

2022

Cardiology and the brain: How an individual's cardiovascular health relates to their mental health

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Cardiology and the brain: How an individual's cardiovascular health relates to their mental health

Abstract

Background: Scoping reviews are still in the infancy stages of growth yet are rapidly gaining popularity in the research community. A scoping review was conducted to analyze the relationship between the cardiovascular system and neurological system to determine if there is a connection between certain mental disorders and heart health.

Methods: This study was guided through implementation of Arksey and O'Malley's five stages of a scoping review: 1) identifying and stating the research question presented; 2) identifying and quantifying relevant studies to the hypothesis through a literature review or search; 3) selecting proper studies to be employed in favor of said hypothesis; 4) categorizing and charting data selected; and 5) reporting and summarizing results within the scope of practice for the study. Usage of electronic databases PubMed, CINAHL, Cochrane Library, and Google Scholar with keywords "cardiology" AND "neurology" AND "generalized anxiety disorder" AND "relationship" AND "mental health" OR "depression" OR "schizophrenia" OR "chronic heart disease" OR "myocardial infarction" OR "atrial fibrillation" OR "premature ventricular contractions" were implemented.

Results:

Conclusion:

Keywords: cardiology, neurology, generalized anxiety disorder, relationship, mental health, depression, schizophrenia, chronic heart disease, myocardial infarction, atrial fibrillation, premature ventricular contractions

Degree Type

Open Access Senior Honors Thesis

Department or School

Nursing

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Keywords

cardiology, neurology, generalized anxiety disorder, relationship, mental health, depression, schizophrenia, chronic heart disease, myocardial infarction, atrial fibrillation, premature ventricular contractions

Subject Categories

Nursing

**CARDIOLOGY AND THE BRAIN: HOW AN INDIVIDUAL'S CARDIOVASCULAR
HEALTH RELATES TO THEIR MENTAL HEALTH**

By

Megan Shea Kopicko

A Senior Thesis Submitted to the

Eastern Michigan University

Honors College

In

Partial Fulfillment of the Requirements for Graduation

With

Honors in Nursing

Approved at Ypsilanti, Michigan, on this date _____

Supervising Instructor _____

Honors Advisor _____

Department Head _____

Dean, Honors College _____

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**CARDIOLOGY AND THE BRAIN: HOW AN INDIVIDUAL'S
CARDIOVASCULAR HEALTH RELATES TO THEIR MENTAL
HEALTH**

The human body is made up of various structures that are all interconnected in some way, shape, or form. The brain is neurologically based which is a vital organ that keeps us alive while the heart is cardiovascular based that allows our body to stay alive and keep thriving. The interdisciplinary relationship that coincides between these two organs is rarely considered to be one of a symbiotic relationship outside of keeping the human body alive. The significance of conducting a scoping review on the relationship between an individual's cardiovascular health and neurological health is crucial as the heart and the brain are arguably the two most salient organs in the body in response to keeping us alive. Finding and establishing a connection between a person's neurological disorder(s) could illuminate the cardiovascular risks someone could encounter in their future and possibly even help to prevent them before they occur and vice versa. Silvani et al. (2016) stated, "Both acute and chronic manifestations of an imbalanced brain–heart interaction represent a risk factor for the development of cardiovascular diseases or acute cardiovascular events, which can also lead to sudden cardiac death" (p. 90). Researchers suggest that the connection that lies amongst the brain and the heart could have outstanding effects on a person's health that could prove to be detrimental-even deadly-in the long-run.

The heart is defined as a muscle that “is at the center of your circulatory system, which is a network of blood vessels that delivers blood to every part of your body. Blood carries oxygen and other important nutrients that all body organs need to stay healthy and to work properly.” (Healthwise staff, 2020). This crucial organ is the reason that our body's other organs are able to function and maintain a sense of homeostasis within our body. The brain is another organ that is not to be dismissed; humans cannot live without the brain. The brain is defined as “[an organ] that integrates sensory information from inside and outside the body in controlling autonomic function (such as heartbeat and respiration), in coordinating and directing correlated motor responses, and in the process of learning” (Merriam-Webster, 2022).

In the United States, the Centers for Disease Control and Prevention, or CDC, states (2021) that heart disease “is the leading cause of death for men, women, and people of most racial and ethnic groups and about 659,000 people in the United States die from heart disease each year—that's 1 in every 4 deaths”. The CDC quotes (2021) that “Someone has a heart attack every 40 seconds, while every year, about 805,000 people in the United States have a heart attack.” According to statistics the CDC updated in the year of 2020, heart disease was still the leading cause of death in the United States at 696,962 deaths with cancer (602,350 deaths) and COVID-19 (350,831 deaths) following suite.

Mental health statistics have been slowly climbing as more individuals are leaving behind negative stigmas about having a mental health disorder and seeking help. Mental Health America, or MHA, cites (2021) that “19.00% of adults are experiencing a mental illness; equivalent to over 47 million Americans.” The National Alliance of Mental Illness, or NAMI, (2021) provides statistics on how there are 8.4% (21 million people) with depression nationwide, 19.1% (48 million) with a form of an anxiety disorder, and less than 1% (1.5 million) with schizophrenia. Despite the rising percentage of mental health disorders in the country, only 46.2% of adult Americans received treatment in the year 2020 for their mental health disorder. However, NAMI (2021) states that the nationwide average delay for seeking medical treatment for any mental health disorder is typically 11 years, starting at the onset of symptoms. This hindrance of seeking professional care for mental health issues not only deteriorates an individual's mental health well-being further but increases their chances at shortening their lifespan and encountering further health complications.

Grimshaw (2010) defines scoping reviews as systematic mapping of the desired research topic available that identifies significant theories, key concepts, proper sources of evidence, and any gaps noted in previous research (p. 81). The scoping review was beneficial to the research at hand as it provided a detailed and in-depth analysis of the relationship that coincides between cardiovascular health and mental health. The

methodology for the scoping practice of the cardiovascular and neurological relationship has clear expectations and guidelines that need to be followed in order to reach a cohesive conclusion that will benefit the research. The purpose of this scoping review was to 1) Synthesize research regarding the relationship between cardiovascular health and mental health and 2) Identify how neurological disorders affect the cardiovascular system negatively over an individual's lifespan. ~~The specific research question was:~~ *How do neurological disorders (mental health issues) affect the cardiovascular system negatively over an individual's lifespan?* The neurological disorders (mental health issues) that were studied and presented within this paper consist of depression, generalized anxiety disorder, and schizophrenia. The negative implications that were of focus were cardiovascular disorders that can shorten an individual's lifespan or cause significant damage within a period of time, such as coronary heart disease, myocardial infarction, atrial fibrillation, or premature ventricular contractions.

Methods

Study Framework

The Arksey and O'Malley's (2005) framework was used for the purpose of this study. This framework includes the following five stages to ensure robustness: 1) identifying and stating the research question presented; 2) identifying and quantifying relevant studies to the hypothesis through a literature review or search; 3) selecting proper studies to be

employed in favor of said hypothesis; 4) categorizing and charting data selected; and 5) reporting and summarizing results within the scope of practice for the study.

Scoping reviews are becoming increasingly popular in the medical community to present statistics about emerging studies that can be difficult to quantify in systematic reviews. Per Arksey and O'Malley (2005), the purpose for a scoping review is; 1) to examine the extent, range, and nature of research activity; 2) to determine the value for undertaking a full systematic review; 3) to summarize and disseminate research findings; and 4) to identify research gaps in the existing literature. A scoping review will not only provide a detailed report about the subject at hand but will also provide a wide array of research evidence that is currently available for use. While a scoping review was the focus of this research paper, it is critical to identify the discrepancies between a scoping review itself and a systematic review. A systematic review is often used to question the effectiveness of a treatment then to formulate an answer by summarizing evidence that met the desired criteria threshold (Mellor, n.d.). In comparison, scoping reviews are often focused on answering a broader question and connecting any gaps of knowledge that may be discovered during the research process. Due to the rise in popularity of scoping reviews in our current society, an international research organization by the name of the Joanna Briggs Institute (JBI) constructed a guidance document extension based upon the earlier work of Arksey and O'Malley.

This document-known as PRISMA-ScR-was based off of a reporting guideline developed systematic reviews (PRISMA). An article published by Tricco et al. (2018) stated that “The intent of the PRISMA-ScR is to help readers (including researchers, publishers, commissioners, policymakers, health care providers, guideline developers, and patients or consumers) develop a greater understanding of relevant terminology, core concepts, and key items to report for scoping reviews”. The overall objective of the research was to complete a scoping review in relation to the cardiovascular and neurological aspect of healthcare to synthesize published evidence of connections between the heart and the brain that can impact the longevity of an individual's life.

Search Strategy

An electronic database can be a very resourceful tool when implementing a scoping practice review. Ali Nearn (2020) states...

An electronic database is a searchable electronic collection of resources. There are two basic types of databases: Indexes or bibliographic databases. Indexes or bibliographic databases, also known as indexing and abstracting services, provide indexing information for topical searching across resources in multiple formats (including multidisciplinary searches) and abstracts (short descriptions) of the contents (eg. articles), to help you decide if it is relevant to your research. Full-text databases provide the same services as above, but also include the full text of articles, allowing you to read it online, or download it for offline reading. For the purpose of

this scoping review, full-text databases were used which allowed for full disclosure of information that was relevant to the research question. There was no usage of “abstract only” papers as this hindered and could have allowed for bias in the research being conducted.

A search was conducted from January 1st, 2017, to December 31st, 2021, using the following four databases: PubMed, CINAHL, Cochrane Library, and Google Scholar. The keywords used in the search were “cardiology” AND “neurology” AND “generalized anxiety disorder” AND “relationship” AND “mental health” OR “depression” OR “schizophrenia” OR “chronic heart disease” OR “myocardial infarction” OR “atrial fibrillation” OR “premature ventricular contractions”. Limiters used included anything published between 2017-2021, English language, population aged greater than 18, and full-text articles. *Figure 1* depicts how articles were selected for this review.

Study Selection: Screening

Once all the literature sources had been gathered and data had been compiled, a study screening was completed. The focus of the screening was to eliminate studies that did not meet inclusion criteria. Studies and literature reviews were compiled that were relevant to the relationship between cardiovascular health and mental health.

Inclusion and exclusion criteria

According to Pettito and Ferreira (2018), the definition of inclusion criteria is using specific characteristics of the population desired that will

allow investigators to answer their question. Examples of inclusion criteria can be clinical instances, demographic, or geographic (p. 84). For the purpose of this research, the focus was mainly on demographic and clinical characteristics. The inclusion criteria that were set for this research included studies of participants over the age of 18 years with no race or ethnicity exclusions, a diagnosis of schizophrenia, depression, or generalized anxiety disorder, and a diagnosis of cardiovascular disease such as coronary heart disease, myocardial infarction, atrial fibrillation, or premature ventricular contractions. In addition, studies had to be published between 2017-2021, in English, available in “full-text”, contain a population greater than 18 years old, and be published in peer reviewed journals. Geographically, the review was not limited to exclude foreign countries outside of Canada and the United States in order to incorporate a less culturally biased, well-rounded scoping review. After the inclusion criteria was determined and applied, the next step was to read through the entirety of the paper. The exclusion criteria were any duplicates in articles found, abstract-only articles, and any sources that were not written in the English language. Consideration was taken when exploring studies with small sample sizes, biased data, or insufficient information to contribute to the research question.

Charting the Data

Upon completion of the selection of each full-text article used in this research, the following data were recorded into a spreadsheet:

author(s), the year, the location and settings, the study method, the sample and/or target size, and key components of the study reviewed (see Appendix A). Thematic analysis was the approach used to identified themes in the studies that met study inclusion criteria. *Figure 1* shows the study selection process for this review.

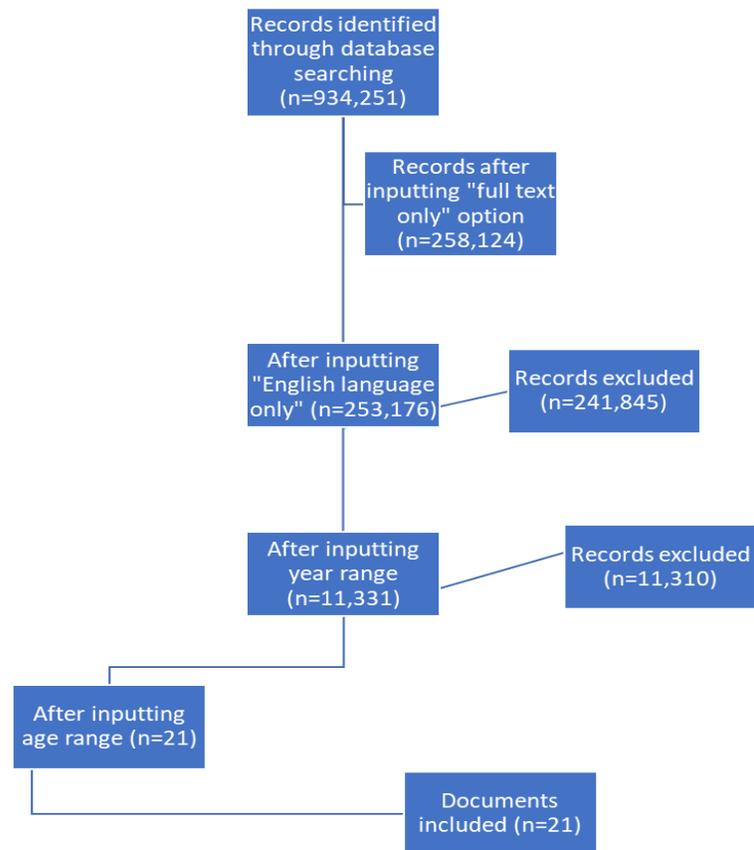


Figure 1

Flowchart of Search Strategy and Article Selection

Results

The literature search was completed using PubMed, CINAHL, Cochrane Library, and Google Scholar databases. The keywords used were cardiology, neurology, generalized anxiety disorder, mental health,

depression, schizophrenia, chronic heart disease, myocardial infarction, atrial fibrillation, and premature ventricular contractions. There was a total of 934, 251 articles found. 258,124 titles and abstracts were screened, and after including only English language, 4,948 articles were removed, leaving 253,176 articles. After establishing and inputting the year range, 11,331 articles were left after 241,845 articles were excluded. Inputting the age range led to exclusion of 11,310 articles and after reviewing the full text of these articles, 21 remained for inclusion in this review.

There was a total of 21 articles and these articles focused on current cardiovascular disease diagnoses and mental health diagnoses that contributed to possible cardiovascular disease. Five themes from thematic analysis were identified from the scoping review: 1) vulnerability; 2) access to care; 3) reduced quality of life; 4) psychological health status; and 5) cardiovascular health. When reporting and summarizing the results of a scoping review, it is crucial to not condense the results as a systematic review would. According to Arksey and O'Malley (2005)...

Whilst a scoping study will need some analytic framework or thematic construction in order to present a narrative account of existing literature, there is no attempt made to present a view regarding the 'weight' of evidence in relation to particular interventions or policies. This is because the scoping study does not seek to assess quality of evidence and consequently cannot

determine whether particular studies provide robust or generalizable findings (p 27).

Thematic analysis was the data analysis method employed in this scoping review.

Vulnerability

7 studies reviewed and reported that previous comorbidities and gender can be influential on an individual's vulnerability of developing a cardiovascular disease. In a systematic review by Hagi et al. (2021), it's concluded that individuals with metabolic syndrome place themselves at a higher risk for certain cardiovascular diseases. Another study noted that middle-aged adults with depression are at an increased risk of cardiovascular disease compared to those in the same age bracket who don't have depression (Rajan et al., 2020). Not only can previous comorbidities create cardiovascular turmoils, but an individual's gender can also contribute to their heart health vulnerability. According to Pimple et al. (2019):

In the overall population, there was no association between the psychological distress measure and CVD events, but there was a sex-based interaction ($P=0.004$). In women, higher psychological distress was associated with a higher incidence of CVD events; each SD increase in the composite score of psychological distress was associated with 1.44 times adjusted hazard of CVD events (95% CI, 1.09–1.92). No such association was found in men.

Having a neurological disorder such as schizophrenia not only increases the individual's vulnerability of having a cardiovascular disease but can also be caused by the issues that come along with a diagnosis of schizophrenia or any other mental disorder. Hauck, Liu, Wijesundera, and Kurdyak (2020) published that "The causes of this cardiovascular disease-related elevated mortality risk are multifactorial and include the underlying biology of the mental illnesses; exposure to antipsychotic medications; behavioral factors such as diet, exercise, and smoking; and reduced access to medical care". Gender and previously diagnosed comorbidities can contribute greatly and negatively to an individual's potential future diagnosis of a cardiovascular disorder and therefore, make them vulnerable to unpredictable heart issues.

Access to Care

4 studies reviewed and reported that access to care can be crucial in preventing cardiovascular complications in an individual's future. Hauck, Liu, Wijesundera, and Kurdyak (2020) established that several different factors can contribute to the reduced access of care patients with cardiovascular diseases and schizophrenia can have, such as informed consent, bias concerns, and adherence to the program. Other limitations that can affect access of care can be financial implications. Research conducted by Murphy et al. (2020) suggests that the notion of financial strain can increase anxiety and depression by 3 to 5 times the patient's prior noted baseline after a cardiovascular event has occurred. This not

only demonstrates that while cardiovascular health is impacted directly by neurological status, a patient's cognitive function can adversely affect their cardiovascular function by possibly causing a secondary cardiovascular health implication.

Reduced Quality of Life

5 studies were reviewed and reported that reflected a reduced quality of life in individuals with a cardiovascular disease and/or mental impairment. Smolderen et al. (2017) reported that "Depression among patients with acute myocardial infarction (AMI) is... associated with an adverse quality of life and prognosis... it is unclear whether treatment of depression in patients with AMI is associated with better outcomes" (p 1681). The lack of research being conducted to find connection between treatment of depression in myocardial infarction patients and improved quality of life concludes that depression treatment will not improve a patient's overall quality of life. An article published by Levine et al. (2021) describes that while there are positive ways an individual's psychological health can affect their cardiovascular health, there are detrimental ways that someone's psychological health can alter their cardiovascular health, therefore reducing their quality of life. An instance of this can be if an individual experiences a myocardial infarction and becomes depressed from said event. The individual's depressive state can result in them becoming more withdrawn and lethargic and in turn, reduce physical activity and instill poor eating habits, ultimately increasing their

chances at another cardiovascular complication. The reduced quality of life may not be directly related to one certain event, but can instead accumulate over several instances that stemmed from one cardiovascular or psychological event.

Psychological Health Status

18 studies were reviewed and reported on the topic of psychological health status and the future implications having a mental impairment can have on a person's cardiovascular health. De Hert, Detraux, and Vancampfort (2018) cited:

An intriguing relationship between mental illness and CHD appears to exist. A higher prevalence of mental diseases in CHD patients has been demonstrated. Conversely, people suffering from a mental disease seem to have an increased risk of CHD.

Moreover, common pathophysiological mechanisms may link both diseases. (p 31)

Another study published in the *Harvard Review of Psychiatry* concludes that patients experiencing a cardiovascular disease are more prone to have generalized anxiety or depression, both affecting their overall health status and chances of improving their condition (Celano et al., 2018). All studies reviewed reported that psychological health plays a significant role in cardiovascular well-being for before, during, and after a cardiovascular event.

Discussion

The purpose of this scoping review of the literature was to

Name Theme 1

Name Theme 2

Name Theme 3

Name Theme 4

Strengths and Limitations

While the limitation of only using the English language for these studies was beneficial towards this research, it could also prove detrimental as key pieces of information from other backgrounds could have been missed due to the language barrier. Lack of adherence to the American population for this research could prove detrimental as there are greater cultural implications to address as every culture does not view mental health disorders the same as the American culture. However, the limitation of excluding foreign studies can present as bias towards American culture and therefore create skewed results in this scoping review.

Conclusion

Optional Stage 6: Consultation

Arksey and O'Malley (2005) suggested that consultation could be an optional sixth stage in the framework of a scoping study. Given that the consultation stage is used correctly, it can only further aid any given

research. Upon further research and forethought, consultation was implemented to improve the research. Team members that collaborated on this research were consulted throughout the various stages of the scoping review in order to provide input on the search criteria and strategy, data abstraction and collection, and the interpretation of the results.

Appendix A

Number	Authors (Year)	Location & Settings	Method	Sample/Target	Key Components
1	De Hert, Detraux, & Vancampfort (2018)	General/Undefined	Comprehensive Review	Severe Mental Illness (SMI) individuals	Anxiety disorder and coronary heart disease; schizophrenia and coronary heart disease; mental diseases and CHD
2	Foldes-Busque, Dionne, Turcote, Tully, Tremblay, Poirier, & Denis (2021)	Canadian Based Hospitals	Longitudinal Cohort Study	3,610 individuals who underwent CAD revascularization	Anxiety disorder and CAD; management of GAD and CAD; estimate correlation of GAD and CAD in two-year period
3	Karlsen, Matejschek, Saksvik-Lehouillier, & Langvik (2021)	General/Undefined	Meta-analyses Result Review	6 (meta-analyses) and 15 (large studies); specific population numbers undefined	Anxiety and cardiovascular disease; anxiety and coronary disease; anxiety and risk factors
4	Veeneman, Vermeulen, Abdellaoui, Sanderson, Wootton, Tadros, Bezzina, Denys, Mufano, Verweij, & Treur (2021)	European Based Studies	Multivariable Mendelian Randomization (MR) & Genome Wide Associated Studies (GWAS)	Diagnosis of schizophrenia (n=130,644), heart failure (n=977,323), coronary artery disease (n=332,477), systolic/diastolic blood pressure issues (n=757,601), heart rate variability (n=46,952), QT interval (n=103,331), & early repolarization or dilated cardiomyopathy ECG patterns (n=63,700)	Coronary artery disease and schizophrenia; heart rate variability and QT interval; early repolarization and cardiomyopathy; coronary artery disease and casualty
5	Smolderen, Buchanan, Gosch, Whooley, Chan, Vaccarino, Parashar, Shah, Ho, & Spertus (2017)	General U.S. Hospitals	TRIUMPH (Translational Research Investigating Underlying Disparities in Acute Myocardial Infarction Patients' Health Status) Observational Multicohort Study	4,062 patients from 24 U.S. hospitals	Depression and acute myocardial infarction; quality of life and prognosis; treatment of depression and improved cardiovascular outcomes

	6 AbuRuz (2019)	Amman, Jordan Hospitals	Prospective Observational Study	300 patients between 1 Amman Government Hospital and 2 Private Hospitals	Cardiovascular disease and psychological factors; depression and complications after ST segment elevation myocardial infarction (STEMI); perceived control and depression scores	
	7 (2018)	Koutelekos, Vasilopoulos, Gerogianni, Gourni, Zyga, & Panoutsopoulos	Outpatient Department of Unspecified Hospital	Hospital Anxiety and Depression Scale (HADS), Convenience Sample, Interview Questionnaire	170 patients diagnosed with Atrial Fibrillation	Anxiety and atrial fibrillation; depression and atrial fibrillation; Hospital Anxiety and Depression Scale (HADS); anxiety and sociodemographic relationship; permanent atrial fibrillation
	8 (2018)	Garg, Neil, Diez-Roux, Alonso, Soliman, & Heckbert	U.S. Hospital Based	Longitudinal Community-Based Study	6,664 Multi-Ethnic Study of Atherosclerosis (MESA) Participants	MESA study; depression and atrial fibrillation; multiethnic cohort; anger and atrial fibrillation; anxiety and/or chronic stress and atrial fibrillation; negative affect of atrial fibrillation; antidepressant use
	9 Kubzansky (2021)	Levine, Cohen, Commodore-Mensah, Fleury, Huffman, Khalid, Labarthe, Lavretsky, Michos, Spatz, & Kubzansky (2021)	General/Undefined	Development of American Heart Association (AHA) Statement	PubMed Studies Gathered (n=undefined)	AHA scientific statements; well-being and health; heart and psychology; cardiovascular health status and psychological health status; longitudinal studies; clinical studies; anger and anxiety; depression and pessimism; optimism and sense of purpose; happiness and mindfulness

	<p>Hagi, Nosaka, Dickinson, Lindenmayer, Lee, Friedman, Boyer, Han, Abdul-Rashid, & Correll (2021)</p>	<p>General/Undefined</p>	<p>Systematic Review & Meta-Analyses</p>	<p>10,174 individuals with schizophrenia over 27 studies</p>	<p>Cardiovascular risk factors and cognitive impairment; schizophrenia and cardiovascular factors; global cognition; diabetes and hypertension; obesity and insulin resistance; systematic review; meta-analyses; cognitive impairment and schizophrenia</p>
<p>11</p>	<p>Rajan et al. (2020)</p>	<p>21 Unspecified Countries on 5 Unspecified Continents</p>	<p>Multicenter Population Cohort Study</p>	<p>145,862 participants</p>	<p>Depression and cardiovascular disease; low and middle-income countries; urban areas; mortality and varying economic areas; self-reported depression; physical health risk; noncommunicable diseases</p>
<p>12</p>	<p>Celano, Villegas, Albanese, Gaggin, & Huffman (2018)</p>	<p>General/Undefined</p>	<p>Literature Review</p>	<p>Meta-analyses of 36 studies</p>	<p>Depression and anxiety; heart failure; diagnosis and treatment; pharmacologic and psychotherapy; generalized anxiety disorder; behavioral and biological mechanisms</p>

	<p>Pimple, Lima, Hammadah, Wilmot, Levantsevych, Sullivan, Kim, Kaseer, Shah, Ward, Raggi, Bremner, Hanfelt, Lewis, Quyyumi, & Vaccarino (2019)</p>	<p>Emory University</p>	<p>Prospective Cohort Study</p>	<p>Assessed 662 individuals with stable coronary artery disease</p>	<p>Emotional distress and cardiovascular disease; women and coronary artery disease; cohort study; psychological distress and women; women with coronary artery disease and vulnerability; growth of mental health disorders</p>
	<p>Kugathasan, Horsdal, Aagaard, Jensen, Laursen, & Nielson (2018)</p>	<p>Denmark</p>	<p>Cohort Study</p>	<p>105,018 patients with myocardial infarction (684 patients with schizophrenia and 104,334 patients from the general population)</p>	<p>Myocardial infarction and schizophrenia; general population; secondary cardiovascular treatment; cardioprotective medications; morbidity and mortality; schizophrenia reduction in mortality</p>
	<p>Hauck, Liu, Wijeyesundera, & Kurdyak (2020)</p>	<p>Ontario, Canada</p>	<p>Population-Based Cohort Study</p>	<p>108,610 patients identified with acute myocardial infarction, including 1,145 patients who had schizophrenia</p>	<p>Epidemiology and access to care; health disparities; schizophrenia and acute myocardial infarction; health services research and cardiovascular disease; mortality and schizophrenia</p>

	Cocchio, Baldo, Furlan, Buja, Casale, Fonzo, Baldo, & Bertoncello (2019)	Rovigo Province, Italy	Retrospective Cohort Study	3,985 patients	Depression and cardiovascular risk; high mortality and comorbidities; antidepressants and higher mortality; Cox multiple regression model; acute myocardial infarction
	Kim, Lee, Han, Han, Min, Choi, Choi, Shim, Choi, & Kim (2022)	South Korea	Population-Based Cohort Study	5,031,222 patients; 148,882 of these patients having depression	Atrial fibrillation and depression; Korean National Health Insurance Service database; screening for atrial fibrillation and depression; depression and young females; Kaplan-Meier analysis; Cox proportional hazards regression
	Murphy, Le Grande, Alvarenga, Worcester, & Jackson (2020)	Four hospitals in Melbourne, Australia and two hospitals in Victoria, Australia	Hospital Anxiety and Depression Scale (HADS), Convenience Sample	911 patients with acute myocardial infarction, acute coronary syndrome, unstable angina, or undergoing coronary artery bypass graft surgery	Anxiety and depression; early, late, and convalescence; 12 months following cardiac event; financial strain and low socioeconomic status; HADS; Chi-square tests; increased anxiety and depression

	19	Kilicaslan, Karakilic, & Erol (2019)	Psychosis Outpatient Unit and Community Health Center of Izmir Katip Celebi University Ataturk Training and Research Hospital	Framingham Risk Score and Follow-Up Study	142 patients; 103 with schizophrenia and 39 healthy controls	Schizophrenia and cardiovascular risk; Framingham risk score; antipsychotic treatments and schizophrenia; mortality rate and schizophrenia; positive and negative symptoms
	20	Padmavati, Kantipudi, Balasubramanian, & Raghavan (2021)	Databases: PubMed & Google Scholar & Indian Only Studies	Comprehensive Literature Review & Scoping Review	198 articles	Physical health and schizophrenia; cardiovascular disease and schizophrenia; India studies; collate and synthesize; metabolic syndrome and obesity; interventions and cardiovascular disease
	21	Bucciarelli, Caterino, Bianco, Caputi, Salerni, Sciomer, Maffei, & Gallina (2019)	General/Undefined	Systematic Review	Undefined	Gender medicine; female etiology; depression and cardiovascular disease; coronary artery disease; heart failure; physiopathology, clinical presentation, and treatments; worldwide health problem; angina and stroke

References

- AbuRuz, M.E. (2019). Patients with ST segment elevation myocardial infarction: Moderating effect of perceived control on the relationship between depression and in-hospital complications. *BMC Cardiovascular Disorders, 19*(143). 1-7.
<https://doi.org/10.1186/s12872-019-1126-z>
- Arksey, H., O'Malley, L. (2005) Scoping studies: Towards a methodological framework. *International Journal of Social Research Methodology, 8*(1). 19-32.
<https://doi.org/10.1080/1364557032000119616>
- Bashi, N., Fatehi, F., Mosadeghi-Nik, M., Askari, M.S., & Karunanithi, M. (2020). Digital Health Interventions for Chronic Diseases: A Scoping Review of Evaluation Frameworks. [Photograph]. *BMJ health and care informatics, 27*(1).
<https://doi.org/10.1136/bmjhci-2019-100066>
- Bucciarelli, V., Caterino, A.L., Bianco, F., Caputi, C.G., Sciomer, S., Maffei, S., & Gallina, S. (2019). Depression and cardiovascular disease: The deep blue sea of women's heart. *Trends in Cardiovascular Medicine, 30*(3). 170-176.
<https://doi.org/10.1016/j.tcm.2019.05.001>
- Centers for Disease Control and Prevention. (2021). *Heart disease facts*.
<https://www.cdc.gov/heartdisease/facts.htm>

Centers for Disease Control and Prevention. (2020). *Leading causes of death*.

<https://www.cdc.gov/nchs/fastats/leading-causes-of-death.htm>

Celano, C.M., Villegas, A.C., Albanese, A.M., Gaggin, H.K., & Huffman, J.C. (2018). Depression and anxiety in heart failure: A review.

Harvard Review of Psychiatry, 26(4), 175–184.

<https://doi.org/10.1097/HRP.0000000000000162>

Cocchio, S., Baldovin, T., Furlan, P., Buja, A., Casale, P., Fonzo, M.,

Baldo, V., & Bertoncello, C. (2019). Is depression a real risk factor for acute myocardial infarction mortality? A retrospective cohort study. *BMC Psychiatry*, 19(122).

<https://doi.org/10.1186/s12888-019-2113-8>

De Hert, M., Detraux, J., & Vancampfort, D. (2018). The intriguing relationship between coronary heart disease and mental disorders.

Dialogues in clinical neuroscience, 20(1), 31–40.

<https://doi.org/10.31887/DCNS.2018.20.1/mdehert>

Foldes-Busque, G., Dionne, C.E., Turcotte, S., Tully, P.J., Tremblay, M.A.,

Poirier, P., & Denis, I. (2021). Epidemiology and prognostic implications of panic disorder and generalized anxiety disorder in patients with coronary artery disease: rationale and design for a

longitudinal cohort study. *BMC Cardiovascular Disorders*, 21(26), 1-9. <https://doi.org/10.1186/s12872-021-01848-3>

- Garg, P., O'Neal, W., Diez-Roux, A., Alonso, A., Soliman, E., & Heckbert, S. (2018). Negative affect and risk of atrial fibrillation: MESA. *Journal of the American Heart Association*, 8(1).
<https://doi.org/10.1161/JAHA.118.010603>
- Grimshaw, J. (2010). A guide to knowledge synthesis. Canadian Institutes of Health Research. <https://cihr-irsc.gc.ca/e/41382.html>
- Hagi, K., Nosaka, T., Dickinson, D., Lindenmayer, J., Lee, J., Friedman, J., Boyer, L., Han, M., Abdul-Rashid, N., & Correll, C. (2021). Association between cardiovascular risk factors and cognitive impairment in people with schizophrenia: A systematic review and meta-analysis. *JAMA Psychiatry*, 78(5). 510–518.
<https://doi:10.1001/jamapsychiatry.2021.0015>
- Hauck, T.S., Liu, N., Wijeyesundera, H.C., & Kurdyak, P. (2020). Mortality and revascularization among myocardial infarction patients with schizophrenia: A population-based cohort study. *Canadian Journal of Psychiatry*, 65(7). 454–462.
<https://doi.org/10.1177/0706743720904845>
- Healthwise Staff. (2020). *How the heart works*. University of Michigan Health. <https://www.uofmhealth.org/health-library/tx4097abc>
- Karlsen, H. R., Matejschek, F., Saksvik-Lehouillier, I., & Langvik, E. (2021). Anxiety as a risk factor for cardiovascular disease independent of depression: A narrative review of current status and

conflicting findings. *Health Psychology Open*, 8(1), 1-7.

<https://doi.org/10.1177/2055102920987462>

Kilicaslan, E.E., Karakilic, M., & Erol, A. (2019). The relationship between 10 years risk of cardiovascular disease and schizophrenia symptoms: Preliminary results. *Psychiatry Investigation*, 16(12). 933-939. <https://doi.org/10.30773/pi.2019.0063>

Kim, Y.G., Lee, K.N., Han, K.D., Han, K.M., Min, K., Choi, H.Y., Choi, Y.Y., Shim, J., Choi, J., & Kim, Y.H. (2022). Association of depression with atrial fibrillation in South Korean adults. *JAMA Network*, 5(1). 1-12.
<https://doi:10.1001/jamanetworkopen.2021.41772>

Kugathasan, P., Horsdal, H.T., Aagaard, J., Jensen, S.E., Laursen, T.M., Nielsen, R.E. (2018). Association of secondary preventive cardiovascular treatment after myocardial infarction with mortality among patients with schizophrenia. *JAMA Psychiatry*, 75(12). 1234–1240. <https://doi:10.1001/jamapsychiatry.2018.2742>

Levine, G., Cohen, B., Commodore-Mensah, Y., Fleury, J., Huffman, J., Khalid, U., Labarthe, D., Lavretsky, H., Michos, E., Spatz, E., & Kubzansky, L. (2021). Psychological health, well-being, and the mind-heart body connection: A scientific statement from the American Heart Association. *Circulation: An AHA Journal*, 143(10). 763-783. <https://doi.org/10.1161/CIR.0000000000000947>

Mellor, L. (n.d.). *The difference between a systematic review & scoping review*. Covidence.

<https://www.covidence.org/blog/the-difference-between-a-systematic-review-and-a-scoping-review/>

Mental Health America. (2021). *Prevalence of mental illness 2021*.

<https://mhanational.org/issues/2021/mental-health-america-prevalence-data>

Merriam-Webster. (2022). Brain. In *Merriam-Webster Dictionary*.

Merriam-Webster.

<https://www.merriam-webster.com/dictionary/brain>

Murphy, B., Le Grande, M., Alvarenga, M., Worcester, M., & Jackson, A.

(2020). Anxiety and depression after a cardiac event: Prevalence and predictors. *Frontiers in Psychology*.

<https://doi.org/10.3389/fpsyg.2019.03010>

National Alliance on Mental Illness. (2021). *Mental health by the numbers*. <https://www.nami.org/mhstats>

Nearn, A. (2020). *What is an electronic database?* The University of

Notre Dame Australia. <https://askus.library.nd.edu.au/faq/204608>

Padmavati, R., Kantipudi, S.J., Balasubramanian, S., & Raghavan, V.

(2021). Cardiovascular diseases and schizophrenia in India: Evidence, gaps, and way forward. *Frontiers in Psychology*.

<https://doi.org/10.3389/fpsyg.2021.639295>

Patino, C. M., & Ferreira, J.C. (2018). Inclusion and exclusion criteria in research studies: definitions and why they matter. *National Center for Biotechnology Information*, 44(2). 84.

<https://doi.org/10.1590/s1806-37562018000000088>

Pimple, P., Lima, B., Hammadah, M., Wilmot, K., Ramadan, R., Levantsevych, O., Sullivan, S., Kim, J., Kaseer, B., Shah, A., Ward, L., Raggi, P., Bremner, J.D., Hanfelt, J., Lewis, T., Quyyumi, A., & Vaccarino, V. (2019). Psychological distress and subsequent cardiovascular events in individuals with coronary artery disease. *Journal of the American Heart Association*, 8(9).

<https://doi.org/10.1161/JAHA.118.011866>

Polikandrioti, M., Koutelekos, I., Vasilopoulos, G., Gerogianni, G., Gourni, M., Zyga, S., & Panoutsopoulos, G. (2018). Anxiety and depression in patients with permanent atrial fibrillation: Prevalence and associated factors. *Cardiology Research and Practice*, 2018.

1-9. <https://doi.org/10.1155/2018/7408129>

Rajan, S., McKee, M., Rangarajan, S., Bangdiwala, S., Rosengren, A., Gupta, R., Kutty, V., Wielgosz, A., Lear, S., Alhabib, K., Co, H., Lopez-Jaramillo, P., Avezum, A., Seron, P., Oguz, A., Kruger, I., Diaz, R., Nafiza, M.N., Chifamba, J... Yusuf, S. (2020). Association of symptoms of depression with cardiovascular disease and mortality in low-, middle-, and high-income countries.

JAMA Psychiatry, 77(10). 1052–1063.

<https://doi:10.1001/jamapsychiatry.2020.1351>

Silvani, A., Calandra-Buonaura, G., Dampney, R., & Cortelli, P. (2016).

Brain-heart implications: physiology and clinical implications. *The Royal Society Publishing*, 374(2067). 90.

<https://doi.org/10.1098/rsta.2015.0181>

Smolderen, K., Buchanan, D., Gosch, K., Whooley, M., Chan, P.,

Vaccarino, V., Parashar, S., Shah, A., Ho, M., & Spertus, J. (2017).

Depression treatment and 1 year mortality after acute myocardial infarction. *Circulation: An AHA Journal*, 135(18). 1681-1689.

<https://doi.org/10.1161/CIRCULATIONAHA.116.025140>

Tricco, A., Lillie, E., Zarin, W., O'Brien, K.K., Colquhoun, H., Levac, D.,

Moher, D., Peters, M., Morsely, D., Weeks, L., Hempel, S., Akel,

E., Chang, C., McGowan, J., Stewart, L., Hartling, L., Aldcroft, A.,

Wilson, M., Garritty, C... Straus, S. (2018). PRISMA Extension

for Scoping Reviews (PRISMA-ScR): Checklist and Explanation.

Annals of internal medicine, 169(7), 467-473.

<https://doi.org/10.7326/M18-0850>

University of North Carolina Health Sciences Library. (2021). Systemic

reviews: study selection screenings.

<https://guides.lib.unc.edu/systematic-reviews/screening>

Veeneman, R., Vermeulen, J., Abdellaoui, A., Sanderson, E., Wootton, R.,

Tadros, R., Bezzina, C., Denys, D., Munafò, M., Verweij, K., &

Treur, J. (2021). Exploring the relationship between schizophrenia and cardiovascular disease: A genetic correlation and multivariable Mendelian randomization study. *Schizophrenia Bulletin*. 1-11.
<https://doi.org/10.1093/schbul/sbab132>