, with depression and anxiety symptoms. Genetic studies through Mendelian randomization suggest depression may causally contribute to the development and progression of specific CVDs. This comorbidity necessitates integrated mental health screening and management within cardiovascular care to improve prognosis and quality of life (Bojanić *et al.*, 2021).

Mechanisms Linking Anxiety and Medication Adherence

Psychological Mechanisms

Anxiety is often underpinned by psychological mechanisms that include fear, catastrophic thinking, and avoidance behaviors, which collectively reinforce and prolong distress.

Fear is an immediate reaction to perceived threats, activating fight-or-flight responses, while anxiety is more anticipatory, focusing on potential future dangers. Catastrophic thinking refers to the irrational and exaggerated negative interpretations of events, which amplify perceived threats and emotional distress.

In chronic conditions like musculoskeletal pain or anxiety stemming from sports injuries, the fear of pain or reinjury can lead to avoidance behaviors, causing individuals to distance themselves from activities that may result in discomfort, thereby reinforcing both disability and anxiety. These avoidance behaviors are negatively reinforced, as the temporary alleviation of distress from avoiding pain ultimately sustains fear and functional limitations (Alaiti *et al.*, 2025).

Cognitive-behavioral methods, such as exposure therapy and cognitive restructuring, are designed to target these mechanisms by challenging irrational beliefs and gradually reintroducing avoided activities, thereby breaking the cycle of fear and avoidance and facilitating recovery. Understanding these mechanisms is crucial for the development of effective psychological and rehabilitative strategies (Ohi *et al.*, 2025).

Pathophysiological Pathways

Pathophysiological pathways linking anxiety, depression, and cardiovascular diseases involve complex interactions between neuroinflammation, immune dysregulation, and autonomic nervous system dysfunction. Chronic inflammation, characterized by elevated proinflammatory cytokines such as IL-1, IL-6, and TNF, plays a central role in sustaining systemic and neuroinflammatory states. This inflammation disrupts the blood-brain barrier, leading to microglial activation and altered neurotransmitter metabolism, including a shift of tryptophan metabolism from serotonin to neurotoxic kynurenine metabolites, contributing to depressive symptoms. Stress activates the hypothalamic-pituitary-adrenal axis, resulting in glucocorticoid imbalances that further enhance immune dysregulation and inflammatory signaling via NF- κ B and β -adrenergic pathways (Figure 1) (Hole *et al.*, 2025). Obesity and high-fat diets induce hypothalamic inflammation through mechanisms involving toll-like receptor 4 activation, angiotensin II, and circulating damaged mitochondria that stimulate the cGAS pathway, leading to sympathetic hyperactivity and endothelial dysfunction (Stathori *et al.*, 2025). This sympathetic overactivity promotes cardiovascular disease through endothelial damage and hypertension. Autonomic dysfunction in conditions like end-stage renal disease further illustrates the interplay

of impaired HR variability, inflammation, and immune cell modulation. Some treatments, including Selective Serotonin Reuptake Inhibitors (SSRIs), MAOIs, and GLP-1 receptor agonists, exhibit anti-inflammatory properties that influence these pathways, potentially improving both psychiatric and cardiovascular outcomes (Seibert *et al.*, 2016).

Behavioral Factors

Behavioral factors have a strong impact on how chronic diseases, like cardiovascular disease, diabetes, and cancer, are managed and their outcomes. Psychological interventions, such as motivational interviewing, cognitive-behavioral therapy, mindfulness, and relaxation, encourage people to adopt healthier lifestyles, manage stress, and stick to their treatment plans. Chronic stress can worsen disease progression by causing physiological effects and promoting unhealthy behaviors. Social support, self-regulation, and health literacy help people cope and maintain changes in behavior, while obstacles like stigma, fear, and financial issues can make it harder to follow treatment. The Health Belief Model guides integrated care that combines medical, behavioral, and psychosocial approaches to improve overall health and manage chronic diseases (Fang *et al.*, 2025; Yazdani and Parsa, 2025).

Impact of Anxiety on Medication Adherence

Evidence from Research Studies

Evidence consistently shows that anxiety and depression greatly affect the risk of CVD and medication adherence. Systematic reviews identify these mood disorders as strong predictors of hypertension, sometimes surpassing traditional factors like obesity and smoking. Comorbid anxiety and depression are especially common among women, younger adults, and low-income or minority groups. Longitudinal studies connect depression to hypertension through pathways involving inflammation and autonomic dysregulation. In chronic conditions like heart failure and diabetes, mood disorders reduce adherence by impacting cognition and self-care, while patient satisfaction and continuity of care improve it. Although some studies report mixed findings on the direct effects of depression, the overall evidence emphasizes the need to include psychosocial assessment and support in CVD management (Ekanmian *et al.*, 2025; Szymczak *et al.*, 2025).

Statistical Relationships

Research evidence from statistical analyses shows a significant relationship between anxiety and CVD. A large population study found that symptoms of anxiety and depression are linked to both intentional and unintentional medication nonadherence, with odds ratios ranging from 1.33 to 2.60. Anxiety is connected to a fear of adverse drug reactions, while depression relates to the actual occurrence of these reactions. This contributes to nonadherence and worsened outcomes. Another study of asthma patients revealed an anxiety prevalence of 27.2%. Moreover, anxiety negatively correlates with disease control ($r=-0.29$, $p<0.001$)

and adherence to inhalers ($r=-0.32$, $p<0.001$). Telemedicine interventions have been shown to improve medication adherence in patients with mental disorders, with an effect size (Hedges' g) of 0.25 (95% CI=0.12-0.38, $p=0.01$). These findings highlight the two-way impact of anxiety on CVD through behavioral and physiological pathways (Mojtaba Alavi, 2020; Wang *et al.*, 2025).

Influence of Anxiety Sensitivity and Somatic Symptoms

Anxiety sensitivity and physical symptoms play a major role in medication adherence for CVD. Research shows that higher anxiety sensitivity, which involves a fear of physical sensations, leads to increased alertness and misinterpretation of bodily symptoms. This often results in avoidance behaviors and poor adherence to treatment. Symptoms like palpitations or breathlessness can be wrongly seen as signs of worsening heart issues, creating anxiety that makes patients less willing or able to follow their medication plans. Reviews of studies on older CVD patients indicate that depression, which often occurs alongside anxiety, reduces medication adherence by about 40%, with odds ratios around 0.6. These psychological issues impact self-efficacy and health behaviors, leading to worse clinical outcomes. Addressing anxiety sensitivity through combined psychosocial support may improve adherence and overall heart health (Berimavandi *et al.*, 2025; Siraj, 2025).

Variability Based on Type and Timing of Anxiety

Variability in the effect of anxiety on medication adherence in CVD depends on the type and timing of anxiety. Longitudinal studies in postcoronary artery Bypass Graft (CABG) patients show anxiety levels significantly decrease from admission to discharge in rehabilitation, but patients with preexisting stress and co-occurring depression tend to have persistently higher anxiety, negatively impacting adherence. Timing matters as acute anxiety pre- and post-surgery can impede recovery and adherence, whereas anxiety reduction during rehabilitation improves outcomes. Different anxiety types, including state anxiety (momentary) versus trait anxiety (chronic), have varying impacts on motivation and adherence behaviors. Integrated cardiac rehabilitation combining psychological support with physical care enhances adherence by addressing anxiety fluctuations across recovery phases (Carola *et al.*, 2025; Panzeri *et al.*, 2025; Sharma *et al.*, 2025).

Methods of Assessing Anxiety and Adherence

Anxiety Assessment Tools

Generalized anxiety disorder 7-item (GAD-7) The GAD-7 tool is a brief, validated screening instrument used to identify and assess the severity of generalized anxiety disorder symptoms. It comprises seven items, each scored from 0 (not at all) to 3 (nearly every day), resulting in a total score ranging from 0 to 21 (Figure 2). Score thresholds categorize anxiety severity as

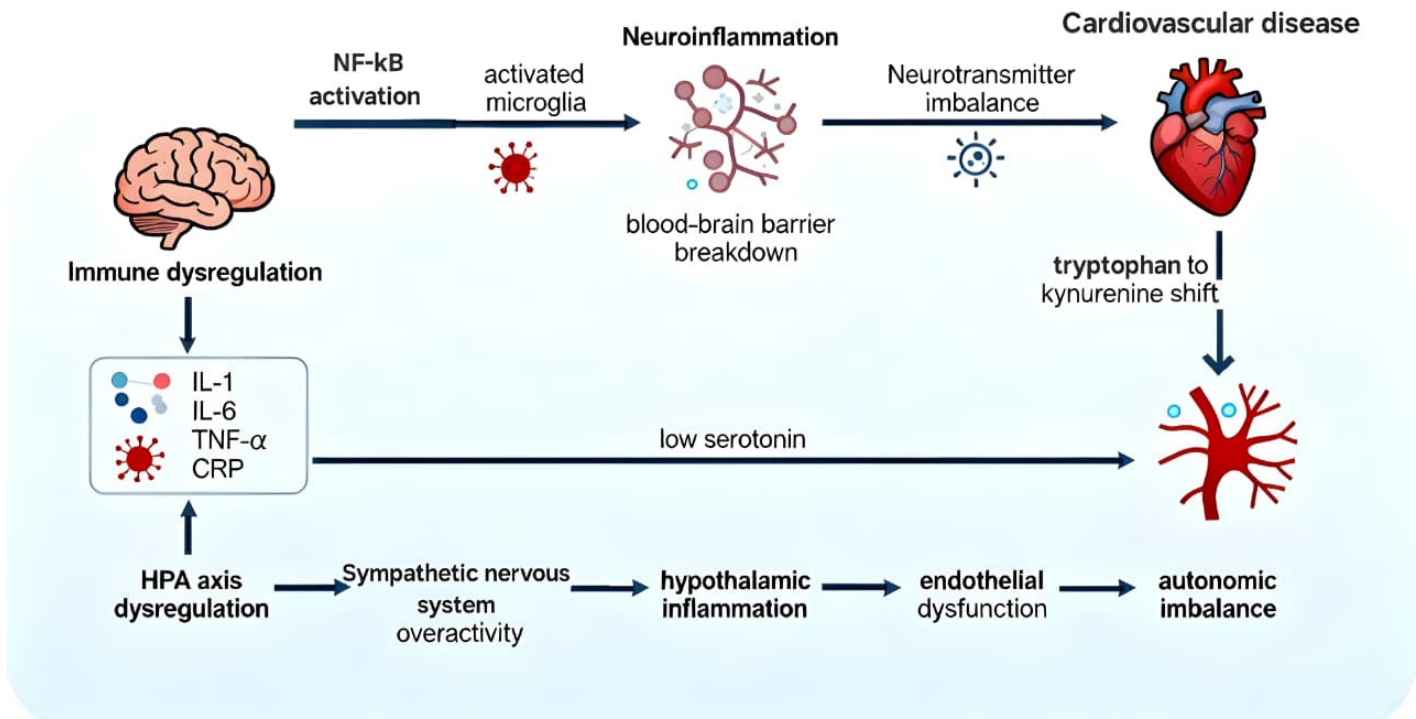


Figure 1: Immune, neuroendocrine, and autonomic mechanisms in anxiety-associated cardiovascular disease (Hole *et al.*, 2025; Seibert *et al.*, 2016; Stathori *et al.*, 2025).

mild (5), moderate (10), and severe (15). The tool is designed for quick administration in clinical settings and is highly specific and sensitive for detecting anxiety. Its use improves accuracy in diagnosis and facilitates timely intervention, making it a valuable resource in both mental health and primary care (Scholarworks and Allwell).

HADS-A

The HADS-A is a common screening tool used to assess anxiety symptoms in both clinical and nonclinical groups, including those with heart diseases. It is part of the Hospital Anxiety and Depression Scale (HADS), which has 14 items split into two subscales: anxiety (HADS-A) and depression (HADS-D), with 7 items each. The HADS-A subscale aims to evaluate generalized anxiety symptoms while avoiding somatic symptoms that could overlap with medical issues. This makes it especially suitable for patients with health conditions. Each item is scored on a 4-point scale (0-3), giving a total score between 0 and 21; higher scores indicate more severe anxiety (Figure 3). The score cut-offs generally classify anxiety as normal (0-7), borderline abnormal (8-10), or abnormal (11-21). Its brevity, simplicity, and reliability have made the HADS-A a preferred assessment tool in cardiovascular research and clinical practice for identifying patients with clinically significant anxiety symptoms that could affect their health outcomes, such as sticking to prescribed medications (Chen *et al.*, 2025; Julious *et al.*, 1997).

Adherence Measurement Methods

MMAS-8

The Morisky Medication Adherence Scale (MMAS-8) has eight items in a self-report format. It is well-known for assessing medication adherence in chronic conditions, especially cardiovascular diseases. Seven items are scored with a yes/no format, while the eighth item uses a 5-point Likert scale. This gives total scores ranging from 0 to 8 (Figure 4). Scores below 6 indicate low adherence, scores of 6-7 suggest moderate adherence, and a score of 8 shows high adherence. The MMAS-8 looks at both behaviors and emotional or situational factors that contribute to nonadherence, such as forgetfulness, the complexity of medication schedules, and individual patient beliefs. Its strength comes from its simplicity, low cost, and its ability to identify barriers to taking medication effectively. Research has shown it is reliable, with Cronbach's alpha values going as high as 0.87 and demonstrating strong test-retest reliability. However, self-reported tools like the MMAS-8 can overstate adherence compared to objective measures. Still, the MMAS-8 is a useful tool for screening in clinical settings and research, helping to identify patients at risk and tailor interventions as needed (Dunbar-Jacob and Zhao, 2025).

Pharmacy refill data offers a clear measure of how well CVD patients stick to their medication. A study at the Sudan Heart Centre using the Adherence to Refills and Medication Scale found a 97.6% nonadherence rate. This was mainly due to dosing

mistakes, intentional skips, forgetfulness, cost issues, and delays in refilling. Factors like age, education, and unemployment also played a role in poor adherence. Similar international studies show that missed refills, complex medication schedules, and cost problems lead to low adherence. Additionally, psychological factors such as anxiety are linked to inconsistent refilling and negative outcomes (Mahmoud *et al.*, 2025).

Furthermore, studies on electronic monitoring after PCI showed different patterns of adherence. These included declining, persistently low, and improving adherence. Predictors of poor adherence were high BMI, taking many medications, low eHealth literacy, weak social support, and negative views about illness. These findings indicate that electronic adherence monitoring effectively spots patients at risk and highlights the need for tailored interventions that address the social and behavioral factors affecting adherence in CVD care (Dai *et al.*, 2025).

Limitations in Measurement of Medication Adherence

Accuracy and Validity Issues

Different methods for measuring adherence, including self-reports, pharmacy refill data, and electronic monitoring, each come with

their own limitations. Self-reports can suffer from recall bias and social desirability, often leading to overestimations of adherence. Pharmacy refill records do not confirm actual medication intake and may also overestimate adherence. Electronic monitoring is accurate, but it can be expensive and may alter patient behavior (Mahmoud *et al.*, 2025).

Data Quality and Completeness

Real-world data sources, such as electronic health records and pharmacy databases, often have missing, inconsistent, or incomplete information. The lack of connections between prescribing and dispensing data, along with missing clinical details, makes it hard to reliably assess adherence and its direct link to clinical outcomes (Dai *et al.*, 2025).

Implementation and Practical Barriers

Measuring adherence in everyday clinical practice faces obstacles like variations in the timing of data collection, patient preferences regarding pharmacy choice, limited integration of different adherence elements, and challenges in capturing subtle behavioral factors that affect adherence. These issues hinder the consistent implementation and interpretation of adherence measures in

GAD-7				
Over the <u>last 2 weeks</u> , how often have you been bothered by the following problems?	Not at all	Several days	More than half the days	Nearly every day
1. Feeling nervous, anxious or on edge	0	1	2	3
2. Not being able to stop or control worrying	0	1	2	3
3. Worrying too much about different things	0	1	2	3
4. Trouble relaxing	0	1	2	3
5. Being so restless that it is hard to sit still	0	1	2	3
6. Becoming easily annoyed or irritable	0	1	2	3
7. Feeling afraid as if something awful might happen	0	1	2	3

Total Score — = Add Columns — + — + —

If you checked off any problems, how difficult have these problems made it for you to do your work, take care of things at home, or get along with other people?

Not difficult at all ☐	Somewhat difficult ☐	Very difficult ☐	Extremely difficult ☐
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Figure 2: The Generalized Anxiety Disorder 7-item (GAD-7) scale.

Hospital Anxiety and Depression Scale (HADS)

Instructions: Doctors are aware that emotions play an important part in most illnesses. If your doctor knows about these feelings he or she will be able to help you more. This questionnaire is designed to help your doctor know how you feel. Read each item and circle the reply which comes closest to how you have been feeling in the past week. Don't take too long over your replies: your immediate reaction to each item will probably be more accurate than a long thought out response.

I feel tense or 'wound up':	A	I feel as if I am slowed down:	D
Most of the time	3	Nearly all of the time	3
A lot of the time	2	Very often	2
Time to time, occasionally	1	Sometimes	1
Not at all	0	Not at all	0
I still enjoy the things I used to enjoy:	D	I get a sort of frightened feeling like 'butterflies in the stomach':	A
Definitely as much	0	Not at all	0
Not quite so much	1	Occasionally	1
Only a little	2	Quite often	2
Not at all	3	Very often	3
I get a sort of frightened feeling like something awful is about to happen:	A	I have lost interest in my appearance:	D
Very definitely and quite badly	3	Definitely	3
Yes, but not too badly	2	I don't take as much care as I should	2
A little, but it doesn't worry me	1	I may not take quite as much care	1
Not at all	0	I take just as much care as ever	0
I can laugh and see the funny side of things:	D	I feel restless as if I have to be on the move:	A
As much as I always could	0	Very much indeed	3
Not quite so much now	1	Quite a lot	2
Definitely not so much now	2	Not very much	1
Not at all	3	Not at all	0
Worrying thoughts go through my mind:	A	I look forward with enjoyment to things:	D
A great deal of the time	3	As much as I ever did	0
A lot of the time	2	Rather less than I used to	1
From time to time but not too often	1	Definitely less than I used to	3
Only occasionally	0	Hardly at all	2
I feel cheerful:	D	I get sudden feelings of panic:	A
Not at all	3	Very often indeed	3
Not often	2	Quite often	2
Sometimes	1	Not very often	1
Most of the time	0	Not at all	0
I can sit at ease and feel relaxed:	A	I can enjoy a good book or radio or TV programme:	D
Definitely	0	Often	0
Usually	1	Sometimes	1
Not often	2	Not often	2
Not at all	3	Very seldom	3

Figure 3: The Hospital Anxiety and Depression Scale (HADS) is a 14-item questionnaire (Chen *et al.*, 2025; Julious *et al.*, 1997).

practical research and routine care (Corral-Partearroyo *et al.*, 2025).

Clinical Implications

Screening for anxiety in CVD patients is essential. Psychological distress, especially anxiety and depression, negatively impacts medication adherence and clinical outcomes. About half of CVD patients show poor adherence, and mood disorders further reduce motivation and self-care. Ongoing anxiety weakens healthy behaviors and raises hospital visits and healthcare costs. Early detection and support through psychological help or integrated care can improve adherence, quality of life, and long-term

cardiovascular results. Therefore, routine anxiety screening should be an important part of CVD management (Kwek *et al.*, 2025; Mojtaba Alavi, 2020).

Role of healthcare professionals and multidisciplinary teams

Barrios-Rodríguez, Requena, Borowska, and Ostrowski (2025), Patel, Huang, and Miliara (2025) and Veloso, Rocha, Macedo, Teixeira, and Almeida.

- Ongoing help from healthcare professionals, including regular follow-ups and monitoring, builds patient trust, motivation, and adherence, especially when emotional

needs and mental health issues, like anxiety, are addressed quickly during recovery.

- Clear communication is necessary, both within the healthcare team and with patients. It helps convey treatment benefits, set expectations, and explain complexities, all of which directly affect adherence outcomes.
- Bringing together expertise from psychology, nursing, pharmacy, and cardiology in a coordinated team is crucial for providing thorough care, early intervention for anxiety, and managing both physical and emotional recovery, which improves adherence rates among patients with CVD.

- Involving family members in educational and support sessions encourages lifestyle changes, offers emotional support, and boosts adherence rates by creating a shared understanding of health goals.
- Challenges in the healthcare system, such as limited resources, disconnected care, and poor interprofessional relationships, can weaken program effectiveness. It is important to support unified protocols and regular interdisciplinary meetings to ensure better adherence to therapy.

The Eight-Item Medication Adherence Scale	YES	NO
1. Do you sometimes forget to take your medication?		
2. People sometimes miss taking their medications for reasons other than forgetting. Thinking over the past two weeks, were there any days when you did not take your medication?		
3. Have you ever cut back or stopped taking your medication without telling your doctor, because you felt worse when you took it?		
4. When you travel or leave home, do you sometimes forget to bring along your medication?		
5. Did you take your medicine yesterday?		
6. When you feel like your symptoms are under control, do you sometimes stop taking your medicine?		
7. Taking medication every day is a real inconvenience for some people. Do you ever feel hassled about sticking to your treatment plan?		
8. How often do you have difficulty remembering to take all your medications?		
Never/Rarely		
Once in a while		
Sometimes		
Usually		
All the time		

Figure 4: Eight-item Morisky Medication Adherence Scale (MMAS-8) (Sanchis-Gomar and Lippi, 2025).

Interventions and Strategies to Improve Adherence

Interventions to improve adherence

(Crepaldi *et al.*, 2025; El-Malahi *et al.*, 2025; Martínez-Quintana *et al.*, 2025).

Group Psychological Therapy

Group therapy helps individuals with cardiovascular issues and anxiety or depression. It builds social support, develops coping skills, and reduces depressive symptoms. It serves as a safe and cost-effective alternative to one-on-one therapy.

Individual Counselling

In-person counseling shows significant decreases in anxiety and depression. It addresses specific emotional and cognitive challenges. This approach allows for personalized coping strategies and improves patients' understanding of their illness, leading to better treatment adherence.

Internet-based Cognitive Behavioral Therapy (CBT)

Online or telehealth CBT reduces anxiety, depression, and stress. It improves the quality of life and mental health for cardiovascular patients. This method provides flexible access and helps overcome barriers to care.

Progressive Muscle Relaxation and Mindfulness

Techniques based on Jacobson's progressive muscle relaxation and mindfulness reduce anxiety and promote mental balance. They work well alongside cognitive strategies.

Multidisciplinary Cardiac Rehabilitation Programs

Adding psychological interventions like psychoeducational groups, relaxation techniques, and counseling to cardiac rehabilitation programs improves mental health. This approach encourages healthier lifestyle choices and leads to better patient adherence and outcomes.

Strategies to Improve Adherence

Psychoeducation and counseling

Psychoeducation and counseling improve medication adherence among CVD patients who experience anxiety. They do this by closing knowledge gaps, tackling emotional barriers, boosting self-confidence, developing behavioral skills, and supporting ongoing psychological well-being. This leads to better treatment compliance and overall health outcomes (Baourda and Panagiotakos, 2025; Kwek *et al.*, 2025).

CBT for anxiety

CBT is widely recognized as an effective approach for reducing anxiety in people with CVD. Significant improvements have been seen in anxiety and depression symptoms, along with a better quality of life. The main components of CBT are cognitive

Category	Pharmacological	Psychological
Purpose	Reduce anxiety symptoms via medication	Address cognitive-behavioral factors in adherence
Common Treatments	SSRIs, SNRIs, benzodiazepines, beta-blockers	CBT, mindfulness, motivational interviewing
Mechanism of Action	Neurotransmitter modulation (serotonin, GABA)	Modify thoughts, behaviors, coping strategies
Advantages	Rapid symptom relief, standardized dosing	No side effects, sustainable long-term skills
Limitations	Side effects, drug interactions, dependency risk	Time-intensive, requires patient engagement
Delivery Mode	Oral, IV, or transdermal administration	In-person, telehealth, group, or self-guided
Effect on Med Adherence	May reduce anxiety barrier to CVD med adherence	Directly targets adherence behaviors and barriers
Evidence Strength	Strong RCT evidence for anxiety reduction	Moderate-strong evidence, growing research base
Integration in Care	Primary care, cardiology, psychiatry coordination	Behavioral health integration in cardiology settings

Figure 5: Pharmacological and Psychological approaches for medication adherence (Berimavandi *et al.*, 2025; Kwek *et al.*, 2025).

restructuring, behavioral activation, exposure therapy, and problem-solving. These can be offered in person or online, either one-on-one or in groups. Both therapist-assisted and self-administered Internet-based CBT (iCBT) show similar effectiveness. Shorter programs, lasting less than 9 weeks, and those with fewer modules, under 8, tend to be more effective for anxiety. In contrast, longer programs with more modules help more with depression. Common medications include SSRIs, SNRIs, and anxiolytics such as benzodiazepines. Examples are sertraline at 50-200 mg/day, escitalopram at 10-20 mg/day, and paroxetine at 20-40 mg/day (Figure 5) (Kwek *et al.*, 2025; Wang *et al.*, 2024).

Techniques to alleviate anxiety sensitivity

The use of CBT techniques, such as cognitive restructuring, behavioral activation, exposure therapy, relaxation training, and emotion regulation, effectively reduces anxiety sensitivity in cardiovascular patients. This approach tackles unhelpful thoughts and avoidance behaviors. Exposure therapy, a part of CBT or iCBT, is known for its effectiveness in lowering both general and heart-related anxiety among cardiovascular patients. It does this by slowly exposing patients to feared sensations or situations, which helps decrease their anxiety response over time (Baourda and Panagiotakos, 2025).

Utilization of digital tools and reminders

iCBT and digital health solutions, like web and mobile apps, greatly improve accessibility. They make self-directed learning easier and provide flexible educational opportunities. These tools also include interactive features and homework assignments. Many of these solutions have automated reminders to help users complete sessions and take care of themselves. Therapist-guided iCBT interventions use regular digital reminders and scheduled online check-ins. This approach encourages better adherence and ongoing engagement with mental health and medication plans (Kwek *et al.*, 2025; Wang *et al.*, 2024).

Strengthening social support

Social support improves through group interventions, whether online or in person. Peer discussion forums on digital platforms and collaborative activities involving family members also help. Nurse-led CBT or iCBT programs build ongoing therapeutic relationships and provide both psychological and practical support. This further boosts feelings of connection, accountability, and motivation for lasting behavior change (Baourda and Panagiotakos, 2025).

Special Populations and Contexts

Women with CVD usually have higher rates of depression and anxiety than men, and this difference continues across age groups. Younger men with CVD show a notably increased risk for depression and anxiety, but the overall rates are always higher in

women. Women also report more severe symptoms and are more likely to seek mental health support, while men often downplay their symptoms and avoid getting help.

People with lower socioeconomic status and less education tend to experience higher anxiety levels and poorer coping skills in CVD patients. Factors like hospital satisfaction, family support, urban-rural differences, and economic struggles all contribute to greater psychological distress and anxiety. Cultural stigma can also hinder seeking help and discussing anxiety symptoms openly, especially during critical times like the COVID-19 pandemic.

Comorbidities make anxiety worse for cardiovascular patients by increasing symptoms, complicating treatment, and raising distress, making integrated care essential (Bondar *et al.*, 2025; Knox *et al.*, 2025; Ul Haq *et al.*, 2025).

Future Research Directions

Future research should focus on community-based, culturally tailored, and technology-driven approaches to tackle anxiety's effects on medication adherence in CVD. Studies must prioritize including underserved, rural, and ethnic minority groups in clinical trials. This inclusion will help ensure that interventions are relevant and fair. Longitudinal research at different time points is crucial for understanding changes in optimism, anxiety, and medication-taking behaviors. It will also test if a better quality of life leads to improved medication adherence.

Researchers should use implementation science methods, such as practice facilitation and stepped-wedge designs, to apply evidence-based adherence programs in real rural family practice settings. New areas to explore include the increased use of mobile health (mHealth) tools, personalized medication approaches through pharmacogenetics, and digital cognitive behavioral therapy platforms that suit low-resource situations.

Additionally, research should look into positive psychological methods, such as optimism training and growth strategies after trauma, as supplements to traditional anxiety reduction techniques. This research should also analyze how coping strategies, stress resilience, and social support networks play a role. Advocacy at the policy level for reimbursement, infrastructure improvements, and fair research funding is vital to achieving lasting gains in medication adherence (Anestina, 2025; Kupper *et al.*, 2025).

CONCLUSION

Current evidence shows that anxiety greatly affects medication adherence and quality of life for patients with CVD. Psychological distress makes clinical outcomes worse. Therapies like therapist-supported iCBT have shown promise, particularly in dealing with depression and improving quality of life. However, the specific effects on anxiety are still unclear. Given how common anxiety is and its harmful effects, routine screening and

effective management are crucial parts of cardiovascular care. Recommendations highlight the need for targeted interventions that address anxiety's specific symptoms in CVD patients. These should combine psychological therapies with traditional heart care. Nurses play an important role here because they have frequent contact with patients and build strong therapeutic relationships. They can effectively deliver psychological support and help maintain adherence. There is a strong call for integrated care models that combine mental health and cardiology services to offer comprehensive, patient-centred care. Collaboration between different disciplines, backed by research and policy frameworks, is vital to break down barriers and ensure ongoing mental health screening, personalized treatment, and fair access, especially for underserved groups. Building optimism and psychological resilience, along with focusing on behavior adherence, may improve long-term recovery and health outcomes for this vulnerable population.

The Generalized Anxiety Disorder-7 (GAD-7) scale is a 7-item self-report questionnaire. It asks how often, over the last 2 weeks, individuals have been bothered by core anxiety symptoms (items 1-7). Each item is rated from 0 = Not at all, 1 = Several days, 2 = More than half the days, and 3 = Nearly every day. The scores for each item are added together to get a total severity score. The scale also includes a single item that rates how difficult these problems have made it to function at work, at home, or with other people. The options are Not difficult at all, Somewhat difficult, Very difficult, and Extremely difficult.

The Hospital Anxiety and Depression Scale (HADS) is a 14-item self-report questionnaire designed to assess anxiety and depression in medically ill patients. It asks respondents to rate their feelings over the past week. Each item is scored from 0 to 3. Seven items make up the Anxiety subscale (HADS-A, labelled "A"), and seven items form the Depression subscale (HADS-D, labelled "D"). The scores from each subscale are added together to show the severity of symptoms.

The Eight-Item Morisky Medication Adherence Scale (MMAS-8) is a self-report questionnaire. It has seven yes/no questions and one item with five frequency options: Never/Rarely, Once in a while, Sometimes, Usually, and All the time. This scale measures forgetfulness, intentional dose omission, and practical barriers to taking medicines. The scores from the items are combined to determine each patient's overall level of medication adherence.

Comparative overview of drug-based versus psychological treatments for anxiety in Cardiovascular Disease (CVD) care and their effects on medication adherence. The table compares purpose, common treatments, how they work, benefits, drawbacks, delivery methods, effects on medication adherence, evidence strength, and integration into routine care. Drug options (e.g., SSRIs, SNRIs, benzodiazepines, beta-blockers) work by modulating neurotransmitters. In contrast, psychological

approaches (e.g., CBT, mindfulness, motivational interviewing) change thoughts, behaviors, and coping strategies to directly tackle adherence issues.

ABBREVIATIONS

NFκB: Nuclear Factor Kappa B; **TNFα:** Tumor Necrosis Factor Alpha; **CVD:** Cardiovascular disease; **SSRIs:** Selective Serotonin Reuptake Inhibitors; **CBT:** Cognitive-Behavioral Therapy.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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