Understanding the Diagnostic Experience of Cardiovascular Disease in Patients with a Pre-Existing Common Mental Health Condition: A Mixed-Method Study

Katie Baker

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School of Health and Social Care

University of Essex

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Abstract

Background: Anxiety and depression are associated with increased cardiovascular disease (CVD) risk, yet the influence of a pre-existing common mental health condition (CMHC) on the timing and experience of CVD diagnosis remains poorly understood.

Methods: A sequential explanatory mixed-methods design was used. UK Biobank data were analysed to identify individuals with anxiety or depression and subsequent diagnosis of CVD. Logistic regression was used to explore the socio-demographic characteristics associated with an increased risk of a CVD diagnosis within 60 days of CMHC diagnosis. Semi-structured interviews with six clinicians and six patients from an East of England cardiology service were analysed to explore diagnostic experiences in this population, using reflexive thematic analysis.

Results: Younger age (Odds Ratio (*OR*)= 0.95, 95% Confidence Interval (CI)= 0.94 - 0.97), female sex (ref = male, *OR*= 0.50, 95% CI 0.42 - 0.59) and white ethnicity (*OR*= 1.92, 95% CI= 1.14- 3.24) were consistently associated with increased odds of a CVD diagnosis within 60 days of CMHC diagnosis. Qualitative findings indicated that diagnosis operates as a relational sense-making process influenced by mental health considerations, epistemic bias, pathway structures and resource constraints. Clinicians described barriers related to access, inter-professional coordination, and service pressures. Patients highlighted a need for community education, clearer clinical communication, longer consultation time, and improved integration of mental health within cardiology care.

Conclusion: CVD diagnostic pathways following CMHC are shaped by patient characteristics, clinician reasoning, and systemic limitations. Embedding psychological services in cardiology, strengthening public education on this topic, and the use of digital innovations for care delivery may support earlier recognition and facilitate shared decision making, promoting more inclusive and individualised treatment.

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Introduction

Cardiovascular disease and mental health conditions are the leading global causes of death and disability, respectively (World Health Organisation, 2023). With a global prevalence of over 600 million people with cardiovascular disease and 1.17 billion with a mental health condition in 2023 (Institute for Health Metrics and Evaluation, 2025), it is important to optimise preventative and clinical strategies for the management of these conditions.

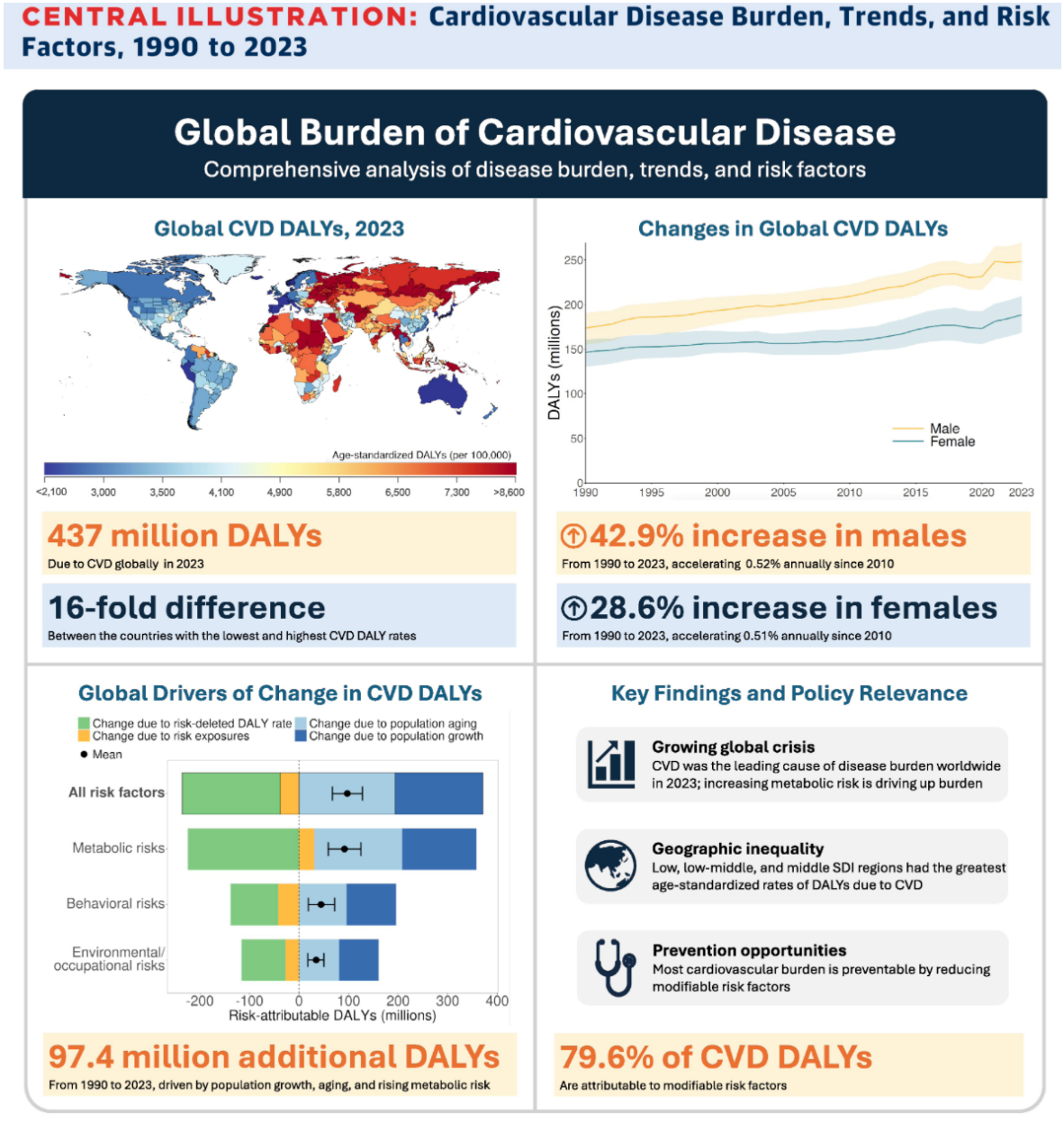
The Global Burden of Disease (GBD) study consistently identifies cardiovascular disease as the leading cause of mortality worldwide, accounting for approximately one in three deaths globally (Evaluation, 2025). Coronary heart disease accounts for a large proportion of this burden, contributing to reduced lifespan and quality of life (Global Burden of Cardiovascular Diseases Risks 2023 Collaborators, 2025; Roth et al., 2020). Between 2010 and 2021, the global prevalence of coronary heart disease increased by approximately 30% (British Heart, 2025). As illustrated in **Figure 1**, the global burden of cardiovascular disease remains substantial, with approximately 437 million disability-adjusted life years (DALYs) attributed to cardiovascular disease in 2023. One lost DALY equates to one lost year of healthy life, as a result of premature death from disease, or due to disease-related illnesses or disability. The figure also demonstrates marked geographic variation in cardiovascular burden, alongside a continued increase in global DALYs since 1990.

Coronary heart disease is caused by atherosclerosis, which is due to the deposition of fatty material (atheroma) in the coronary arteries. This narrows the arterial lumen, thereby restricting the flow of blood to the heart muscle. Early and accurate diagnosis is critical for the effective management of coronary heart disease (World Health Organisation, 2023). Despite advances in diagnostic techniques, the timely diagnosis of cardiovascular disease remains challenging. This challenge may be further compounded in individuals with

coexisting mental health conditions. However, limited research has examined how these conditions influence diagnostic pathways.

Figure 1

Cardiovascular Disease Burden, Trends, and Risk Factors, 1990-2023 (Global Burden of Cardiovascular Diseases Risks 2023 Collaborators, 2025)



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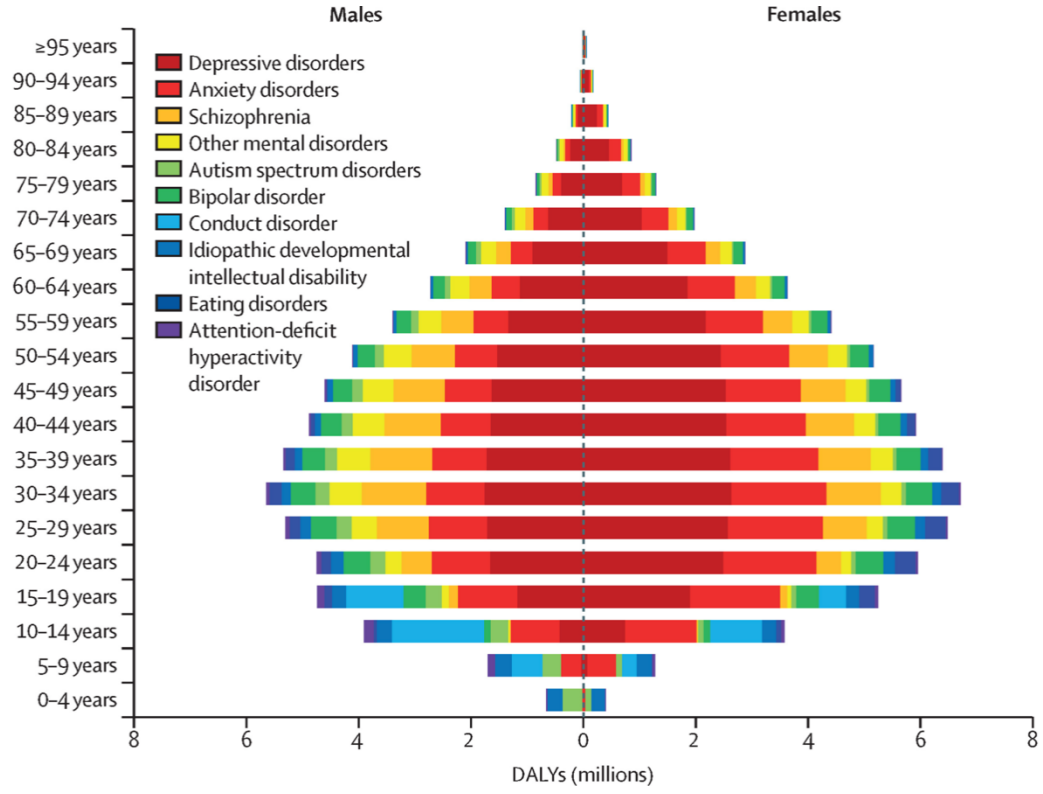
Similarly, mental health conditions are among the leading contributors to global disability, particularly in terms of years lived with disability (GBD 2019 Mental Disorders

Collaborators, 2022). As illustrated in **Figure 2**, depression and anxiety account for a substantial proportion of DALYs across the life course. The burden is greatest during early and middle adulthood, with depressive disorders contributing to a substantial proportion of DALYs across most adult age groups. Anxiety disorders also contribute consistently across age groups, particularly from adolescence into later adulthood. The figure further demonstrates higher DALYs among females compared with males for both depressive and anxiety disorders, highlighting sex differences in mental health related disability. These findings emphasise that depression and anxiety represent major contributors to global morbidity and may have important implications for coexisting physical health conditions, such as cardiovascular disease.

Figure 2

Global DALYs by Mental Health Disorder, Sex, and Age, 2019 (GBD 2019 Mental Disorders Collaborators, 2022)



A mental health condition is defined as a clinically significant disturbance in an individual's cognition, emotional regulation or behaviour. It is usually associated with increased levels of distress and impairment of important areas of daily functioning (World Health Organisation, 2022). Mental health conditions are associated with physiological dysfunction, including autonomic dysregulation and inflammation, which may contribute to the pathogenesis of coronary heart disease (Steptoe & Kivimäki, 2013). In addition, having a pre-existing mental health condition may also influence symptom interpretation and communication, potentially impacting the diagnostic process.

A growing body of evidence demonstrates an increased risk of coronary heart disease among individuals with mental health conditions, including depression, anxiety, and post-traumatic stress disorder (Firth et al., 2019). Characteristics including ethnicity (Leigh et al., 2016), gender (Berg Gundersen et al., 2017), age (Jousilahti et al., 1999; Nadeem et al., 2013; Navas-Nacher et al., 2001) and life experiences (McDonald et al., 2014; Wilhelmsen et al., 1973) have been investigated as potential risk factors contributing to this observed association. The elevated risk of cardiovascular disease in people with a mental health condition has been shown to be partly mediated by a higher prevalence of modifiable risk factors such as smoking and increased alcohol use (Khraishah et al., 2023; McSweeney et al., 2005). These adverse health behaviours are strongly associated with increased cardiovascular risk and mortality (Firth et al., 2019). Whilst these associations are well established, less is known about how mental health impacts the diagnostic pathways and timeliness in diagnosis.

Despite the recognised association between mental health conditions and coronary heart disease, individuals with mental health conditions often experience significant diagnostic challenges in coronary heart disease (Bosner et al., 2011). The coexistence of coronary heart disease and a mental health condition may allow one condition to mask the

other, prolonging the diagnostic process. Delayed diagnosis can be conceptualised as a temporal variant of misdiagnosis (Hunter et al., 2024), whereby the patient's true condition exists at the time of first evaluation, but is either not recognised or misattributed to another condition in the first instance (Institute of Medicine et al., 2015). Diagnostic challenges have the potential to contribute to diagnostic delay. Prolongation of the diagnostic process can lead to outcomes comparable to those associated with misdiagnosis, including lost opportunities for early intervention and disease progression (Newman-Toker & Pronovost, 2009; Singh et al., 2014). Despite growing recognition of diagnostic challenges in this population, the mechanisms behind this remain incompletely understood. In particular, there is limited research regarding how multiple intersecting demographics, in addition to psychological and social factors, collectively influence diagnostic outcomes in cardiovascular disease among individuals with a coexisting mental health condition.

The factors contributing to the diagnostic challenges are incompletely understood. Existing research has identified specific populations, such as women and ethnic minorities who are more likely to experience diagnostic challenges for coronary heart disease. This is particularly so when presenting with overlapping symptoms of mental and physical health conditions (Khraishah et al., 2023; McSweeney et al., 2005). Current evidence suggests that diagnostic challenges for coronary heart disease in these individuals is partly driven by atypical symptomology that is misattributed to a non-cardiac aetiology. For example, McSweeney et al. (2005) found that women frequently report fatigue, shortness of breath and sleep disturbance rather than classic chest pain, with the potential to introduce diagnostic ambiguity and challenges. Furthermore, Khraishah et al. (2023) describes how patients from ethnic minorities often have their risk underestimated by standard diagnostic tools and thresholds. These findings suggest that examining individual risk factors in isolation may be

insufficient, calling for an intersectional approach to further understand how overlapping identities shape diagnostic experiences.

Many studies rely too heavily on homogenous samples, often from Western, educated, industrialised, rich, and democratic (WEIRD) societies (De Oliveira & Baggs, 2023), with clinical trials continuing to underrepresent women and other marginalised groups (Rivera et al., 2025; Zhang et al., 2013). This can subsequently impact the diagnostic process for individuals with these demographic profiles. For example, when individuals present with clinical features that align with the typical male cardiovascular symptom profile, the diagnostic process and clinical response may differ from those experienced by women, whose experiences more frequently diverge from the symptomatic norms (Al Hamid et al., 2024).

Further, the findings outlined thus far suggest that sociocultural, psychological, and physiological factors may influence the prevalence of coexisting coronary heart disease with a mental health condition. These biopsychosocial factors may intersect to shape the patient's experience of diagnostic pathways and healthcare-seeking behaviours, potentially contributing to diagnostic challenges (Hamed et al., 2022; Paradies et al., 2015). An intersectional perspective helps us to understand how identities and characteristics in different combinations create both opportunities and obstacles in the diagnostic process, such as why young black women are at high risk of developing cardiovascular disease (Kalinowski et al., 2019). Through an intersectional lens, this allows the investigation and identification of inequalities to guide meaningful change within the diagnostic processes for coronary heart disease (Losleben & Musubika, 2023). However, existing research rarely applies an intersectional framework to the study of cardiovascular disease, particularly among individuals with a co-existing mental health condition.

Taking this all into consideration, thought must be given to the increasing pressure to move the diagnostic process to Artificial Intelligence (AI) to accommodate the increasing

demand of referrals. As a result, AI is becoming increasingly used to assist medical decision-making, aiming to increase the speed and accuracy of diagnoses with a role in the investigation of factors causing diagnostic challenges (Shu et al., 2021). Artificial intelligence is coded by software developers to imitate the process undertaken by doctors. The coding process aims to create a model without bias and inequality to avoid an unintentional negative impact on patient care (Satori & Bocca, 2022). However, bias has been identified within healthcare systems (Gopal et al., 2021; Rivenbark & Ichou, 2020). A pre-existing bias in the diagnostic process could limit the efficacy of the AI model and increase the risk of error (Satori & Bocca, 2022). Some demographic groups are more at risk of diagnostic challenges, impairing access to appropriate care (Hamed et al., 2022; Paradies et al., 2015). Investigating the impact of intersectionality on diagnostic accuracy will help facilitate the reduction of bias within future AI applications. Without a comprehensive understanding of how intersectional factors influence diagnostic pathways, there is a risk that AI systems may replicate existing inequalities in cardiovascular disease diagnosis.

This study aims to critically examine how individual characteristics and their intersection impact the diagnostic process for cardiovascular disease in the presence of a coexisting common mental health condition. Before this, a systematic literature review will be conducted. This will enable the synthesis of existing research in this area, highlighting key themes and gaps in knowledge to further inform the study design.

A Systematic Review Examining the Influence of Intersectionality and Mental Health Comorbidities in the Diagnosis of Cardiovascular Disease

This systematic review examines the relationship between mental health, cardiovascular disease and intersectionality, with a view to better understanding the mechanisms and mediators of diagnostic challenges in coronary heart disease. Specifically, it aims to examine how intersectional characteristics influence the timeliness and accuracy of coronary heart disease diagnosis in individuals with pre-existing mental health conditions.

Methods

Search Strategy and Definitions

The systematic review adhered to the Preferred Reporting Items of Systematic Reviews and Meta-Analysis (PRISMA) guidelines (Page et al., 2021). The literature search was conducted across multiple academic databases: MEDLINE Ultimate, APA PsycArticles, CINAHL Ultimate to identify peer-reviewed studies examining the relationships between mental health conditions, cardiovascular disease, intersectionality, and diagnostic challenges.

The final search strategy was structured around four key concepts: “mental health conditions”, “cardiovascular disease”, “misdiagnosis”, and “intersectionality” (**Table 1**). Synonyms and related terms within each concept were combined using the Boolean operator “OR” (S1–S4) to maximise the retrieval of relevant literature. The four concept searches were then combined using the Boolean operator “AND” (S5) to identify studies addressing all aspects of the research question. The final database search was completed on April 22nd, 2025.

It is acknowledged that across research papers and institutions, there is some nuance to the definitions of the search terms applied in this systematic review. For the purpose of this review, the definitions found in **Table 2** were applied.

Table 1

Search Terms Used for the Literature Search.

Search Label	Search Category	Search Strategy
S1	Mental Health Condition	"mental health" OR MH OR anxiety OR depression OR "mental disorder*" OR "mental illness" OR "mental wellbeing" OR "mental welfare" OR "mental health condition*" OR antidepressant* OR SSRI* OR "psychological therap*"
S2	Cardiovascular Disease	CHD OR "cardiovascular disease*" OR "coronary heart disease" OR "coronary artery disease" OR CAD OR "ischaemic heart disease" OR "ischemic heart disease" OR "myocardial ischaemia" OR "myocardial ischemia" OR "heart disease*"
S3	Misdiagnosis	misdiagnos* OR "delayed diagnos*" OR overdiagnos* OR underdiagnos* OR "wrong diagnosis" OR "missed diagnosis" OR misidentif* OR misinterpret* OR "diagnostic error*" OR "diagnostic delay*"
S4	Intersectionality	intersectionality OR "intersectional characteristic*" OR intersectionalism OR gender OR sex OR "socioeconomic status" OR SES OR age OR sexuality OR "sexual orientation" OR ethnicity OR race OR disability
S5	Combined Search	S1 AND S2 AND S3 AND S4

Inclusion and Exclusion Criteria

The inclusion and exclusion criteria were designed to identify literature that directly addresses the research aims and questions concerning the intersection of mental health conditions, cardiovascular disease, and diagnostic challenges.

Table 2

Definitions of Key Terms Used in the Literature Review.

Terms	Definition
Mental Health Condition	'A mental disorder is characterized by a clinically significant disturbance in an individual's cognition, emotional regulation, or behaviour. It is usually associated with distress or impairment in important areas of functioning. There are many different types of mental disorders.' (World Health Organisation, 2022)
Coronary Heart Disease	'Coronary heart disease is usually caused by a build-up of fatty deposits (atheroma) on the walls of the arteries around the heart (coronary arteries). The build-up of atheroma makes the arteries narrower, restricting the flow of blood to the heart muscle. This process is called atherosclerosis.' (NHS, 2024)
Intersectionality	'The concept helps to understand how identities in their manifold composition can experience and create differently both opportunities and obstacles (including simultaneously) … Intersectionality is a framework to understand these moments and structures of opportunities and oppression within an ethos of social justice' (Losleben & Musubika, 2023)

Studies were included if they met the following conditions:

- Population: Research involving adult participants aged 18 years and older. This age threshold ensures that findings are relevant to adult diagnostic pathways, which differ significantly from paediatric populations.
- Focus: The study examined the relationship between mental health conditions (e.g. anxiety, depression) and cardiovascular disease, specifically the development of cardiovascular disease following a diagnosis of a mental health condition.
- Intersectional Analysis: The study considered intersectional characteristics, such as age, gender, socioeconomic status, and ethnicity, that may influence diagnostic outcomes or the recognition of symptoms.
- Empirical Research: Only original, peer-reviewed empirical studies (quantitative, qualitative, or mixed methods) were considered.
- Papers were included if published in English.

Studies were excluded based on the following criteria:

- Population: Research focused on participants under the age of 18 was excluded due to significant differences in diagnostic criteria, presentation, and clinical pathways in paediatric populations. Research focused on parent or carer experiences was also excluded, as it did not directly relate to the research question.
- Publication Type: Literature reviews, commentaries and non-published theses were excluded to prioritise original empirical evidence.
- Different research focus: Studies where the primary focus was on alternative medical diagnoses (e.g. cancer, dementia, diabetes) rather than cardiovascular disease were excluded.

- Medication and Treatment Outcomes: Research that focused primarily on the efficacy of medication or treatment interventions, rather than diagnostic processes or challenges, was excluded.
- Lack of relevance to the proposed research question: Studies that did not directly address the interaction between mental health conditions and diagnostic challenges in coronary heart disease, or that did not explore relevant intersection variables, were excluded.

Only papers published on or after 1st January 2020 were included. The justification for this being that there has been a major shift in cardiovascular diagnostic processes since 2020, promoting holistic and patient-centred care with an emphasis on shared decision-making (European Society of Cardiology, 2020). This was also the first time that guidance on risk factors for cardiovascular disease explicitly stated depression, anxiety and psychosocial stress (Visseren et al., 2021). With mental health as a risk factor for cardiovascular disease being acknowledged, it is useful to look at diagnostic processes and protocols from this time onwards to reflect current practice based on the updated guidance. Moreover, the COVID-19 pandemic significantly disrupted diagnostic timelines, affecting populations with both mental and physical health conditions (Williams et al., 2020). Furthermore, the literature published after 2020 showed a marked increase in research applying intersectionality frameworks to healthcare disparities (Bowleg, 2021), aligning with this review's focus on diagnostic inequities.

Data Extraction and Synthesis

The retrieved studies were first imported into EndNote reference management software (Clarivate, 2025), and duplicates were removed. The remaining studies underwent a two-stage screening process:

1) Title and abstract screening: studies were screened against the predefined inclusion and exclusion criteria.
2) Full-text review: Articles that passed the initial screening or did not provide enough information in their abstract were reviewed in full to assess their eligibility. Each study was evaluated against the inclusion and exclusion criteria.

Following the screening process, papers were quality assessed systematically using the Critical Appraisal checklist for cohort (Critical Appraisal Skills Programme, 2024b)and cross-sectional studies (Critical Appraisal Skills Programme, 2024a). The CASP (2024a, 2024b) checklists defines a 'good' study as one that is of high methodological quality, with low risk of bias and high validity. The checklists for assessing cohort and cross-sectional studies can be found in **Appendix A** and **B**, respectively. This meaning that the study met most of the checklist criteria, providing enough detail on the justification and design of the study. A 'fair' study is defined as one with acceptable methodological procedures with some potential limitations or biases; a 'poor' study was defined by significant methodological concerns or a high risk of bias. Papers with a quality score of 'poor' were excluded from the review. Although studies deemed to be 'fair' were included, the data were interpreted with caution.

Metadata from each paper included were systematically extracted to ensure consistency and facilitate comparative analysis. The extracted information included 1) bibliographic details (author, year of publication, and country), 2) study characteristics (study design, sample size, and population), 3) methodological features (data sources, analytical procedures, and key variables examined), 4) information on primary outcomes, and 5) main findings relevant to the review objectives.

Data Analysis

A narrative synthesis approach was adopted to summarise the results. This allowed for a more flexible and critical interpretation of the evidence, enabling the integration of findings from diverse methodologies and contexts. A narrative review is particularly well-suited to examining complex, socially embedded issues. This includes diagnostic inequities, where a broad interpretive perspective is necessary to unpack structural and intersectional influences that quantitative synthesis may overlook.

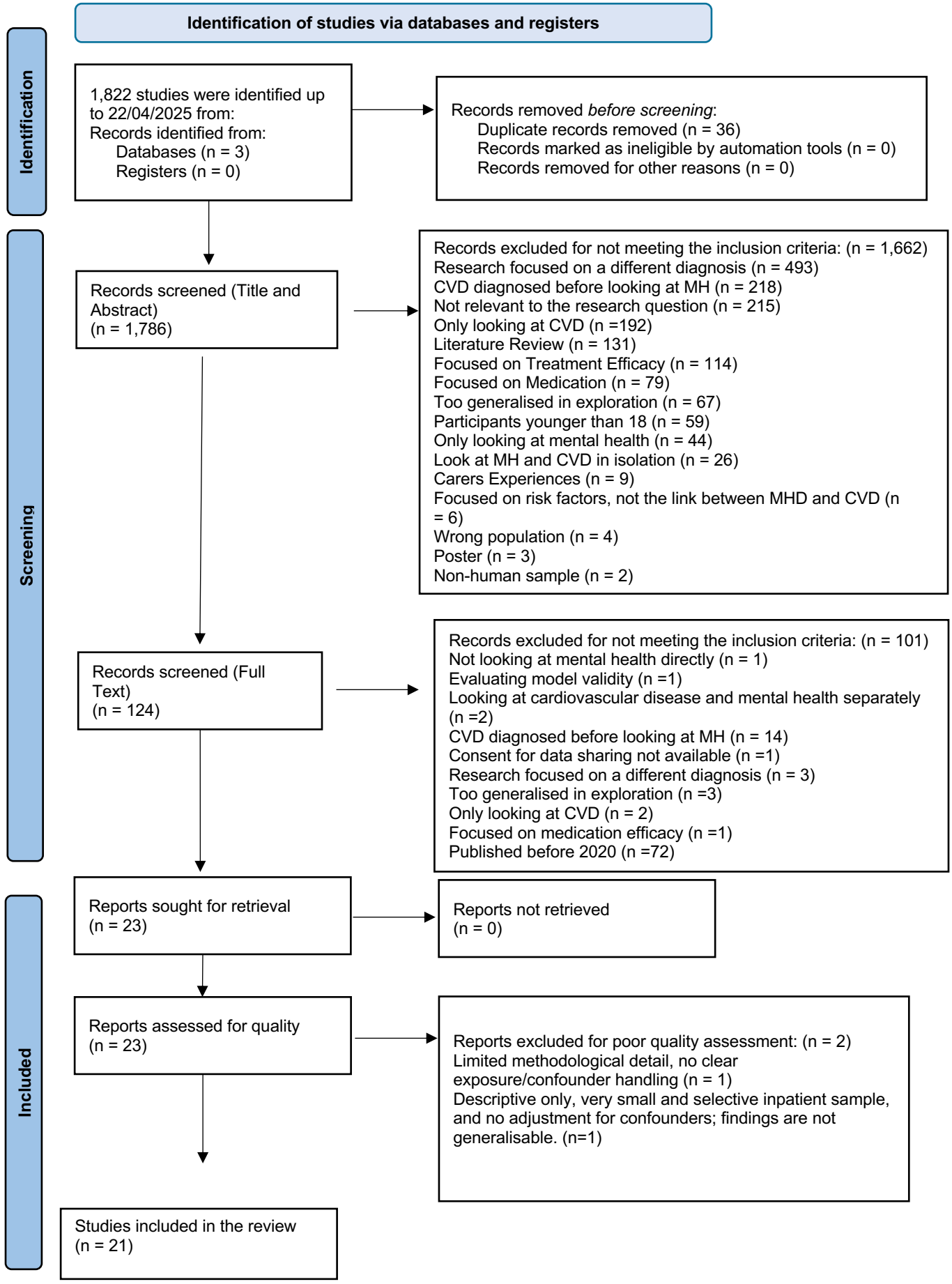
Results

The initial search identified 1822 papers. After removing duplicates, the articles were reduced to 1787. Following the review of the titles and abstracts, 124 papers met the inclusion criteria for full-text review. Once full-text review had been completed, 23 papers fulfilled the inclusion criteria (**Figure 3**). Two papers were subsequently excluded from the review due to being deemed of poor quality by the CASP checklist (**Appendix A and B**). Therefore, a total of 21 papers were included. Of these studies, thirteen were cohort studies, seven were cross-sectional studies, and one study utilised a mixed methods design. A summary of the key features of each paper included can be found in **Table 3**, with a summary of findings provided in **Appendix C**.

The 21 studies included were characterised by high levels of heterogeneity in study design, population characteristics, outcome measures, and methodologies. For instance, studies varied in how they defined and measured both mental health conditions, cardiovascular disease and diagnostic challenges, with some using self-reported symptom duration, while others used retrospective clinical data or qualitative accounts.

Figure 3

PRISMA Flowchart to show how Included Papers Were Selected (template obtained from McKenzie et al. (2021)



Moreover, intersectionality was conceptualised and operationalised differently across studies, with limited consistency in the identity categories considered (e.g. ethnicity, gender, socio-economic status) or how intersectional variables were analysed. This variability prevents the meaningful aggregation of effect sizes or pooled estimates required to conduct a meta-analysis.

Across both cohort and cross-sectional designs, the results consistently demonstrated an association between the diagnosis of a mental health condition and a subsequent increased risk of cardiovascular disease. This association was observed even when analyses controlled for confounding factors shared within families, such as genetics and early-life environmental exposures. However, the effect sizes and significance varied by population characteristics and study design.

A large multi-country cohort study by Shen et al. (2023) reported differences in the incidence of cardiovascular disease per 1,000 people-years across three comparison groups. People-years is a measure of the total amount of time that all participants in a study are observed and are at risk of developing the outcome of interest. It combines the number of participants and the length of time each participant is followed, allowing researchers to calculate incidence rates and compare groups even when follow-up times differ. The study employed a sibling-controlled design allowing adjustment for a large proportion of unmeasured genetic and early-life environmental confounding factors. Patients diagnosed with psychiatric disorders had the highest incidence rate (9.7 disease per 1,000 people-years), followed by their unaffected full siblings (7.4 disease per 1,000 people-years) and a matched general reference population (7.0 disease per 1,000 people-years). In the first year following a diagnosis of a mental health condition, patients exhibited a substantially higher rate of cardiovascular disease compared to their unaffected siblings (HR [hazard ratio]=1.88; 95% CI=1.79–1.98), (Shen et al., 2023).

These findings were corroborated by Lee et al. (2025), who observed that within the first year of a recorded mental health diagnosis, the prevalence of at least one physical comorbidity ranged from 20% in 2006 to 14.5% in 2020. Importantly, cardiovascular disease was identified as the most common comorbidity in this population. Further, individuals with a mental health condition identified as having a higher number of physical comorbidities were seen to have a greater number of inpatient contacts (inpatient contacts: 2.6 [2.6, 2.7] for no comorbidities to 4.5 [4.1, 4.9] for ⩾ 3 comorbidities).

Bobo et al. (2020) found the relationship between cardiovascular disease and a mental health condition to be bi-directional. After adjusting for 16 comorbid chronic conditions, individuals with depression were found to have a significantly increased risk of developing newly diagnosed heart failure (HR =2.08, 95% CI= 1.89-2.28). Conversely, individuals with heart failure also had a significantly elevated risk of a new diagnosis of depression (HR 1.34, 95% CI= 1.17-1.54).

The role of pharmaceutical treatment was also considered (Kim et al., 2024). A large national cohort study demonstrated an increased risk of atherosclerotic cardiovascular disease with antidepressant use. The results showed that the use of antidepressants (HR 1.39, 95% CI= 1.36-1.42) and Tricyclic antidepressant use only (HR 2.11, 95% CI= 2.06-2.16) significantly increased the odds of developing cardiovascular disease, compared to those not taking antidepressants (HR 0.93, 95% CI= 0.91-0.96).

Across the studies, gender differences in the relationship between depression and cardiovascular disease were heterogeneous, with several studies demonstrating stronger associations in women (Han et al., 2021; Liu et al., 2025; Yu et al., 2022). while others suggested elevated risk among men (Kwobah et al, 2023; Patterson et al., 2022). For example, Yu et al. (2022) found that depression was more strongly associated with

cardiovascular disease and stroke in women compared with men (p <.05). Similarly, Liu et al. (2025) identified sex-specific predictors of cardiovascular risk, with restless sleep showing a stronger association with cardiovascular disease in women (aHR [adjusted hazard ratio] 1.44; 95% CI= 1.28-1.62) than men (aHR 1.18; 95% CI= 1.04-1.34)). Women also demonstrated higher cardiovascular rates (20.8% vs. 17.1%).

Han et al. (2021) further reported gender-specific disease trajectories following a diagnosis of depression, with women more likely to develop heart failure and exhibit higher mortality risks, including respiratory death (HR 5.89 vs 3.82) and death from unnatural causes (HR 7.85 vs 5.72). Specific subgroups of women were also found to be at a greater risk of developing cardiovascular disease, such as women who have experienced post-partum depression (HR=1.42, 95% CI= 1.35-1.49) compared to women who did not (Brann et al., 2024).

Table 3
Summary of Key Features of the Studies Included

Authors	Year	Country/region	Study Design	Sample Size	Quality Measure	Quality Score (CASP)	Measures Used
(Andrews et al., 2021)	2021	USA(United States of America)	Cross-sectional study	99 (42 for inflammatory markers)	CASP Cross sectional Study Checklist	Fair	Perceptions of neighbourhood, social cohesion, CESD-R, IL-1β, IL-6, IL-18, NDI
(Bafna et al.)	2025	USA (Miami, Florida)	Cross-sectional study	2,356	Cross Sectional Study	Good	CCTA, PHQ-9, GAD-7, blood markers
(Bobo et al.)	2020	USA (Rochester, MN)	EHR-based cohort study	10,649 (Depression), 5,911 (HF)	CASP Cohort Study Checklist	Fair	Depression, HF, EF, comorbidities
(Brann et al., 2024)	2024	Sweden	Matched cohort using registers	55,539 PND, 545,567 controls	CASP Cohort Study Checklist	Good	PND, CVD outcomes, sociodemographic, obstetric and psychiatric history
(Haigh et al.)	2020	USA	Population-based prospective cohort study	274 cardiovascular disease–free older adults	CASP Cohort Study Checklist	Good	ZDI, both baseline (W4) and cumulative exposure over time (W4-5 mean ZDI). Anxiety Symptoms, STPI, CVD. mean arterial pressure (MAP).
(Han et al.)	2021	UK	Community-based cohort	502,493 (24,130 with depression)	CASP Cohort Study Checklist	Good	ICD-10 depression, medical conditions, CCI, Townsend index
(Hsu et al.)	2020	Taiwan	Population-based Cohort Study	766,427	CASP Cohort Study Checklist	Good	IHD, demographics, medications, comorbidities
(Johar et al.)	2024	Malaysia	Prospective cohort study	6,599	CASP Cohort Study Checklist	Good	FRS, DASS-21, physical activity, BMI, SES factors
(Kim et al.)	2024	South Korea	Cohort using NHISS	626,163	CASP Cohort Study Checklist	Fair	Depression, antidepressants, ASCVD, ICD-10, covariates
(Kwobah et al.)	2023	Kenya	Cross Sectional Comparison.	597	CASP Cross-sectional Study Checklist	Fair	Psychotic disorders, FRS, metabolic syndrome, lifestyle factors
(Lee et al.)	2025	Western Australia	Retrospective cohort study	253,362	CASP Cohort Study Checklist	Good	Diagnoses of schizophrenia spectrum disorders and bipolar disorders.
(Liu et al.)	2025	China	Cohort Study	11,735	CASP Cohort Study Checklist	Good	8-item CES-D scale. 10 specific depressive symptoms, categorised into cognitive affective and somatic domains.
(Lu et al.)	2024	USA & UK	Cohort Design	17,787 (baseline), 11,725 (Cox)	CASP Cohort Study Checklist	Good	Depression trajectories, heart disease, CES-D, demographics, behaviours, health

Authors	Year	Country/region	Study Design	Sample Size	Quality Measure	Quality Score (CASP)	Measures Used
Nmezi et al.	2022	USA (Baltimore-Washington D.C.)	Cross-sectional; African Immigrant Health Study	395	CASP Cross-sectional Study Checklist	Fair	PHQ-9, CVH metrics (tobacco, BMI, activity, diet), demographics
Oliveira et al.	2022	Brazil	Cross Sectional	289 (quant), 30 (qualitative)	CASP Cross-sectional Study Checklist	Fair	FRS, sociodemographic, depression, CVD risk, health habits, anthropometry
(Patterson et al.)	2022	USA	Cross-sectional study	875	CASP Cross-sectional Study Checklist	Good	Cardiovascular Health, Anxiety, Depression.
(Shen et al.)	2023	Sweden, Denmark, Estonia	Longitudinal matched cohort study with national registry data	Sweden: 900,000+; Denmark: 875,000+; Estonia: 30,000+	CASP Cohort Study Checklist	Good	Psychiatric disorders (ICD), CVD, socioeconomic/health covariates
(Vyas et al.)	2023	USA	Retrospective nationwide cohort comparison (2007 vs 2017)	1,274,118 (total)	CASP Cohort Study Checklist	Fair	Depression, CVD outcomes, demographics, hospital admission details
(Wooldridge et al.)	2023	USA	Cross-sectional (NESARC-III); Latent Class Analysis + regression	36,309	CASP Cross-sectional Study Checklist	Fair	ACEs, depression, CVD risk factors (BMI, smoking, inactivity), SES covariates
(Wu et al.)	2022	China	Prospective cohort study	487,000	CASP Cohort Study Checklist	Good	Health outcomes via registries, questionnaires, physical/lab measurements
Yu, et al.	2022	Southwest China	Prospective cohort study	7,735	CASP Cohort Study Checklist	Fair	Depressive Symptoms: Assessed using the Patient Health Questionnaire-9 (PHQ-9). Level of depression, Cardiovascular outcomes, Incident cardiovascular disease, Acute myocardial infarction and stroke.

Note. ACEs = Adverse Childhood Experiences; ASCVD = Atherosclerotic Cardiovascular Disease; BMI = Body Mass Index; CASP = Critical Appraisal Skills Programme; CCI = Charlson Comorbidity Index; CES-D = Centre for Epidemiologic Studies Depression Scale; CESD-R = Centre of Epidemiologic Studies Depression Scale – Revised; CCTA – Coronary Computed Tomography Angiography; CVD= Cardiovascular Disease; CVH= Cardiovascular Health; DASS-21= Depression Anxiety Stress Scales (21-item); EF= Ejection Fraction; EHR= Electronic Health Records; FRS= Framingham Risk Score; GAD-7= Generalised Anxiety Disorder Scale (7-item); HF= Heart Failure; ICD= International Classification of Diseases; ICD-10= International Classification of Diseases; 10th Revision; IHD= Ischemic Heart Disease; IL-1β= Interleukin-1 beta; IL-6= Interleukin-6; IL-18= Interleukin-18; MAP= Mean Arterial Pressure; NDI= Neighbourhood Deprivation Index; NESARC-III= National Epidemiologic Survey on Alcohol and Related Conditions; NHISS= National Health Insurance Service System; PHQ-9= Patient Health Questionnaire (9-item); PND= Postnatal Depression; SES= Socioeconomic Status; STPI= State-Trait Personality Inventory; ZDI= Zung Depression Index; W4/W4/5= Wave 4/ Wave 4-5 (study time points)

However, other studies indicated protective cardiovascular profiles among women. For example, Kwobah et al. (2023) found that female sex was associated with a reduction in 10-year cardiovascular risk in a Kenyan psychosis cohort (β = -1.13, SE = 0.35, t = -3.25, *p* = .007). Patterson et al. (2022) similarly reported slightly higher cardiovascular health scores among young women compared to men (mean 20.5 vs 9.9).

Furthermore, prospective findings from Haigh et al. (2020) in a cohort of older adults showed that the link between cardiovascular disease and mental health is not confined to acute events or specific diagnoses. Over a 15-year follow-up period, depressive symptoms prospectively predicted future cardiovascular disease events, even after adjustment for demographic variables, trait anxiety and mean arterial pressure, with an odds ratio of 1.15 (95% CI= 1.06-1.24) in the fully adjusted model. These findings were subsequently supported by findings from studies conducted by Han et al. (2021) and Yu et al. (2022). Han et al. (2021) found that those with an ICD code for depression had an increased risk of developing cardiovascular disease (HR = 3.00, 95% CI= 2.69-3.36), using data from the UK Biobank. Similarly, Yu et al. (2022) found that for every one standard deviation (SD) increase in PHQ-9, a self-report screening for depression, there was an increased risk of developing a cardiovascular disease (HR= 1.14, 95% CI= 1.03-1.26), myocardial infarction (HR= 1.26, 95% CI= 1.01- 1.57) or a stroke (HR= 1.12, 95% CI= 1.01-1.25).

The risk of depression on cardiovascular disease outcomes was observed not to be static but to be influenced by the trajectory of symptoms over time. Lu et al. (2024) analysed pooled data from two prospective cohort studies (Health Retirement Study and English Longitudinal Study of Ageing) to explore the association between trajectories of depressive symptoms and the risk of cardiac events. The findings showed that persistent (HR 1.64, 95% CI= 1.45-1.84) or worsening symptoms (HR 1.43, 95% CI= 1.25-1.64) were associated with a greater risk of developing a cardiovascular disease, compared to a fluctuating (HR 1.13,

95% CI= 1.06-1.20) or decreasing (HR 1.07, 95% CI= 0.96-1.19) trajectory. Liu et al. (2025) found that the depressive symptom of restless sleep was linked to an increased risk of developing a cardiovascular disease, notably more so in women (HR= 1.44; 95% CI= 1.28-1.62) compared to men (HR= 1.18; 95% CI= 1.04-1.34).

The type of mental health condition and related symptomatology were demonstrated to be associated with cardiovascular disease (Hsu et al., 2021; Lu et al., 2024) . For example, Lu et al. (2024) found that the association with cardiovascular disease was substantially stronger for somatic depressive symptom trajectories (HR 1.93, 95% CI= 1.70-2.19), such as fatigue and sleep disturbance, than for cognitive-affective ones, such as hopelessness and negative self-appraisal. Restless sleep was more strongly associated with cardiovascular disease in women (HR, 1.44; 95 % CI= 1.28–1.62) compared to men (HR, 1.18; 95 % CI 1.04–1.34). Hsu et al. (2021) demonstrated a significantly increased incidence of ischemic heart disease in patients with bipolar disorder compared to controls (2.02% vs 1.24%; risk ratio 1.60; 95% CI= 1.36–1.90). This risk was elevated in people aged 40-59 (HR 3.12, 95% CI= 2.02-4.82).

Anxiety was identified as a risk factor for cardiovascular disease, independent of depression related symptoms (Wu et al., 2022). Wu et al. (2022) conducted a large prospective study, examining differences in cardiovascular disease risk between subsets of anxiety presentation. The experience of panic attacks was associated with an increased risk to cardiovascular health (HR 1.08, 95% CI= 1.04-1.13), including ischaemic heart disease (HR 1.10, 95% CI= 1.02-1.19) and haemorrhagic stroke (HR 1.20, 95% CI= 1.05-1.38). In contrast, continuous anxiety was positively associated with the incidence of cardiovascular disease (HR 1.123, 95% CI= 1.04-1.20), but its relationship with stroke was not statistically significant.

The impact of anxiety on cardiovascular health was also observed in younger populations through its association with health behaviours. In cross-sectional analyses of young adults, moderate to severe anxiety was associated with a lower likelihood of meeting ideal levels of physical activity (aPR [adjusted prevalence ratio] = 0.60, 95% CI= 0.44–0.82), smoking status (aPR, 0.90, 95% CI= 0.82–0.99) and body mass index (aPR, 0.79, 95% CI= 0.66–0.95) compared to those without anxiety (Patterson et al., 2022).

Individuals with psychotic and bipolar disorders have profoundly adverse health outcomes with a life expectancy reduced by 15-20 years (Kwobah et al., 2023). This is largely due to premature cardiovascular disease (Kwobah et al., 2023). In a Kenyan cohort of patients with psychosis, Kwobah et al. (2023) found that patients were significantly more likely to be current smokers (13.8%) compared to controls (7.0%). In addition, this group exhibited an extremely high prevalence of poor diet, with over 97% consuming fewer than five servings of fruit and vegetables per week, and inadequate physical activity (78%). Kwobah et al. (2023) also observed higher Framingham cardiovascular risk profiles in patients with psychotic disorders (3.16) compared to controls (2.93) with the estimated 10-year cardiovascular risk in patients being significantly associated with a reduction in risk for female sex (β = -1.13, SE = 0.35, t = -3.25, p = .007) and increased risk with increased age (β = 0.24, SE = 0.02, t = 14.73, p < .001), current tobacco smoking (β = 3.75, SE [standard error] = 0.57, t = 6.62, p < .001) and metabolic syndrome (β = 2.89, SE = 0.42, t= 6.88, p < .001).

The association between mental health conditions and cardiovascular disease was observed to not be direct but mediated through a complex interplay of different factors. For example, Adverse Childhood Experiences (ACE) were observed to contribute to later cardiovascular risk (Wooldridge et al., 2023). It was found that out of all of the modifiable cardiovascular risk factors, tobacco smoking (z (z-score) =17.14, p <.001), obesity (z = 3.7, p

<.001), and lifetime depression (z = 20.68, p <.001) had the strongest relationship with adverse childhood experiences.

The association between mental health conditions and cardiovascular disease was also found to be present in younger populations. A retrospective analysis comparing hospitalised young adults aged 18-44 years old with comorbid depression in 2007 and 2017, revealed a significant increase in the prevalence of several modifiable cardiovascular risk factors over this time, including: hypertension (23.6% vs 27.7%), diabetes (2.1% vs 5.6%), smoking (27.6% vs 45.2%) and obesity (10.3% vs 16.6%) in the 2017 cohort (Vyas et al., 2023). This highlights an increasing trend of risk factor accumulation for cardiovascular disease in young people with depression. This was also noted by Patterson et al. (2022), who showed how those with moderate to severe depression were significantly less likely to meet ideal levels for physical activity (aPR) 0.48), body mass index (aPR 0.75), sleep (aPR 0.79) and blood pressure (aPR 0.92), compared to their non-depressed peers.

This association was found not to be unique to high-income countries. A study by Oliveira et al. (2022) in a cohort of women in Brazil identified a high prevalence of several modifiable risk factors, with sedentarism (60.9%), stress (60.6%), depression (40.1%), and obesity (38.8%) being the most common.

The environment in which a person lives also plays an important role in shaping mental and cardiovascular health (Andrews et al., 2021). It was found that more favourable neighbourhood perceptions, particularly higher social cohesion (β (Beta) = −0.82, p = .01), were associated with decreased depressive symptom scores. These psychological states were then linked to physiological markers, finding that increasing depressive symptom scores were related to higher levels of pro-inflammatory cytokines IL-1ß (β = 21.25, p < .01) and IL-18 (β = 0.006, p = .01), both of which are associated with cardiovascular disease. This relationship was found across diverse populations. Among African immigrants in the U.S.,

Nmezi et al. (2022) found that individuals with moderate to severe levels of depression were less likely to have ideal cardiovascular health compared to those with minimal to mild symptoms (HR 0.42, 95% CI= 0.17-0.99).

Johar et al. (2024) also highlighted the significance of socioeconomic and demographic determinants of cardiovascular disease progression. In a Southeast Asian cohort, Johar et al. (2024) identified that Malay ethnicity (Chinese ethnicity with reference group being Malay ethnicity: β=0.62, 95% CI= 0.39-0.84); non-married status (β=–0.52, 95% CI= –0.77 to –0.26), full-time employment (β=0.78, 95% CI= –1.12 to –0.44) and depressive symptoms (–1.25, 95% CI= –2.44 to –0.06; *P*=.04) were all significantly associated with increased cardiovascular disease scores over five years.

Conversely, Bafna et al. (2025) found no significant link between depression and increased coronary artery plaque formation (adjusted odds ratio [*aOR*]: 1.03; 95% CI= [0.70, 1.52]; p = .891) or anxiety and increased coronary artery plaque formation (*aOR*: 1.27; 95% CI= [0.93, 1.73]; p = .138), compared to individuals without depression or anxiety.

Discussion

The findings of this review indicated that individuals with a mental health condition, particularly depression and anxiety, face an elevated risk of developing cardiovascular disease, including coronary heart disease. This relationship was evident across a range of study designs and populations. However, when this was explored through the lens of intersectionality (which takes into account gender, ethnicity, life stage, and sociocultural context), the patterns became more complex.

Notably, multiple cohort studies reported a consistent elevation in risk among those with depressive symptoms (Bobo et al., 2020; Haigh et al., 2020; Kim et al., 2024). These associations were present even after adjusting for traditional cardiovascular risk factors,

suggesting that mental health conditions may act as independent predictors of cardiac events. However, prior research has primarily focused on the association between depression and the incidence of cardiovascular disease (Haigh et al., 2020; Liu et al., 2025; Shen et al., 2023; Yu et al., 2022), with little attention to how depression may influence the diagnostic pathway for cardiovascular disease. In particular, the potential impact of mental health conditions on time to diagnosis has not been examined. This is an important gap to fill, as diagnostic challenges in coronary heart disease can lead to postponed treatment and poorer clinical outcomes.

Importantly, several studies drew attention to subgroups at increased risk of cardiovascular disease in the presence of a mental health condition. Younger adults and women, for example, showed stronger associations between depressive symptoms and increased coronary heart disease incidence (Kim et al., 2024; Liu et al., 2025; Yu et al., 2022), groups often overlooked in conventional cardiovascular risk models (Kwobah et al., 2023; Oliveira et al., 2022). This highlights a potential blind spot in clinical risk assessment, where standard protocols may underestimate vulnerability in some demographic groups.

Other studies highlighted how intersectional variables such as ethnicity, immigration status and neighbourhood context can influence the mental health–cardiovascular disease association. In one study, acculturation appeared to impact the relationship between depressive symptoms and cardiovascular health, possible due to the psychosocial pressures associated with social and cultural adaptation (Nmezi et al., 2022). Similarly, Andrews et al. (2021) found that individuals living in neighbourhoods with poor social cohesion reported both worse mental health and biological markers of inflammation, reinforcing how environmental stressors intersect with psychosocial and physiological pathways.

Brann et al. (2024) found that perinatal depression significantly elevated the risk of maternal cardiovascular disease, emphasising a need for gender and life-stage specific

prevention strategies. Of all the studies included in this review, only Kwobah et al. (2023) stratified their findings beyond binary gender comparisons.

Bidirectionality in the relationship between mental health and cardiovascular disease was observed but remains underexplored. Bobo et al. (2020) demonstrated that heart failure increased the risk of subsequent depression, while depression also increased the likelihood of developing heart failure. Nevertheless, no other studies incorporated temporal modelling capable of identifying these bidirectional effects. Such reciprocal influences complicate the diagnostic process, potentially obscuring early warning signs and recognition of either condition.

The impact of psychiatric treatment on cardiovascular outcomes also remains a significant knowledge gap. Kim et al. (2024) was the only study to differentiate between the effects of depression and antidepressant use, showing that both independently increased cardiovascular risk. Yet most studies failed to consider how medication, treatment engagement or treatment-resistant depression might shape risk profiles or symptom presentation.

One study did not find statistically significant results. For example, Bafna et al. (2025) reported no significant associations between depression or anxiety and increased quantities of coronary artery plaque compared to individuals without anxiety or depression, suggesting that not all psychiatric distress directly translates to observable cardiovascular pathology. This may reflect that depression and anxiety might influence cardiovascular risk indirectly through behavioural pathways, such as reduced physical activity or poorer medication adherence, which may not immediately translate into measurable plaque accumulation.

Taken together, this body of evidence supports the idea that mental health conditions could be considered a risk factor for developing cardiovascular disease, with the demographic

groups most impacted by this association differing from the typical risk profile for cardiovascular disease, such as the case of younger adults and females (Lu et al., 2024; Patterson et al., 2022; Vyas et al., 2023)

Further, Lu et al. (2024) and Liu et al. (2025) found that somatic symptoms of depression (fatigue, chest discomfort) were more strongly associated with cardiovascular outcomes, potentially complicating accurate triage and diagnostic investigations. These studies suggest that depression may lead to underreporting or misattribution of early cardiovascular warning signs. However, most studies used aggregated depression scores rather than detailed symptom-level analyses, limiting clinical insights into which symptom profiles are most likely to interfere with timely detection. Future work should integrate symptom-specific and intersectional approaches to capture the full extent of this relationship.

Overall, the relationship between mental health as a risk factor for cardiovascular disease is multifaceted and complex. The evidence suggests that individuals with mental health difficulties, especially those facing additional social or structural barriers (Kwobah et al., 2023; Nmezi et al., 2022), are at risk of having coronary heart disease symptoms overlooked or misinterpreted (Liu et al., 2025; Lu et al., 2024). Including the broader context of the individual's social and environmental circumstances will allow clinicians to better understand potential differences in presenting symptomatology (Liu et al., 2025; Lu et al., 2024) and how mental health may shape their engagement with care (Brann et al., 2024).

Limitations

Although this review focuses on diagnostic challenges in coronary heart disease, few of the included studies directly addressed this issue. Most investigations examined the association between diagnosed mental health conditions and subsequent cardiovascular outcomes. However, these studies did not explore whether mental health symptoms

influenced the diagnostic experience for coronary heart disease, whether through patient-level factors such as underreporting of symptoms, service-level biases or systemic barriers to care access. As a result, the coronary heart disease diagnostic timeline from the onset of symptoms to diagnosis remains insufficiently explored.

The intersectional considerations of mental health and cardiovascular risk, such as the influence of ethnicity, socioeconomic status and cultural background, were understudied. While a small number of studies (Brann et al., 2024; Kim et al., 2024; Kwobah et al., 2023; Nmezi et al., 2022) incorporated analyses beyond basic sex stratification, most studies did not separate findings across multiple identity configurations. This lack of stratification restricts our understanding of how these overlapping vulnerabilities influence the impact of mental health conditions on the coronary heart disease diagnostic process.

Only one study (Kim et al., 2024) explicitly examined the role of antidepressant use in modifying cardiovascular risk. This is a significant omission since antidepressant treatment may influence symptom perception, biological risk profiles (through weight gain), and healthcare engagement (Gafoor et al., 2018; Serretti & Mandelli, 2010). Without more consideration of pharmacological factors, the interaction between the treatment of mental illness and coronary heart disease remains incompletely understood.

Future Direction

Future research must explicitly investigate how mental health conditions contribute to challenges in diagnosing coronary heart disease. This includes quantifying time from symptom onset to diagnosis and identifying contributing factors such as misattribution of somatic symptoms to psychological causes and healthcare avoidance due to stigma. Mixed-method approaches combining patient interviews with audits of health records may gather valuable insights into diagnostic pathways.

There is a pressing need for studies that integrate intersectionality frameworks into design and analysis. Research should go beyond sex-based or single socio-demographic comparisons and incorporate the intersection, such as ethnicity, socioeconomic status, immigration status, gender identity, and their interaction. This would better capture the effects of structural inequality on both mental and cardiovascular health outcomes, particularly in underrepresented or marginalised populations.

Expanding on the work of Liu et al. (2025) and Lu et al. (2024), future studies may benefit from a more granular approach, sub-dividing depression and anxiety into symptom domains, such as somatic and cognitive-affective symptoms. This may help identify which symptom profiles are most likely to complicate coronary heart disease diagnosis or mimic cardiovascular symptoms, thereby improving screening strategies in both psychiatric and primary care settings.

To capture the dynamic relationship between mental health and cardiovascular disease, future research should use longitudinal designs with repeated measures and reciprocal analyses. Structural equation modelling (combining aspects of factor analysis and multiple regression) or cross-lagged panel models (repeated measurements over multiple time points) can better account for the temporal trajectory in the period between the diagnosis of a mental health condition and cardiovascular disease.

Justification for the Research

Despite substantial evidence linking mental health conditions to increased cardiovascular risk, important gaps remain in understanding how and why these risks may translate into elongating the diagnostic process of cardiovascular disease. While existing research has established that individuals with mental health conditions experience heightened cardiovascular risk, much of the literature has focused on documenting associations rather

than examining the mechanisms through which diagnostic disparities arise. As a result, the processes by which mental health status influences the interpretation of symptoms and subsequent diagnostic pathways remain insufficiently understood.

Although previous studies have utilised UK Biobank data to explore the relationship between depression and the subsequent impact on physical health (Han et al., 2021), more targeted analyses are required to explore the specific interaction between common mental health conditions and subsequent cardiovascular risk. The study protocol of Han et al. (2021) utilised UK Biobank data to examine how depression influences subsequent medical conditions and mortality. Through using UK Biobank, the data linkage to patient records allowed for the identification of subsequent diagnoses over a 6-month period. Han et al. (2021) identified 129 medical conditions being significantly associated with a diagnosis of depression, including cardiovascular disease. Whilst this highlighted the association, it warrants further investigation to capture the characteristics (e.g. age, sex) and trends (e.g. increased or decreased risk) of people who are diagnosed with a cardiovascular disease (including more ICD codes) in a shorter time following a diagnosis of depression, increasing the risk of cardiovascular disease going unnoticed by patients and clinicians.

Differences in demographic risk profiles of patients with a coexisting mental health condition and coronary heart disease may benefit from a modification of the standard diagnostic approach. Several studies suggest that vulnerability may be greater among particular subgroups, including younger adults and women (Kim et al., 2024; Liu et al., 2025; Yu et al., 2022), raising concerns that conventional cardiovascular risk assessment and diagnostic frameworks may insufficiently capture early or atypical presentations in these populations (Hsu et al., 2021; Patterson et al., 2022). However, studies rarely adopt an explicitly intersectional approach capable of assessing how overlapping characteristics (e.g. age, gender, ethnicity) interact with mental health status to shape diagnostic trajectories and

exposure to structural or clinical bias (Losleben & Musubika, 2023). Although contextual and psychosocial factors, such as neighbourhood disorder (Andrews et al., 2021), acculturation (Nmezi et al., 2022) and adverse childhood experiences (Wooldridge et al 2023) have been linked to poorer mental health outcomes and increased cardiovascular morbidity profiles, these influences are often examined in isolation rather than as interacting determinants of increasing cardiovascular risk following a mental health diagnosis.

Importantly, the literature also provides limited insight into how symptom presentation and diagnostic reasoning may contribute to delayed recognition of coronary heart disease in individuals with mental health conditions. Evidence that somatic depressive symptoms (e.g. fatigue and chest discomfort) may be strongly linked to subsequent cardiac events (Liu et al., 2025; Lu et al., 2024) raises the possibility of misattribution or diagnostic overshadowing. However, few studies directly examine clinician-patient interactions, specifically what nuances within the diagnostic process may be overlooked, such as reduced interoceptive accuracy (the objective capacity to detect internal bodily signals; Desmedt et al., 2023). Similarly, while prior studies have highlighted poorer cardiovascular health among young adults with depression (Patterson et al. 2022; Vyas et al 2023), the temporal relationship between mental health symptom onset or diagnosis and subsequent coronary heart disease diagnosis has never been definitively investigated.

The themes of intersectionality and symptom presentation provide potential challenges in the diagnosis of cardiovascular disease in individuals with a mental health diagnosis and require further investigation to understand how they may translate into challenges relating to help-seeking behaviour and identification during diagnostic processes. Quantitatively, this study will identify which individual characteristics, including which intersections of characteristics, are associated with a shorter length of time between mental health condition diagnosis and subsequent coronary heart disease diagnosis. Qualitatively, it

will examine clinician and patient perspectives to identify those factors potentially contributing to challenges in the diagnostic processes of coronary heart disease for individuals with mental health conditions.

This research is particularly timely given the increasing integration of artificial intelligence into diagnostic processes (Alizadehsani et al., 2021; Sun et al., 2023). While artificial intelligence may improve efficiency and standardisation, there is a risk that systems trained on biased data could replicate or amplify existing disparities affecting underserved or underrepresented intersectional populations (Satori & Bocca, 2022). Without robust evidence on how diagnostic frameworks already disadvantage specific groups, technological innovation may inadvertently entrench inequities rather than reduce them.

Research Aims and Objectives

Aims

To identify how individual characteristics and their intersection influence the diagnostic process for cardiovascular disease following a diagnosis of a mental health condition, and how clinician and patient biases may influence the diagnostic process.

Objectives

Quantitative:

1) To identify characteristics which increase or decrease the odds of a first diagnosis of a cardiovascular disease following a first diagnosis of a mental health condition, within 60 days.

Qualitative:

1) To identify how current diagnostic processes for cardiovascular disease in individuals with a pre-existing mental health condition are influenced by clinician, patient and systemic interactions.

Hypothesis

People with mental health conditions experience greater barriers to accessing and receiving appropriate cardiovascular disease diagnosis, increasing the likelihood of diagnostic challenges.

Methods

Epistemological Positioning

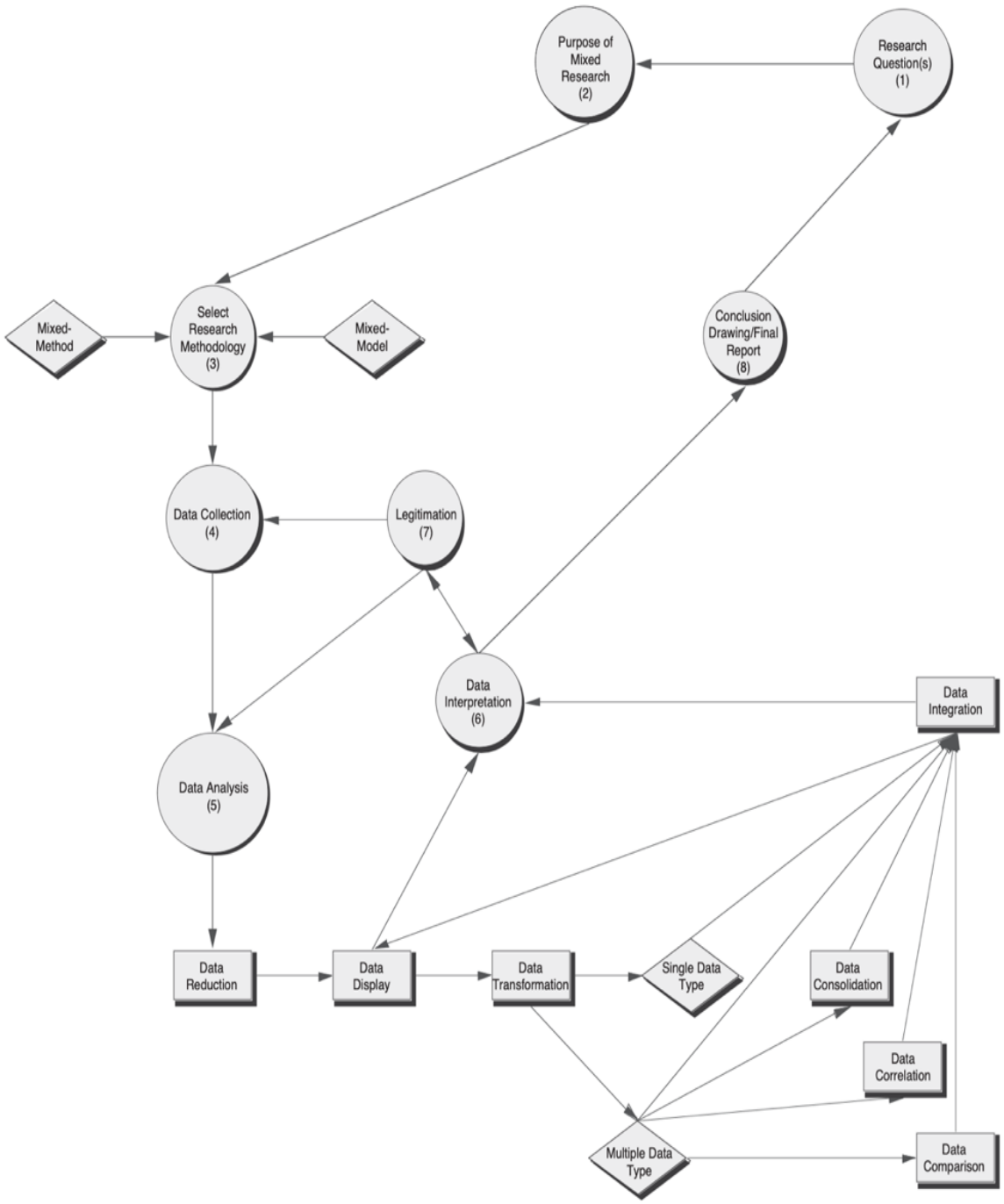
This study adopts a pragmatic epistemological position, focusing on those factors with a direct influence on clinical efficacy, since this approach has been demonstrated to be the optimal paradigm for mixed-methods research (Johnson & Onwuegbuzie, 2004; Morgan, 2014). Following the eight-step mixed methods process outlined by Johnson and Onwuegbuzie (2004), this epistemological position underpins the rationale for integrating quantitative and qualitative data to explore how intersectionality might contribute to diagnostic challenges of a cardiovascular disease following a diagnosis of a mental health condition. The corollary of this being the ability to improve diagnostic performance when intersectional characteristics are incorporated into the diagnostic process.

Johnson and Onwuegbuzie's (2004) method includes initially determining the research question, identifying whether a mixed design is appropriate, selecting a mixed-method or mixed-model research design, collecting the data, analysing the data, interpreting the data, legitimating the data and drawing evidence-based conclusions for the final report (**Figure 4**).

From a pragmatic perspective, knowledge is viewed as both constructed and grounded in observable reality. Pragmatism suggests that we are unable to differentiate human action from experiences and beliefs from the past (Morgan, 2014). This supports the notion that both quantitative and qualitative data can be used synergistically to meaningfully and purposefully explain a research question. This approach allows the combination of quantitative methods (to identify patterns associated with demographic, psychological and clinical factors) and qualitative methods to explore how individuals make sense of bodily sensations, interactions with healthcare professionals and social identities.

Figure 4

Mixed Methods Process Model Outlined and Extracted from Johnson and Onwuegbuzie (2004)



Note. Circles represent steps (1–8) in the mixed research process; rectangles represent steps in the mixed data analysis process; diamonds represent components.

Acknowledging the complexity and individuality of lived experience, this study is also informed by critical realism (Archer et al., 1999). Critical realism complements a pragmatic approach by recognising that social and biological phenomena exist independently of our perceptions, while acknowledging that our understanding of these phenomena is inevitably mediated through social, cultural, and historical contexts. Bhaskar (2008) conceptualises reality as comprising three interconnected domains: the empirical (what is experienced), the actual (what happens), and the real (the underlying mechanisms that produce observable events).

Within the present study, the empirical domain is reflected in the accounts of patients and clinicians describing their experiences of cardiovascular risk assessment and management after a mental health diagnosis. The actual domain is represented by the occurrence of CVD following an MHC, as examined through the logistic regression analysis looking at how patient characteristics impact the odds of developing a CVD following a diagnosis of a MHC. The real domain extends beyond these observable experiences and events to the underlying mechanisms that may generate them, including the interaction of individual, clinical, and structural factors identified through the qualitative findings, such as barriers to accessing care and healthcare system processes that may contribute to inequities in diagnostic processes.

Justification of Methodology

Greene et al. (1989) spoke of five main rationales for employing a mixed methods design. Triangulation, complementarity, initiation, development and expansion. The reason for this study utilising a mixed-methods design is for ‘complementarity’, using qualitative data to elaborate upon the quantitative data analysis that will be completed initially.

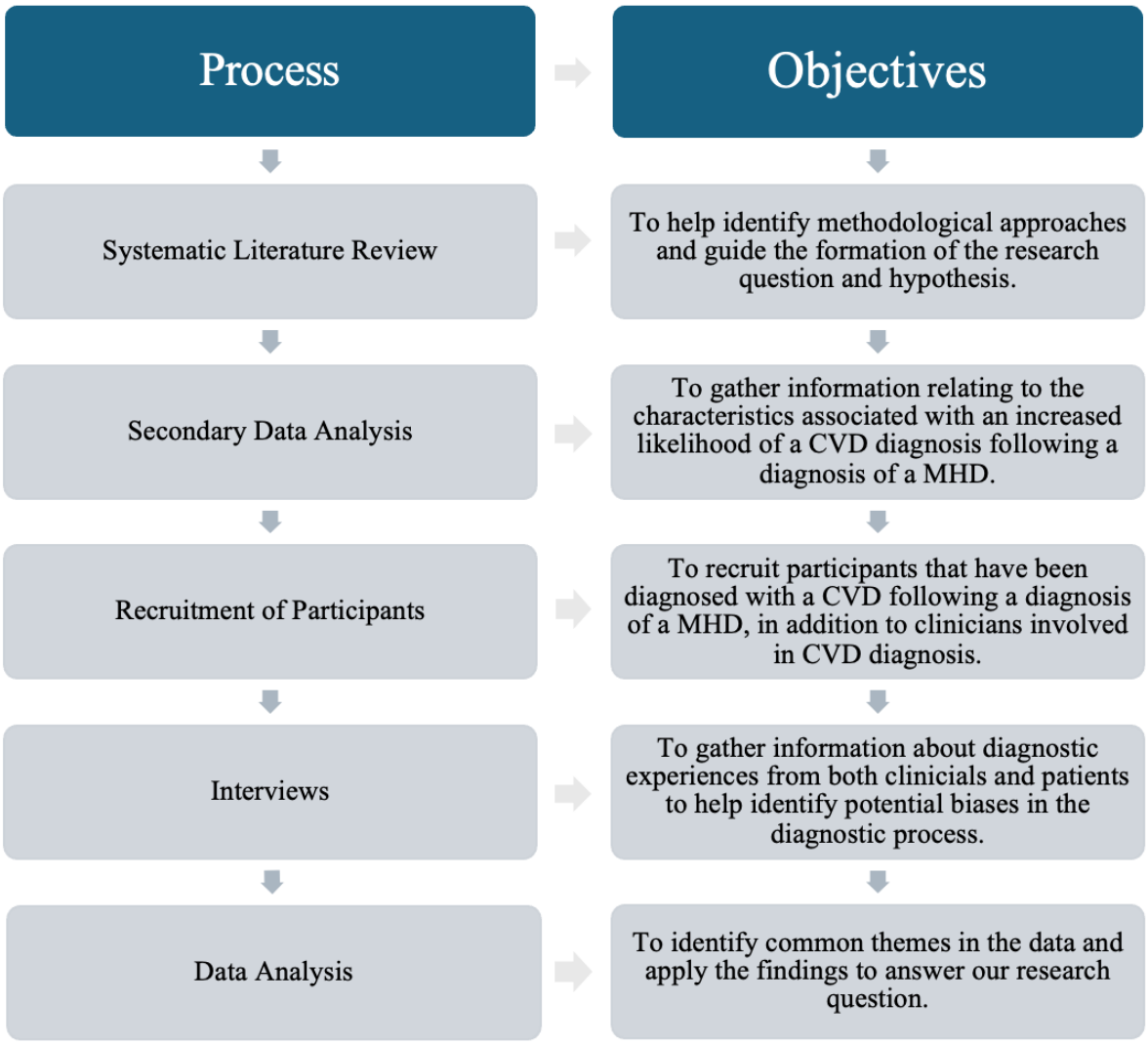
Overview

In line with a pragmatic epistemological position, this study will employ an explanatory sequential design. Therefore, a mixed-methods approach will be employed with two distinct phases: quantitative analysis followed by qualitative analysis (Ivankova et al., 2006).

To enable increased reliability and application to the general population of the UK, this study will use data extracted from the UK Biobank and recruit participants via the National Health Service (NHS). Using the NHS as a data source enables data collection from clinicians in addition to patients. This allows a holistic overview of diagnostic processes offering insights into those factors contributing to the diagnostic challenge posed by presenting symptomatology which could be secondary to cardiovascular disease or a mental health condition. A summary of the research process is reported in **Figure 5.**

Figure 5

Overall Process and Objectives



Note: MHD = mental health condition, CVD = cardiovascular disease

Quantitative Methodology

UK Biobank data (Sudlow et al., 2015) have been used to address the first research question: "To identify characteristics which influence the length of time between a diagnosis of a mental health condition and the subsequent diagnosis of coronary heart disease".

The UK Biobank

The UK Biobank is a large-scale, population-based prospective cohort study established to investigate the genetic, environmental, and lifestyle determinants of a wide range of diseases. Through using a prospective study design, it allowed the identification of exposures before the onset and treatment of disease, and both the adverse and beneficial effects of a specific exposure on the lifetime risks of different diseases (Sudlow et al., 2015). The UK Biobank was established with the explicit aim of supporting large-scale, hypothesis-driven empirical research into the causes of complex diseases. Its design enables the investigation of interactions

Participants attended baseline assessment centres where detailed information was collected through questionnaires, physical measurements, and biological sampling. Ongoing linkage to national health records, allows long-term follow-up of health outcomes. The breadth and depth of data available within the UK Biobank make it a valuable resource for examining complex relationships between mental health, physical health and disease progression.

Participants

Between 2006 and 2010, over 500,000 participants aged 40-69 years were recruited from across the United Kingdom. This age range was selected because it includes people at high risk of developing a wide range of important diseases, such as heart disease, over the subsequent decades.

Participants for the Biobank study were identified and invited using NHS patient registers. They had to live within a convenient travelling distance of an assessment centre in

England, Scotland and Wales. The invitation to participate was stratified according to demographic parameters to enhance the generalisability of the recruited population.

Design

The UK Biobank study employs a retrospective cohort design using a large-scale, population-based prospective cohort study established to investigate the genetic, environmental and lifestyle determinants of a wide range of health outcomes. Participants were invited to attend one of 22 assessment centres, where baseline data were collected through questionnaires, physical measurements, and biological sampling.

The study has been designed to enable long-term follow-up through linkage to routinely collected health records, including hospital admissions, cancer registries, and mortality data. This design allows for the prospective investigation of disease incidence and progression across multiple health domains. In addition to baseline assessments, subsets of participants have undergone repeat assessments, imaging studies and further phenotypic characterisation, enhancing the depth and longitudinal nature of the dataset.

Continuous tracking of health and disease is achieved through the linkage of participants to their NHS health records. This allows the identification of a large number of individuals with a wide range of mental and physical health conditions. Consent is obtained at the recruitment stage to access all past and future medical records.

The Biobank methodology included repeating the baseline assessment in about 25,000 participants during the recruitment phase and then every 2-3 years during follow-up, to correct for the regression dilution bias.

Materials

Data collection included self-completed questionnaires capturing information on sociodemographic characteristics, lifestyle behaviours, and health history. Physical measurements were conducted using standardised protocols and included anthropometric and physiological assessments. Biological samples, including blood and urine, were collected for biochemical and genetic analyses. Health outcomes were ascertained through linkage with national health databases, including hospital episode statistics, cancer registries, and mortality records. (**Figure 6**).

Procedure

Potential participants who met the inclusion criteria were identified from NHS registers, and an invitation package was sent out approximately 6-8 weeks before a pre-booked provisional appointment. Invitees confirmed their appointment by freephone or a reply form.

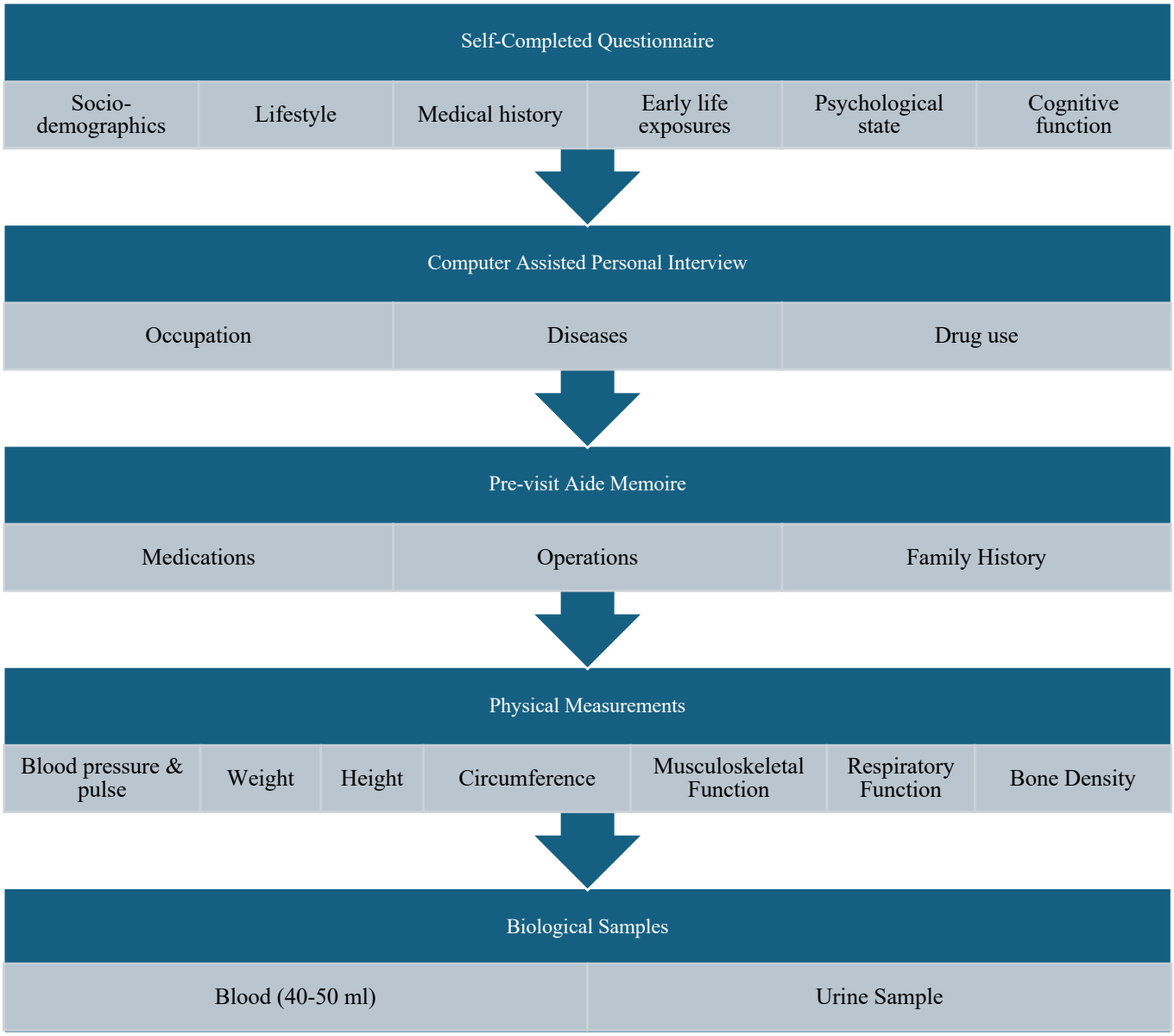
During the baseline assessment visit, consent was obtained, and then the questionnaires and physical health data were collected. Firstly, participants completed the questionnaires and cognitive function tests (40 minutes). Then Participants completed the computer-assisted Personal Interview (CAPI) conducted by a nurse. At this point, the participant's blood pressure and pulse were measured twice over a 10-minute period using an Omron monitor after the participant had been seated for at least 5 minutes.

Following this was physical measurements, where hand grip strength, waist and hip circumference, standing and sitting height, bio-impedance, calcaneal bone densitometry and spirometry measurements were completed (15 minutes). Finally, a blood sample of 40-50ml, was collected via venepuncture using bar-coded vacutainers in a specified priority order. A

random urine sample was also collected. At the end of this assessment, participants received a printed copy of their consent form and a copy of their initial measurements.

Figure 6

Information Collected by Biobank at the Recruitment Stage.



To follow up on participants' health status, data linkage was completed using identifiers such as NHS numbers. This provided access to all NHS health records. Linkages were sought with Death and Cancer Registries, Hospital Activity Records and Primary Care Records. A summary of the health outcomes measured can be found in **Table 4.**

Table 4

UK Biobank health outcomes measures

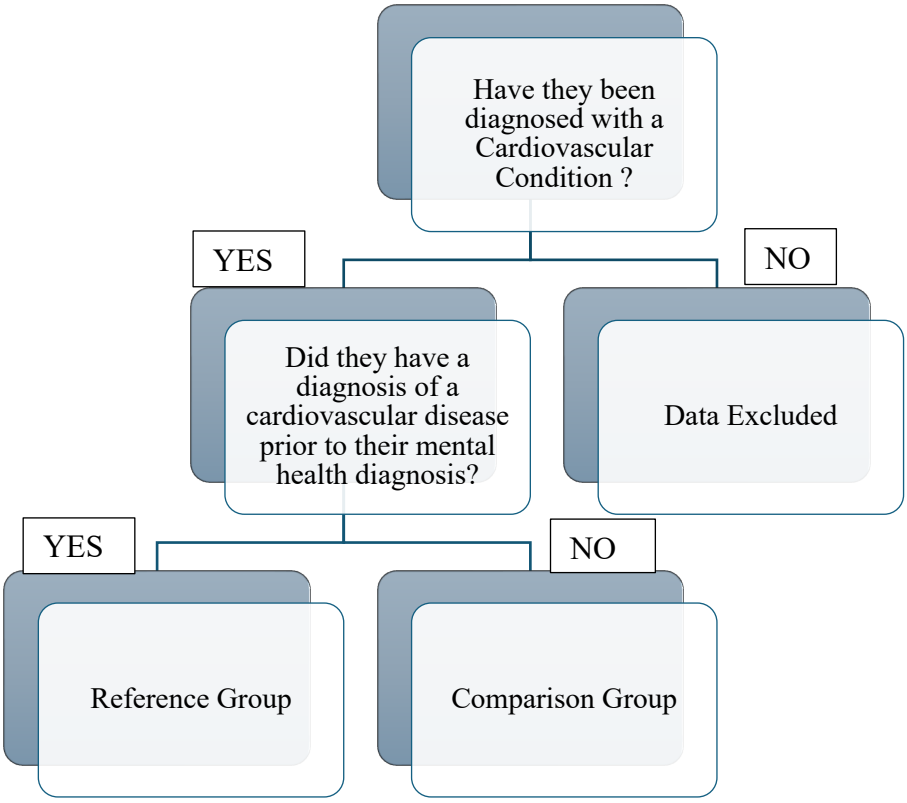
Conditions Measured or Reported at Baseline	Major Disease Outcomes	Mental Conditions and Cognitive Outcomes
• Diabetes mellitus (Type 1 and Type 2) • Ischemic heart disease • Angina pectoris • COPD • Stroke • Parkinson's disease • Rheumatoid arthritis • Osteoarthritis of the knee • Respiratory conditions • Musculoskeletal conditions Disability • Chronic pain • Chest pain • Wheeze • Hypertension • Obesity or overweight (from BMI and waist circumference) • Low bone mass or density • Reduced lung function • Asymptomatic ECG abnormalities	• Diabetes mellitus (Type 1 and Type 2) • Heart disease / ischemic heart disease / Myocardial infarction / Coronary death Stroke (including ischemic stroke) • Cancer: - Breast cancer - Colorectal cancer - Prostate cancer - Lung cancer - Bladder cancer - Non-Hodgkin's lymphoma - Ovarian cancer - Stomach cancer - Kidney cancer - Endometrial cancer • Chronic obstructive pulmonary disease (COPD) • Rheumatoid arthritis • Hip fracture • Vascular diseases	• Dementia (including Alzheimer's disease) • Neuroticism • Mood disorders • Psychological symptoms • Cognitive function and decline • Serious life events • Psychiatric disorders

Target population

For this study participants who had been newly diagnosed with a mental health condition and subsequently been diagnosed for the first time with a cardiovascular disease were selected (**Figure 7**).

Figure 7

How Data Selection was Completed Using the UK Biobank Dataset.



To identify the cardiovascular disease and mental health condition diagnoses, the International Classification of Disease (ICD) was used (**Table 5**). Specifically, the ICD used were: I21-24 (ischemic heart diseases), I60-66 (Cerebrovascular Diseases), F32.0-33.9 (depression) and F40.1-41-9 (anxiety).

Table 5

ICD codes, descriptions, and symptoms for cardiovascular diseases, anxiety and depression

Category	ICD Code	Description	Symptoms
Cardiovascular Diseases	I21	Acute myocardial infarction	Chest pain; **shortness of breath, fatigue, sleep disturbances**; **restlessness**; **difficulty concentrating**; heart palpitations; dizziness; swelling; irregular heartbeat; nausea; cold sweats
	I22	Subsequent myocardial infarction	
	I23	Certain current complications following myocardial infarction	
	I24	Other acute ischemic heart diseases	
	I60	Subarachnoid haemorrhage	
	I61	Intracerebral haemorrhage	
	I63	Cerebral infarction	
	I64	Stroke, not specified as haemorrhage or infarction	
	I65	Occlusion and stenosis of precerebral arteries, not resulting in cerebral infarction	
	I66	Occlusion and stenosis of cerebral arteries, not resulting in cerebral infarction	
Anxiety	F41.9	Anxiety disorder, unspecified	Uncontrollable worry; **restlessness; fatigue; difficulty concentrating; sleep disturbances;** irritability**; heart palpitations; shortness of breath**; sweating; trembling
	F41.1	Generalized anxiety disorder	
	F41.0	Panic disorder	
	F40.1	Social phobia	
	F40.2	Specific (isolated) phobias	
Depression	F32.0	Major depressive disorder, single episode - Mild	Low mood; loss of interest in activities; **fatigue; sleep disturbances; difficulty concentrating; restlessness;** changes in appetite; feelings of worthlessness; slowed movements or speech
	F32.1	Major depressive disorder, single episode - Moderate	
	F32.2	Major depressive disorder, single episode - Severe without psychotic features	
	F32.3	Major depressive disorder, single episode - Severe with psychotic features	
	F32.9	Major depressive disorder, single episode - Unspecified	
	F33.0	Major depressive disorder, recurrent- Mild	

Category	ICD Code	Description	Symptoms
	F33.1	Major depressive disorder, recurrent-Moderate	
	F33.2	Major depressive disorder, recurrent - Severe without psychotic features	
	F33.3	Major depressive disorder, recurrent - Severe with psychotic symptoms	
	F33.9	Major depressive disorder, recurrent - Unspecified	

Note: Bold symptoms represent the overlap between conditions.

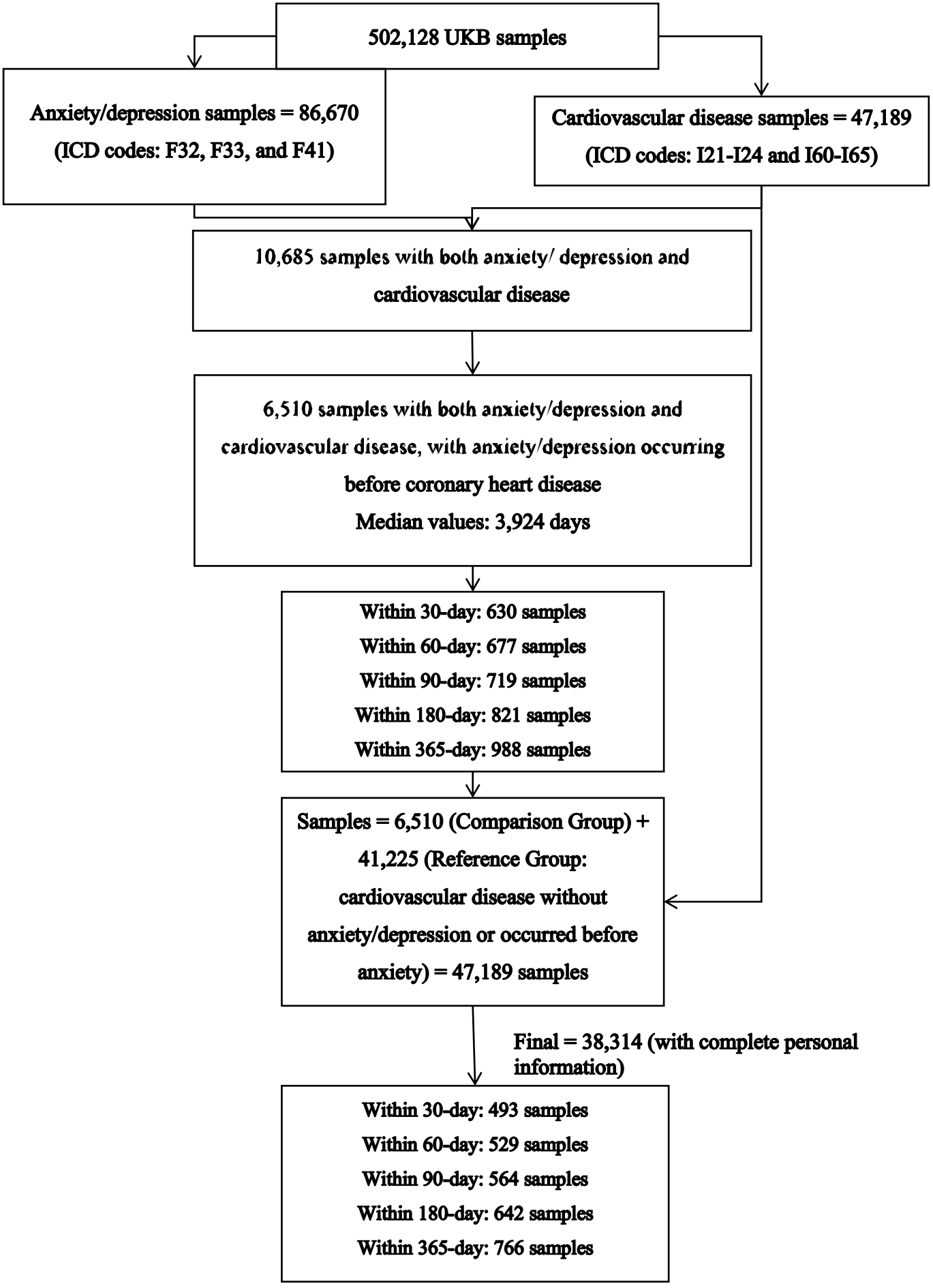
Although the UK Biobank captures information regarding other cardiovascular diseases, ischemic heart disease and cerebrovascular disease have been found to have pathophysiological similarities, and both appear to be influenced by behavioural and psychosocial influences (Shah et al., 2021). With both cerebrovascular and ischemic heart disease having a vascular aetiology, it allows for comparison of risk factors and preventative measures (Ajoolabady et al., 2024). In contrast, other cardiovascular categories, such as heart failure and arrhythmias, have more electrical and structural pathophysiological mechanisms (Frąk et al., 2022). This means that the impact of behavioural and psychosocial influences might manifest differently (Mulle & Vaccarino, 2013). Therefore, cardiovascular codes that are not primarily related to a vascular aetiology were excluded to maintain consistency in the underlying disease mechanism and allow the linkage between psychological and behavioural factors with vascular processes.

Out of 502,128 participants included in the Biobank repository, 86,670 participants were identified to have an anxiety or depression diagnosis, and 47,189 participants were identified to have a cardiovascular disease. Of these 133,859 participants, 10,685 had a diagnosis of both a mental health condition (anxiety or depression) or a cardiovascular disease (ischemic heart disease or cerebrovascular disease). A total of 6,510 were identified as meeting the criteria of being diagnosed for the first time with a cardiovascular disease post

diagnosis of a first mental health condition, including same-day diagnosis (**Figure 8**), the group potentially at risk of diagnostic challenges (reference outcome). 40,697 participants were identified as being diagnosed with a cardiovascular disease only and not at risk of the reference outcome of diagnostic challenges. Hence, there were a total of 47,189 participants. Subsequently, participants were removed that did not include the variables required for our investigation (e.g. age, sex, education). For the quantitative analysis, participants who were diagnosed with a mental health condition and a cardiovascular disease on the same day were included. Once participants with incomplete datasets were removed, 38,314 participants remained for inclusion in the analysis. A total of 766 participants were identified as having been diagnosed with a cardiovascular disease subsequent to a mental health condition, within the 365-day time point cut-off. A breakdown of participants between same-day and non-same-day diagnoses can be found in **Appendix D.**

Figure 8

The Process of Biobank Sample Selection.



Measures and Variables

Cleaned data were accessed after ethical approval (ETH2324-0764). The researcher only had access to the outcome results.

The primary outcome was the occurrence of a cardiovascular disease diagnosis within 60 days following an initial diagnosis of a mental health condition. This outcome was operationalised as a binary variable, indicating whether an individual received a cardiovascular diagnosis within this specified time frame. Cardiovascular diagnoses were identified using the cardiovascular ICD codes outlined in **Table 5.**

Table 6

Descriptions of Sociodemographic Variables Included in the Analysis

Demographic Category	**Variable Type**	**Definition**	
Age	Continuous	Age measured in years	
Biological Sex	Binary	**Male**	Female
Income	Binary	**>£31,000**	<£31,000
Ethnicity	Binary	**White**	Other Ethnicity
Employment	Binary	**Paid Employment**	Not in Paid Employment
High Education	Binary	**University qualification (or equivalent) and above**	Below GCSE level
Intermediate Education	Binary	**A-levels or GCSE (or equivalent)**	Below GCSE level
Other Education	Binary	**None of the above/ not UK recognised qualification**	Below GCSE level
Townsend Deprivation Index (Townsend et al., 1988)	Continuous	A scale ranging from -6 meaning very affluent area, to ≥ +6 meaning highly deprived area	

Note: Reference category highlighted in bold.

Quantitative findings are presented for the within-60-day group because this interval provided the most appropriate balance between temporal proximity to the MHC diagnosis and sufficient incidence of CVD diagnoses to support robust statistical estimation. A shorter follow-up period was considered conceptually appropriate, as it enabled examination of the association between participant characteristics measured at the time of MHC diagnosis and subsequent CVD during the early post-diagnostic period, thereby maintaining a closer temporal relationship between exposure and outcome. Extending the follow-up period would have increased the likelihood that changes in psychiatric treatment and health-related behaviours contributed to subsequent CVD risk. This approach is consistent with evidence that cardiovascular risk is heightened during the period immediately following the onset or diagnosis of psychiatric disorders (Shen et al., 2023), although no consensus exists regarding an optimal follow-up interval. Consequently, the within-60-day group was considered the most appropriate compromise between methodological rigour and statistical power.

To assess the sensitivity of findings to the selected exposure window, additional analyses were conducted using alternative follow-up periods, 30, 90,180 and 365 days. These supplementary analyses enabled evaluation of whether the observed association persisted across different temporal thresholds, thereby strengthening the robustness of the finding.

The socio-demographic variables used were: age, sex, income, ethnicity, employment, education and level of deprivation. Each variable was dichotomised (**Table 6**).

Statistical Analysis

A multivariate logistic regression model was used to explore the association between socio-demographic variables (e.g. age, ethnicity, employment status) and the likelihood of developing a cardiovascular disease diagnosis within 30, 60 90,180 and 365 days following a mental health diagnosis. Multivariate logistic regression allows analysis of how multiple

variable parameters affect a binary outcome, estimating the probability of that outcome for a given variable, often expressed as an odds ratio (*OR*), while controlling for other factors (Peng & So, 2002). A multivariate logistic regression was completed for each of the time points, 30, 60 90,180 and 365 days.

The model was specified as:

$$Y_i = \beta_0 + \beta_1 X_i + \in_i \quad (1)$$

Where *Y* represent the that the individual (i) received a cardiovascular disease diagnosis within the time period specified (e.g. 30 or 60 days) following the diagnosis of a mental health condition (as defined in **Table 5**). The intercept term, β_0, represents the log-odds of the outcome when all predictor variables are equal to zero. The regression coefficients, denoted by β_1, represents the change in the log-odds of the outcome associated with a one-unit increase in the corresponding predictor variable X_i, holding all other variables constant. A positive β_1 suggests higher log-odds of the outcome as X_i increases, while a negative β_1 indicates lower log-odds. The term $\in_i$ represents the random error component, capturing unobserved factors that influence the log-odds of the outcome but are not explicitly included in the model. Logistic regression coefficients were exported and presented as *OR*s (exponentiated log-odd) with 95% confidence intervals (CIs).

Although we aimed to look at the intersection of predictors, this was not possible due to an inadequate sample. Therefore, the models presented are only adjusted for all key predictors.

Qualitative Methodology

Design

Semi-structured qualitative interviews were completed via video call (Microsoft Teams) or telephone call, exploring their personal experiences of cardiovascular disease diagnosis, both from the perspectives of patients and clinicians. Remote data collection allowed participation from individuals who may have experienced barriers to in-person attendance due to health, mobility, financial or geographical constraints.

Interviews were guided by a semi-structured interview schedule designed to explore participants' experiences of cardiovascular care, perceptions of symptom recognition and diagnosis, and interactions with healthcare services. The interview questions were adapted from the study by Berg Gundersen et al. (2017), which looked at coronary heart disease in women. Although the present study is looking at the diagnostic experiences across participants of both male and female sexes, the quantitative aspect of this study highlighted that women have a higher risk of developing cardiovascular disease following a mental health condition. Therefore, it was thought imperative to follow a question style designed to incorporate their experiences, as historically research in this area has been very androcentric (Al Hamid et al., 2024). Some questions refer to personal and systemic biases. For this study, we aimed to explore perceived personal and interpersonal biases related to demographic and social characteristics that participants believed influenced healthcare experiences and clinical decision-making. The study did not specifically explore clinicians' cognitive biases in diagnostic reasoning, such as anchoring bias, confirmation bias, or premature closure. Examples of the questions used in this study can be found in **Table 7**.

The interview guide provided a flexible framework that ensured consistency across interviews whilst allowing participants to elaborate on issues of personal relevance. Interviews were audio-recorded with participants' consent and subsequently transcribed

verbatim for analysis. Interviews with clinicians lasted between 35 and 60 minutes (mean= 48 minutes). Interviews with patients lasted between 25 and 60 minutes (mean= 40 minutes).

Participants were recruited from an NHS cardiology service in the East of England through convenience sampling. Information sheets were handed to two members of staff working in the team who agreed and were appointed to help with recruitment during the ethical approval process. They disseminated the information sheets to other members of their team for clinician recruitment and to patients who met the inclusion criteria for the study.

To participate in this study as a patient (inclusion criteria), patients had to have a previous diagnosis of a common mental health condition before a diagnosis of a cardiovascular disease. Patients also had to be over the age of 18 years old. Participants were excluded from the study if they had a lot of other physical health difficulties or if they were diagnosed with some form of cognitive deficit. For clinicians to participate (inclusion criteria), they had to be working in a cardiology service, with their role involving the diagnosis of cardiovascular disease. Clinicians were excluded from the study if they were new to the role (less than one year of experience).

Positionality Statement

My perspective is informed by both my professional experience as a Clinical Psychologist and my personal experience of navigating cardiovascular pathways. Through my clinical practice, I have developed an understanding of the experiences of individuals living with mental health conditions and the challenges they may encounter when accessing physical healthcare. My personal experiences have also provided insight into the complexities of cardiovascular diagnostic pathways. These experiences shaped my interest in this area of research while also requiring careful consideration of how they might influence the research process.

I acknowledge that my professional and personal experiences may have influenced my assumptions, interactions with participants, and interpretation of the data. As a clinician, I was particularly mindful of avoiding the assumption that participants' experiences reflected my own personal experiences. During interviews, I adopted a curious and non-judgemental stance, using open-ended questions and prompts to privilege participants' perspectives rather than my own.

To enhance reflexivity throughout the study, I maintained a reflective journal in which I documented my assumptions, emotional responses, and reflections following interviews and during data analysis. Regular supervision with my thesis supervisor provided opportunities to critically examine my interpretations and explore alternative explanations within the data. These reflexive practices supported the credibility and trustworthiness of the analysis by ensuring that themes were grounded in participants' accounts rather than my prior experiences or expectations.

Participants

The qualitative aspect of the study followed the logistic regression analysis and was designed to explain and contextualise the quantitative findings within a sequential explanatory mixed-methods framework. Consistent with the principles of reflexive thematic analysis, sample adequacy was evaluated in terms of information power rather than numerical saturation. Given the focused aims of the qualitative analysis, specifically to supplement the quantitative findings of the study, a total of 12 participants (six patients and six clinicians) was considered sufficient to support coherent theme development.

All procedures were conducted in accordance with ethical approval obtained from the NHS and University of Essex. Participants were informed of their right to withdraw at any time without consequence. All data were handled in accordance with data protection and confidentiality requirements.

Table 7

Interview Questions from Berg Gundersen et al. (2017).

Paper:	**Interview questions:**
Women with coronary heart disease – making sense of their symptoms and their experiences from interacting with their general practitioners (Berg Gundersen et al., 2017)	• How did you experience the early signs and symptoms of the illness? • What were your own thoughts about these symptoms prior to consulting your GP? • What was the GP´s response and interpretation of your symptoms and complaints? • What types of diagnostics or treatment have been provided? • How did you experience the treatment you have received?

Recruitment

Participants were recruited through a cardiology outpatient clinic within a secondary care setting. A cardiology Clinical Nurse Specialist and Consultant Cardiologist supported the initial recruitment by identifying individuals who met the study's inclusion and exclusion criteria. Recruitment was completed during routine appointments with patients meeting the inclusion criteria being provided with an information sheet (**Appendix E)** and a recruitment poster (**Appendix F).** A separate information sheet was provided to clinicians **(Appendix G).** If participants wanted to participate in the study, both clinicians and patients were asked to complete a consent form (**Appendix H and I**). Following the completion of the study, participants were provided with a debrief, including contact details for any follow-up questions and support. Patient participants were given a £20 voucher for completing the study, and clinician participants were entered into a £30 prize draw.

Materials

A semi-structured interview schedule was developed, influenced by the interview schedule utilised to explore participants' experiences of cardiovascular diagnosis (Berg

Gundersen et al., 2017). The interview schedule was redesigned to capture perceptions of symptom recognition and interactions with healthcare professionals, for both physical and mental health symptoms. The interviews consisted of open-ended questions organised around key thematic areas, allowing flexibility for participants to elaborate on issues most salient to their experiences. Interviews were conducted remotely via Microsoft Teams software on a computer and were audio-recorded with consent. All interviews were transcribed verbatim before analysis.

The interview schedule for patients covered three main domains: 1) diagnostic experiences of their mental health condition, 2) diagnostic experiences of their cardiovascular disease, and 3) what changes they would like to see in the diagnostic process. The interview schedule for clinicians covered four main areas: 1) key characteristics observed in people diagnosed with cardiovascular diseases, 2) experiences of diagnosing cardiovascular disease in people with a pre-existing mental health condition, 3) thoughts around the presence of individual and systemic bias in the diagnostic process and 4) what changes they want to see to improve the diagnostic process, especially in relation to patients with a pre-existing mental health condition. A copy of the interview schedule for patients and clinicians can be found in **Appendix J** and **Appendix K,** respectively.

Analysis

To interpret the data collected during the interviews, a reflexive thematic analysis was completed. Using reflexive thematic analysis enabled us to highlight key themes that occur across participants in order to contextualise and elaborate on the quantitative findings. A reflexive thematic analysis was completed as outlined by Braun and Clarke (2006).

Firstly, familiarisation with the dataset was completed through repeated reading of the transcripts. Initial codes were generated inductively and were subsequently reviewed to

develop themes that captured shared meanings across participants, in addition to answering the study's aims. Themes were then refined to make sure they reflected the full data set and to make sure themes were mutually exclusive. Reflexive thematic analysis recognises that qualitative analysis is interpretive, in that it is developed through the researcher's engagement with the data (Braun & Clarke, 2006). Reflexivity was operationalised through reflective journaling to identify assumptions, evolving interpretations and to prevent research bias in the analytical process. The qualitative findings were subsequently integrated with the quantitative results to provide a mixed-methods account of observed statistical findings.

Ethical Considerations

This study was carried out in a clinical setting, with personal data and information being analysed. Therefore, significant consideration was given to ethical considerations in the planning stage of this study.

Firstly, through asking participants to talk about their physical health difficulties and related diagnostic processes, there was the potential to unintentionally re-traumatise participants, resulting in psychological harm. To account for this, a trauma-informed approach was utilised for recruitment and data collection processes. A trauma-informed approach has five main areas of consideration: safety, trustworthiness, choice, collaboration and empowerment (**Figure 9**). In addition, contact details were provided for follow-up support to discuss any thoughts, feelings and emotions that were brought up during the study.

Since we were exploring factors that could be interpreted as relating to diagnostic accuracy and the length of the diagnostic process, the names of specific cardiology clinics and the names of clinicians will remain anonymous.

As sensitive and personal topics were discussed during the clinical interviews, we provided participants with enough information at the recruitment stage so that they had a

comprehensive understanding of what would be expected of them. This allowed them to think about whether this was something they would feel able to participate in, both in relation to physical and mental well-being. To inform participants of what would be expected of them from signing up to the study, an information sheet about the study was provided. The specific research aims were not provided at this stage, as this could result in biases and invalidation at the data collection phase. Written informed consent was obtained, with the opportunity to ask any questions provided.

At the end of the study, a debrief was provided with the opportunity to ask any follow-up questions relating to the study. Contact details for the main researcher were provided for any questions or queries at a later point. Participants had the option to opt in to receiving a 'summary of findings', to allow full disclosure of what their data was used for. Since the study deals with confidential data from medical records and recruiting participants from an NHS setting, NHS ethics and NHS trust ethical approval were obtained to allow for explicit guidance on how to ethically execute this research study (**Appendix L**). Furthermore, to protect the identity of the participants, names and identifiable patient information have been consistently anonymised. However, information relating to demographic information and characteristics were required for the research aims and objectives; however, all data were password-protected stored on an encrypted and secure computer system. All participants had the right to withdraw from the study at any time, along with their data.

Figure 9

Principles of the Trauma-Informed Care Model (Fallot & Harris, 2015).

Dissemination

Since this research area directly affects clinical practice, the study aims to share its findings with clinical services, particularly in cardiology and mental health. The aim of this is to inform and improve the process of diagnosis for cardiovascular diseases in people with a pre-existing mental health condition, advocating and outlining areas that will enable proactivity, as opposed to reactivity.

To disseminate the findings of this study, we aim to publish the results in medical and psychology journals, such as the British Medical Journal and The British Journal of Psychology.

We also aim to disseminate the findings of this study to NHS management and governing bodies, since they are influential on deciding upon policy and NICE guidelines for best clinical practice. It is anticipated that this study will inform best practice, as thus far research into the impact of intersectional characteristics on diagnostic processes for this clinical population has been limited.

Quantitative Results

Individual Characteristic Analyses

Table 8 summarises the baseline characteristics of the sample analysed (N=38,314). The mean age of the target sample (first cardiovascular disease condition diagnosed after the diagnosis of a mental health condition) was 58.2 (SD= 8.00) compared to 60.5 (SD= 6.82) in the reference sample (cardiovascular diagnosis prior to a diagnosis of mental health condition, or no diagnosis of mental health condition) (*p<.001).* Men made up 50.9% of the target sample (N= 269; female: N=260), compared with 68.0% in the reference sample (N=25,675; female: N=12,110) (*p<.001).* The majority of participants identified as 'White' for both the target (97.2%, N= 514) and reference categories (95.7%, N= 36140), with 'other' ethnicities making up only 2.8% and 4.4%, respectively (*p*=.089). No significant differences were observed in terms of educational attainment (*p*=.899), household income (*p*=.798), and employment (*p*=.899).

The mean score on the Townsend Deprivation Index (a measure of material deprivation based on four key indicators: unemployment, non-car ownership, non-home ownership, and household overcrowding) was 0.64 (SD = 3.21) for the target sample and -0.97 (3.25) for the reference sample (*p*=.019).

Findings at 60 days post-mental health diagnosis are reported. Output from logistic regression analyses for the other time points can be found in **Appendix M**. As the results from the models remained consistent across the different combinations only the combinations anxiety and cardiovascular disease, depression and cardiovascular disease, and anxiety and depression and cardiovascular disease, are reported in the main text. The results for the other models can be found in **Appendix N (Tables 1-6, Figures 1-6)**.

Table 8

Descriptive Statistics for the Covariates Included in the Analysis

Variable	Category	Target sample CVD after MHC		Reference sample CVD prior to MHC or without MHC		p-value
		mean/n	SD/%	mean/n	SD/%	p-value
Age (years)	Age	58.2	8	60.5	6.8	**<.001**
Sex	Male	269	50.9	25,675	68.0	**<.001**
	Female	260	49.2	12,110	32.1	
Household income	Income >=£31,000	191	36.1	13,440	35.6	.798
	Income <£31,000	338	63.9	24,345	64.4	
Ethnicity	White	514	97.2	36,140	95.7	.089
	Other	15	2.8	1,645	4.4	
Employment status	Employed	214	40.5	13,783	36.5	.059
	Other	315	59.6	24,002	63.5	
Educational attainment	High	204	38.6	15,111	40.0	.899
	Medium	97	18.3	6,559	17.4	
	Low	90	17.0	6,305	16.7	
	Other	138	26.1	9,810	26.0	
Townsend Deprivation Index (TDI)	TDI	-0.6	3.2	-1.0	3.3	**.019**

Note: '-' = continuous variable. n and % given for binary variables. Mean and SD provided for continuous variables. Test of significance for age and TDI was completed using a t-test, whilst binary variables were tested using a chi-squared test. p-values ≤ .05 are highlighted in bold

Anxiety and Cardiovascular Disease

Table 9

Logistic Regression – Anxiety and Cardiovascular Disease at 60-days.

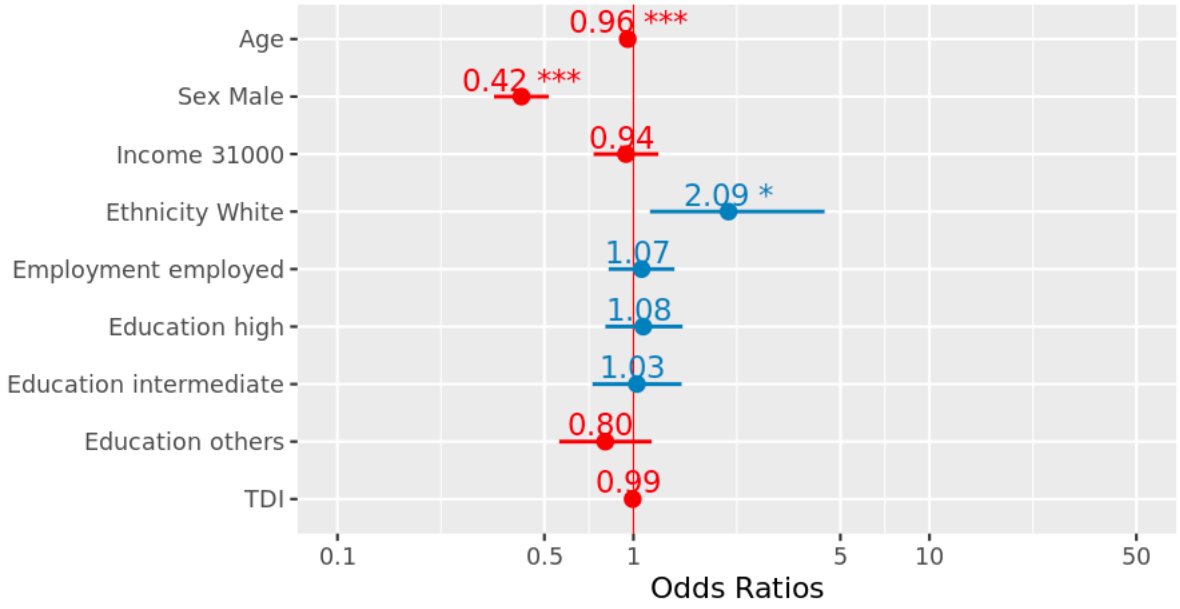
Combinations	Variables	Odds Ratio	95% CI	P Value
Anxiety + All Cardiovascular Disease	Age	0.96	0.94 – 0.97	***p* < .001**
	Male (ref=female)	0.42	0.34 – 0.52	***p* < .001**
	Annual income > £31,000 (ref=Annual income < £31,000)	0.94	0.73 – 1.21	*p* = .650
	White (ref= other ethnicities)	2.09	1.07 – 4.10	***p* = .031**
	Employed (ref=others)	1.07	0.82-1.38	*p* = .630
	High level of education (ref=low level of education)	1.08	0.80 – 1.46	*p* = .620
	Intermediate level of education (ref=low level of education)	1.03	0.73 – 1.45	*p* = .880
	Other education (ref=low level of education)	0.80	0.56 – 1.15	*p* = .230
	TDI (Townsend Deprivation Index)	0.99	0.96- 1.03	*p* = .730

Note: p-values ≤ .05 are highlighted in bold.

The results of the association between diagnosis of cardiovascular disease (ICD 21-24, 60-66) at the 60-day time point after being diagnosed with anxiety (ICD 40.1-41.9) are displayed in **Table 9** and **Figure 10**. Each additional year of age is associated with approximately 4% (Odds Ratio (*OR*)= 0.96; 95% Confidence Interval (CI)=0.94-0.97) lower odds of a diagnosis of cardiovascular disease following a diagnosis of anxiety. Being a man is associated with lower odds (*OR*=0.42; 95% CI=0.34-0.52), indicating that men had approximately 58% lower odds compared to women. Being of white ethnicity is associated with twice the odds of a diagnosis of cardiovascular disease following a diagnosis of anxiety, compared to non-white individuals (*OR*=2.09; 95% CI= 1.07-4.10).

Figure 10

Forest Plot of Adjusted Odds Ratios for Cardiovascular Disease at 60 days: Anxiety as the Primary Predictor



Note: * $p < .05$, ** $p < .01$, *** $p < .00$, model is adjusted for all covariates

Annual income (*OR*= 0.94; 95% CI= 0.73-1.21), being employed (*OR*= 1.07, 95% CI= 0.82-1.38), high levels of education (*OR*= 1.08, 95% CI= 0.80-1.46), intermediate levels of education (*OR*=1.03, 95% CI= 0.73-1.45), other forms of education (*OR*= 0.80, 95% CI= 0.56-1.15), and TDI (*OR*=0.99, 95% CI= 0.96-1.03) did not have a significant effect on the odds of being diagnosed with a cardiovascular disease following a diagnosis of anxiety.

Depression and Cardiovascular Disease

The results of the association between cardiovascular disease (ICD 21-24, 60-66) at the 60-day time point after being diagnosed with depression (ICD 32.0-33.9) are displayed in **Table 10** and **Figure 11**. Each additional year of age was associated with approximately 5% (*OR*= 0.95, 95% CI= 0.93- 0.96) lower odds of a diagnosis of cardiovascular disease

following a diagnosis of depression (*OR*= 0.95, 95% CI= 0.93- 0.96). Being a man is associated with lower odds (*OR*= 0.59, 95% CI= 0.48- 0.72), indicating that men had approximately 41% lower odds compared to women. Being of white ethnicity is associated with twice the odds of a diagnosis of cardiovascular disease following a diagnosis of depression, compared to non-white individuals (*OR*=2.0, 95% CI= 1.09 – 3.67).

Table 10

Logistic Regression – Depression and Cardiovascular Disease at 60-days.

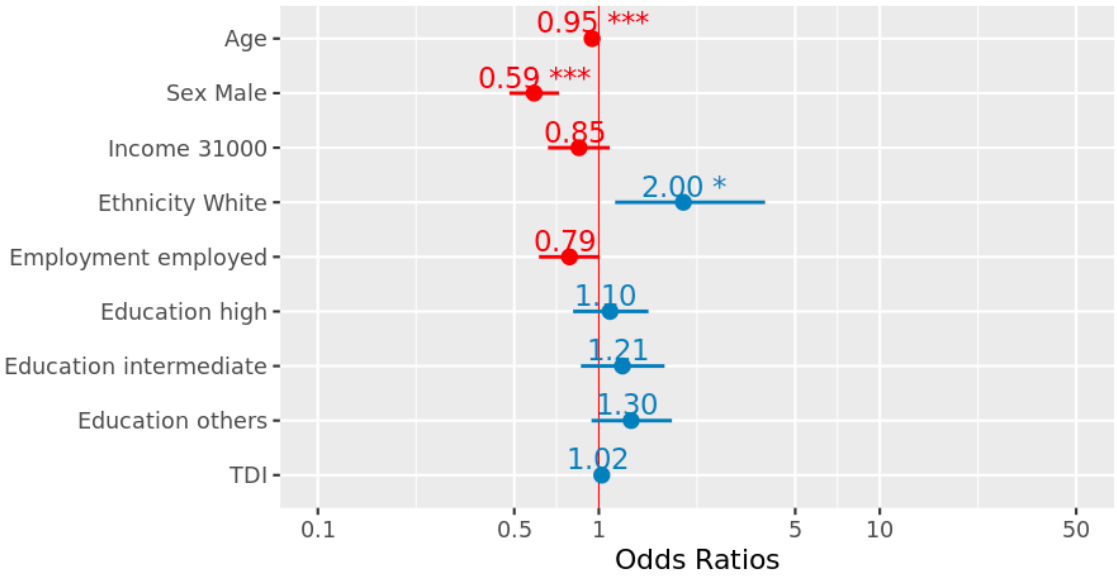
Combinations	Variables	Odds Ratio	95% CI	P Value
Depression + All Cardiovascular Disease	Age	0.95	0.93 – 0.96	***p* < .001**
	Male (ref=female)	0.59	0.48 – 0.72	***p* < .001**
	Annual income > £31,000 (ref=Annual income < £31,000)	0.85	0.66 – 1.10	*p* = .210
	White (ref= other ethnicities)	2.00	1.09- 3.67	***p* = .026**
	Employed (ref=others)	0.79	0.61- 1.01	*p* = .059
	High level of education (ref=low level of education)	1.10	0.81 – 1.49	*p* = .560
	Intermediate level of education (ref=low level of education)	1.21	0.86 – 1.71	*p* = .270
	Other education (ref=low level of education)	1.30	0.94 – 1.81	*p* = .110
	TDI (Townsend Deprivation Index)	1.02	0.99 – 1.06	*p* = .130

Note: p-values ≤ .05 are highlighted in bold.

Income (*OR*= 0.85, 95% CI= 0.66-1.10), being employed (*OR*= 0.79, 95% CI= 0.61-1.01), high levels of education (*OR*=1.10, 95% CI= 0.81-1.49), intermediate levels of education (*OR*= 1.21 95% CI= 0.86-1.71), other forms of education (*OR*=1.30, 95% CI= 0.94-1.81), and TDI (*OR*= 1.02, 95% CI= 0.99-1.06) did not have a significant effect on the odds of being diagnosis of cardiovascular disease following a diagnosis of depression.

Figure 11

Forest Plot of Adjusted Odds Ratios for Cardiovascular Disease at 60 Days: Depression as the Primary Predictor



*Note: * p < .05, ** p < .01, *** p < .00,* model is adjusted for all covariates

Depression and Anxiety, and Cardiovascular Disease

The results of the association between diagnosis of cardiovascular disease (ICD 21-24, 60-66) at the 60-day time point after being diagnosed with depression (ICD 32.0-33.9) and anxiety (40.1-41.9) are displayed in **Table 11** and **Figure 12**. Each additional year of age is associated with approximately 5% (*OR*= 0.95, 95% CI= 0.94 – 0.97) lower odds of a diagnosis of cardiovascular disease following a diagnosis of depression and anxiety. Being a man is associated with lower odds (*OR*= 0.50, 95% CI= 0.42 – 0.59), indicating that men had approximately 50% lower odds compared to women. Being of white ethnicity is associated with 92% higher odds of a diagnosis of cardiovascular disease following a diagnosis of anxiety and depression, compared to non-white individuals (*OR*= 1.92, 95% CI= 1.14- 3.24).

Table 11

Logistic Regression – Depression and Anxiety, and Cardiovascular Disease at 60-Days.

Combinations	Variables	Odds Ratio	95% CI	P Value
Anxiety + Depression + All Cardiovascular Disease	Age	0.95	0.94- 0.97	***P* < .001**
	Male (ref=female)	0.50	0.42 – 0.59	***p* < .001**
	Annual income > £31,000 (ref=Annual income < £31,000)	0.98	0.80 – 1.22	*p* = .890
	White (ref= other ethnicities)	1.92	1.14 – 3.24	***p* = .014**
	Employed (ref=others)	0.92	0.75 – 1.14	*p* = .460
	High level of education (ref=low level of education)	1.01	0.78 – 1.30	*p* = .970
	Intermediate level of education (ref=low level of education)	1.03	0.77- 1.37	*p* = .870
	Other education (ref=low level of education)	1.13	0.86 – 1.50	*p* = .380
	TDI (Townsend Deprivation Index)	1.02	0.99 – 1.04	*p* = .240

Note: p-values ≤ .05 are highlighted in bold.

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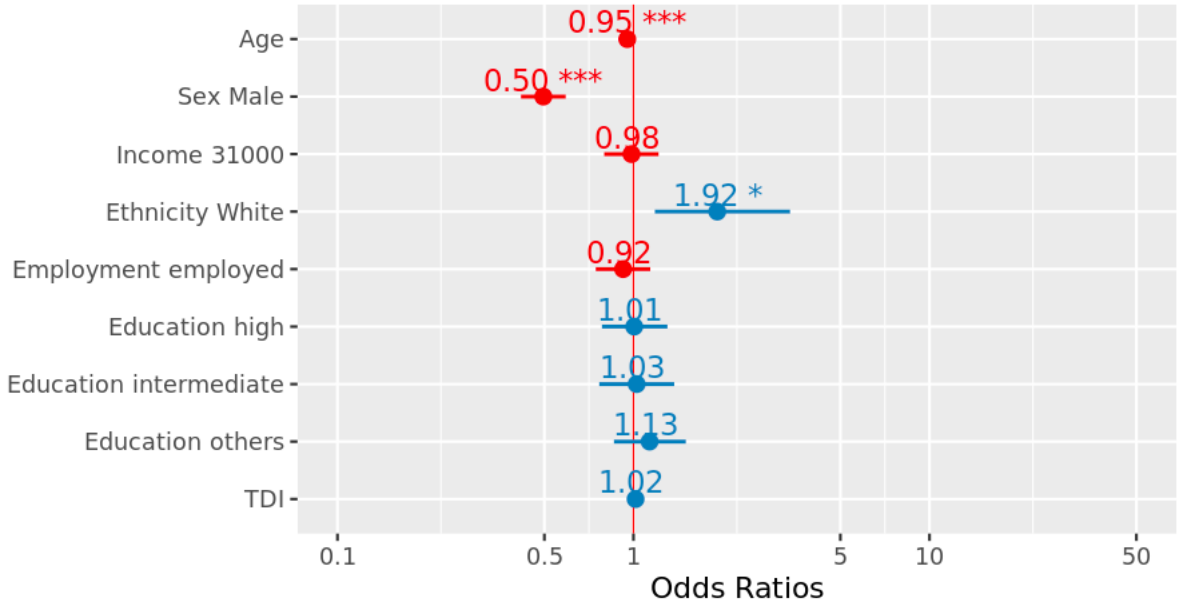
Annual income (*OR*= 0.98, 95% CI= 0.80-1.22), being employed (*OR*= 0.92, 95% CI= 0.75-1.14), TDI (*OR*= 1.02, 95% CI= 0.99-1.04), high level of education (*OR*=1.01, 95% CI= 0.78-1.30), intermediate level of education (*OR*=1.03, 95% CI= 0.77-1.37) and other forms of education (*OR*=1.13, 95% CI= 0.86-1.50), did not have a significant effect on the odds of being diagnosed with a cardiovascular disease following a diagnosis of anxiety and depression.

Figure 12

Forest Plot of Adjusted Odds Ratios for Cardiovascular Disease at 60 Days: Depression and Anxiety as the Primary Predictor



*Note: * p < .05, ** p < .01, *** p < .00,* model is adjusted for all covariates

Intersectionality

We tested whether the odds of developing cardiovascular disease subsequent to a mental health condition significantly changed based on the intersection of individual characteristics, such as age, sex, and ethnicity (**Appendix O, Table 1 and 2)**. Due to an inadequate sample, we were unable to look at the intersection of predictors; therefore, the models presented are only adjusted for all key predictors. However, the results show no statistically significant effects.

Summary

The logistic regression analyses identified several covariates that were consistently associated with an increased likelihood of a cardiovascular disease following a diagnosis of a common mental health condition. Across all models, female sex was associated with higher odds of a subsequent cardiovascular disease diagnosis compared to male sex. Ethnicity was also significantly associated with this outcome, with individuals of white ethnicity showing higher odds relative to other ethnic groups. Also, for every year of age added, there was seen to be a reduction in odds of developing a cardiovascular disease following a diagnosis of a common mental health condition. It is important to note that the average age for the sample was 58.2 years (SD =8), meaning that the increased risk for lower age is relating to middle aged participants. All other covariates were not consistently found to be associated with an increased likelihood of a cardiovascular disease following a diagnosis of a common mental health condition.

The results from the logistic regression will be triangulated with the qualitative results in the section titled ‘Integrated Interpretation of Quantitative and Qualitative Findings’.

Qualitative Results

Interpretation of Clinician Narratives

Clinician Sample Description

In total, six clinicians were recruited and participated in the study, including consultant cardiologists (n=3) and clinical nurse specialists (n=3). Participants had an average of 16.5 years clinical experience between 9 and 39 years of experience either as a Consultant Cardiologist or Clinical Nurse Specialist (**Table 12**). An example excerpt from an interview transcript can be found in **Appendix P**.

Table 12

Role of Clinicians

Participant	Clinical Role
Clinician 1	Consultant Cardiologist
Clinician 2	Consultant Cardiologist
Clinician 3	Clinical Nurse Specialist
Clinician 4	Clinical Nurse Specialist
Clinician 5	Clinical Nurse Specialist
Clinician 6	Consultant Cardiologist

Overview of Main Themes

The interviews with cardiology clinicians identified seven main themes: 1) diagnosis as a relational sense-making process, 2) the impact of mental health on diagnostic processes, 3) epistemic bias in cardiology knowledge, 4) the role of socio-demographic characteristics in cardiology pathways, 5) barriers to accessing care, 6) collaborative practice within and across professional disciplines and 7) hopes for the future.

The first theme, diagnosis as a relational sense-making process, highlights the importance of diagnosis emerging through interactions between patients and clinicians, rather

than an overreliance on objective tests. The second theme brings together the narratives around how pre-existing mental health conditions can impact symptom description and navigating diagnostic pathways. The third theme, epistemic bias in cardiology knowledge, captures how existing teaching resources and policies may perpetuate inequality within the diagnostic process through gender, socioeconomic and cultural bias. The fourth theme considers how socio-demographic characteristics, including factors such as gender, age and ethnicity, influence cardiology pathways and diagnostic outcomes. The fifth theme consists of the clinician narratives around systemic barriers that might affect access to care. The sixth theme highlights the importance of consultation and collaboration both within services and between other professions, in order to improve diagnostic processes and treatment compliance. Finally, the seventh theme, hopes for the future, reflects clinicians' perspectives on how cardiology services and diagnostic processes could be improved in the future. Each theme is explored in detail in the following sections.

Theme 1: Diagnosis as a Relational Sense-Making Process

This theme captures the importance of qualitative input to the diagnostic process, rather than an overreliance on quantitative test results. Clinicians positioned communication and the development of a shared narrative as central to the diagnostic process. Within a system increasingly oriented toward numerical diagnostic markers, they emphasised the importance of taking a clinical history to fully understand the complexities of patients' presenting difficulties. Clinician 2 used a quote to illustrate this point, "*listen to the patient, he's telling you the diagnosis*", highlighting the need for time for conversation and shared meaning-making to happen.

As part of this diagnostic process, communication was constructed as imperative not only within the consultation itself, but across the wider referral pathway. Clinicians

emphasised that the quality and clarity of information shared before the appointment could significantly shape the clinical encounter. For example, clinician 5 shared that "*if the referral is a good referral and there's plenty of information about the patient on there and we triage them well, then definitely we can make a space for them. So that they are properly supported and get the required consultation that's needed*". This account demonstrates how communication operates as a practical mechanism within the service structure. When information regarding a patient's needs is shared in advance, such as a longer appointment time to accommodate symptoms of anxiety, the system is better able to explore the needs of the patient and reduce the chance of critical aspects being missed.

Clinicians expressed that an overreliance on numbers provides comfort where uncertainty lies, in a system that encourages a diagnosis to be made. It was reflected that the reason for presenting at the cardiology service sometimes shifts, with the narrative changed to fit the numbers; "*if you just get presented with a big bunch of numbers, you know with big asterisks next to them, you try and work backwards and think what could have caused those problems that then gives you the original diagnosis and you kind of forget what the original reason was*." (clinician 2). Caution was added around an overreliance on numbers, adding that "*particularly the elderly people your bloods are often abnormal just because of lots of organs are not doing their best of their best job and it gets very confusing*." (clinician 6). A strong narrative across clinicians centred on the value of experience in the field and the confidence to trust one's professional judgement, draw on colleagues' expertise, and move beyond an over-reliance on numerical indicators: "*young doctors that just want to do lots and lots of tests and get numbers back and think that the numbers are going to tell them the diagnosis, but the numbers really don't. The numbers probably lie a lot. Blood test results often have abnormalities in them*" (clinician 2).

Theme 2: The Impact of Mental Health on Diagnostic Processes

This theme explores how mental health can impact the interpretation and description during diagnostic processes. Patients presenting with preexisting mental health disorders are commonly seen within cardiovascular settings, "*Things like depression and anxiety, I would say it's quite a high proportion of patients.*" (clinician 4), with patients attending often taking antidepressant medication, "*Many of our patients are on sertraline or other medication*" (clinician 1). Although presentation of anxiety and depression are high in cardiovascular populations, having a preexisting mental health disorder can act as a barrier during the diagnostic process for cardiovascular disease: "*say if someone's got mental health problems, sometimes they are very anxious, especially if they've got family history…they're very fixated on that*." (clinician 4), "*cases that I had in the past that had significant mental issues … communication definitely was a barrier. Most of them were unable to understand the need for a healthy diet, risk factor reduction*." (clinician1).

The presence of a preexisting mental health diagnosis can shape, and at times complicate the history taking process during the diagnostic process through a lack of time for consultations, "*you know major depressive episodes or you know true, psychiatric disease … that's a huge burden to both how we get a history because people don't tell us the things in the way that we're expecting and particularly when we're a consultant who's rushed and hurried and not spending that time, that's then difficult*." (clinician 6). Being able to communicate presenting difficulties was also highlighted in this population, "*some people with mental health conditions can be very hard to get a good story from. They're very withdrawn and maybe just don't want to talk and or don't want to talk a lot and just want to be left alone*." (clinician 2). This was also emphasised by clinician 4, "*I had a man recently who was known to mental health services. You know, he had a lot of mental health problems, and it was very hard to get him to actually talk about his chest pain, which he didn't actually*

have any in the end. But it was hard to get him to actually talk about that. He mainly wanted to talk about everything else in his life that was going on. So sometimes it's that they go off track." In addition, when patients present with anxiety, it impacts the testing options: "*Some tests I request require good heart rate control, then I always worry when they go for a test that they might become anxious and the test needs to be abandoned, for instance*." (clinicians 3), and patients themselves may be unable to tolerate some tests "*I think there are tests that we can obviously do that aren't great for extremely anxious patients. So, I think if we take that into account, if we're referring for say, a CT scan, where we know they're going to be really anxious, and their heart rate might be really high. It's probably not a test that we'd immediately go for, and we try to do something else to accommodate them, because we know that they may well get turned away at that scan and then might not return for anything else. So, we do try and keep that in mind when we're ordering tests*" (clinician 4). Patients, especially with health anxiety (having a preoccupation with having a serious illness and anxiety related to health; APA., 2013) tend to request further testing, even if this is not justified during the history-taking process: "*the biggest mental health challenge I have treating patients is if they've got health anxiety. Because they find it very hard to be happy with you just taking a history and telling them what's wrong with them. And they may well have seen lots and lots of doctors before and not been given a name for what's wrong with them. And physical doctors like to do physical tests. They give you a physical diagnosis and so they may have ended up with some names for what's wrong with them, which might not be true*" (clinician 2). Clinicians have found that clinically unjustified further testing can further increase anxiety, "*they will often end up then with over-testing, and then you can then potentially find other conditions. Sort of incidental findings … but you felt pressured to do further tests because they're very anxious. So sometimes you find yourself maybe over-testing to appease their anxiety or concerns*." (clinician 5). In addition to this, it was also reported

that there is a systemic pressure to not over-test, having to justify that tests are warranted; "*I'm going to be judged by the consultant if I request the test for anxious patient and they say, well, it's not justified. It was just, you know, the depression or the anxiety*." (clinician 3), especially due to the financial constraints of the NHS: "*there is a kind of little bit of pressure about. Saving money for the NHS to basically select those people who really need the test*" (clinician 3).

Although the awareness of the overlap in symptom presentation between anxiety and cardiovascular disease has increased, "*we probably have a significant chunk of anxiety overlays which have become, over the course of the last year or so, become much more of a problem*" (clinician 6). This is further explored "*When it comes to anxiety, it's a difficult one because sometimes I don't know if it's true angina or just anxiety causing symptoms. So, then I have to be again more thorough*" (clinician 3). Another aspect highlighted by participants is that diagnostic approaches remain unchanged, with patients who have a mental health diagnosis undergoing the same procedures as patients who do not: "*the protocols are the same... but there's no restriction in protocols about mental health the contrary. But you understand that the support of these people it's more difficult and time consuming*." (clinician 1).

Theme 3: Epistemic Bias in Cardiology Knowledge

This theme reflects how resources and guidance for cardiology practice may unintentionally perpetuate bias through overgeneralising cardiac risk profiles. Although there were differing views on the extent to which systemic bias exists within cardiology diagnostic processes, "*I think there is no bias. If yeah, if it is I haven't noticed to be honest, it's just one policy for everyone*." (clinician 3), when such biases are acknowledged "*There is no doubt that institutions, including us, contribute to diagnostic biases or what tests can you get*

readily available with ease within your centre, is going to influence what tests you do and what tests you do then influences what diagnosis you make" (participant 6), addressing them remains challenging due to their systemic nature, ingrained within institutional factors making it difficult to achieve meaningful change: "*It's not even that it's lack of willpower to do the harder things particularly. Over the years, our waiting times are going up and up and up, and it feels like there's not enough of us to do the work that's needed as it is*." (clinician 6).

Nonetheless, it was agreed that clinical diagnostic processes must remain free from the influence of personal biases: "*I think it's really important that there is no personal bias and everyone's treated equally. I think that's important. No matter their background. Whether you like them or dislike them as a person, or how they come across, I think personal bias has to be completely eradicated.*" (clinician 5). Some clinicians confirmed that personal biases did not influence their diagnostic process "*I don't think I deal with my patients differently either white, black or anything*" (clinician 1), whereas others argued that all individuals possess conscious or unconscious bias "*So I think that individual level then the only thing I feel that I can do is just try and be as aware as I can of my own biases. You know as aware you as you can be of your own unconscious biases, but you know to unless you admit that you have biases, I guess you can't address them*" (clinician 6), or as reported by another participant "I *wouldn't say I'm completely unbiased, but if you ask me if I would treat somebody different, be if it's Indian, black or white or anything, I think I wouldn't*" (clinician1). From this perspective, it is the awareness of these biases that enables clinicians to mitigate their potential impact on the diagnostic process. However, developing such awareness requires a foundational understanding of what bias entails and how it manifests in practice. Clinician 2 shared that "*we probably don't get taught enough in medicine about psychological biases and cognitive biases*".

The foundation and identification of these biases stem from the teaching and learning material on offer during training as highlighted by several participants, including cultural biases "*our textbooks are written for British people describing the symptoms in British language based on being brought up in Britain. And you know, almost everyone knows that a man clutching their chest is having a heart attack, but that's a caricature that we brought up in in other cultures, you know, they may have quite different symptoms and descriptions for the same problem.*"(clinician 2), or "*what I was taught in medical schools in the 1990s, how a 50 year old white male presents with ischemic heart disease*" (clinician 6). This bias continues to perpetuate in current cardiology settings, for example clinician 2 shared "*you know the pulse oximeters that everyone started buying and wearing during COVID to check your saturation levels. They were only ever tested on white people. ... no one ever thought to actually test it on any other coloured skin to see whether it made a difference and something we've realised it actually does. If you've got dark skin, then it doesn't pick up the same percentages. But all the manufacturers released their devices, and all got tested, and no one ever thought that, actually maybe we should test it on different coloured skins. And they're all signed off as being, you know, 95% perfect and accurate*".

One aspect of bias acknowledged in cardiology services is that of diagnosing women. Women often present with atypical symptoms, which leaves space for missed diagnoses: "*I think there are both true gender biases and cultural biases*" (clinician 6), "*If a woman of 65 has a heart attack, she might be diabetic and high blood pressure and kidney disease and it's just a bit. Over a mixed picture. So historically they have presented with not so typical stories and under symptoms might not be the classic barn door textbook symptom things*" (clinician 2). There was an overall consensus that women of a pre-menopausal age are at lower risk of cardiovascular disease: "*I mean most of the risk scores that you look at, whether it's nice guidelines or ESC [European Society of Cardiology] guidelines would suggest that females*

of pre menopause age are at far lower risk" (clinician 5). As a result of this atypical presentation clinician 6 shared that "*I think they have a harder time getting into the systems because they probably have to present to a GP [General Practitioner] multiple times to get referrals and things and then we're probably inherently slightly more dismissive of ladies and their symptoms because they don't sound so much like the textbook*". It was also raised that there has been an increase in POTS (Postural Orthostatic Tachycardia Syndrome) being diagnosed in young women, clinician 2 shared "*there's been a huge splurge in a diagnosis called POTS syndrome in the last 10 years which seems to affect young women. And so, we've been inundated with referrals for that to the extent that we have now actually said to GP's, we're not seeing them anymore*".

It was acknowledged by clinician 1 that socioeconomic bias exists "*sometimes I can be biased about low and socioeconomic state because you talk to them and they're not happy to listen to you. So, you're trying to convince them to take statins and to stop smoking, to lose weight and everything is quite hard. To be accepted from their side and sometimes it happened to me, so some of them they even got upset and they put complaints when you're trying to correct their wrong lifestyle. They're much more reluctant to accept changes in their lives or healthy changes*." linking this demographic to lower levels of education and a lack of motivation to change or mitigate lifestyle risk factors: "*I see predominantly similar types of occupation sort of you know very much lower income occupations, you know manual labourers and you know things like that*" (clinician 6), or as more explicitly expressed by clinician 5 "*Maybe level education means they may not have taken care of themselves so well*".

Theme 4: The Role of Socio-Demographic Characteristics in Cardiology Pathways

This theme examines how socio-demographic characteristics, such as age, gender and ethnicity, impact the diagnostic process, in terms of risk profiles and the frequency of presentation to cardiology clinics. There was consensus on the typical characteristics observed in cardiology settings. For example, people attending cardiology settings typically are aged over 40 years: "*most people I've seen in there between 40s and 60s." (clinician 1), and "we see only patients 40 years and above, not younger*" (clinician 3). Overall, it was recognised that men are at higher risk of cardiovascular disease: "*Certainly men are more likely to be diagnosed with cardiovascular disease*" (clinician 5), however it was clarified that this higher risk was only apparent when compared to pre-menopausal women, "*before the menopause, usually men are more frequent as a population to have coronary artery disease or cardiovascular diseases rather than women.*" (clinician 1).

Lifestyle factors were also reported to impact upon cardiovascular risk. Clinician 1 shared that risk factors may be increased in the presence of a mental health condition "*I must mention that people with mental diseases have some other characteristics. So, most of them they don't exercise, most of them they're smokers, they can drink alcohol a little bit more than the population or in smoking especially is a problem and smoking cessation is an even bigger problem to them*". Clinicians spoke about the impact of occupation often increasing cardiac risk: "*If they live a sedentary life with their occupation, that may come into how they look after themselves and also, I guess if they're doing a lot of sitting down and lorry drivers and they are not looking after themselves. So yeah, obviously keep an eye on their occupation*" (clinician 4). Similar consideration was made in relation to invasive interventions such as valve replacement, with more sedentary jobs taken into consideration when deciding about surgery "*So you would offer different things, for example, as far as a valve replacement in one and to the other. It has to do with what kind of activity they've got, what kind of lifestyle*

they've got. Not in a way you punish them, but for somebody that's bedbound, the possibility to be breathless is much less because they were not doing much and if they're high risk, you will think about a valve replacement" (clinician 1). Other factors influencing lifestyle factors that could increase cardiac risk were ethnicity: "*Indians have increased cardiovascular disease, maybe because of hyperlipidaemia and the diet*." (clinician 1) and level of deprivation: "*There's a high incidence of abuse of alcohol and drugs [in deprived areas]. So yeah, so I think this contributes as well to the mental health*" (clinician 3).

Level of deprivation was spoken about in regard to an increased risk for both mental health conditions as well as cardiovascular disease: "*I go once a week to [a deprived area] and there is a high incidence of depression and anxiety there […]the majority that come from a certain [deprived] area have also certain characteristics and in these cases all cardiovascular risk is higher, including diabetes, hypertension, cardiovascular diseases of all forms, arrhythmias*" (clinician 1).

In relation to ethnicity and cardiovascular risk, African American populations and several Asian subgroups were highlighted as experiencing disproportionately higher burden of cardiovascular disease: "*Afro American people have more tendency to have hypertension, some thickening of the heart or hypertrophy in the heart*" (clinician 1), and "*Ethnicity also definitely Asian, Indian ethnicity have higher diagnoses of heart disease*" (clinician 5). However, a lack of diversity seen in cardiology services in the East of England was also recognised, with Caucasians presenting most frequently: "*it's a very white population, Caucasian population, the only non-white group really have been Eastern Europeans that have come in the last five to 10 years and built up some of the population locally*" (clinician 2). Nonetheless, when a patient belongs to an ethnic group associated with an elevated risk of cardiovascular disease, clinicians may be more inclined to pursue additional diagnostic

investigations: "*different ethnicities have different risks in heart disease. So, I tend to be more lenient, I guess if they're of an ethnicity that's higher risk*" (clinician 4).

The importance of societal influence was also highlighted: "*So there's probably a little bit more of an older woman and getting cardiac disease than men. But as the incidence of smoking is going down, that's probably balancing out as well*" (clinician 2), not only in terms of health trends, but in terms of attitudes towards help seeking behaviours: "*in my career, people have become happier discussing psychiatric and psychological problems and seeking help for it. A) because there is potential some help for it and B) because probably there's less stigma attached to it and they're happier to raise that and view that as an issue you need to resolve. I think there's been an enlightenment that people are feeling more willing to admit, you know, I've got a problem here and seek out support for it, whereas in the past they didn't*" (clinician 2). The influence of social media was also noted, increasing awareness but also increasing health anxiety: "*where people are making a self-diagnosis not necessarily because you Googled your symptoms, but because the endless stream of TikTok eventually does trip something on you that says, oh, I wonder if I've got that and then presumably once you've clicked the follow this or I like that a few times the algorithm then displays far more pictures of people telling you do you think you've got X?*" (clinician 2). Demographics of people attending cardiology services was also impacted by the COVID-19 Pandemic, shifting from the typical trends: "*we had a blip around the COVID times that we saw a different population and whether that was because the disease had changed in any way, I suspect not, I suspect who was choosing to present to hospital because I think elderly patients avoided us like the plague and quite possibly sat at home. With cardiovascular disease and then quite possibly caught COVID and died as a consequence, because you know, we know there was a spike in mortality… We saw quite a few young heart failure patients, sort of 25-26 years old*" (clinician 6).

Theme 5: Barriers to Accessing Care

This theme captures the systemic barriers that impact timely cardiology care. Barriers at accessing care were woven throughout the narratives of the diagnostic processes by clinicians. One barrier was the level of education and literacy skills, impacting understanding of symptoms and diagnoses, in addition to obtaining meaningful consent. In relation to consent clinician 2 reported "*I think I had a patient recently who had to get to sign a consent form and you know, admitted that they couldn't read or write*", while clinician 3 explained the need for simple language in describing medication and testing procedures "*describing what the medications are for, the pathway, all this pathway, what's going to happen, it has an impact. Some investigations, such as an echocardiogram, cardiac monitor, are reported back to patients. It requires simple, simple language, but it's still it's kind of difficult to understand*" (clinician 3). Similar barriers are identified in the ability of patients to report and describe symptoms. "*I guess some people don't understand what they're describing, and some people come in as they say that they have chest pain. When you dig down, they actually don't, so I guess sometimes education can come into it.*" (clinician 4). To mitigate this, clinician 6 shared that an adaptation of language is required: "*you know, please turn up for this. Please do that, and no doubt they're running to other family members to get them to read it and explain it. So, to that degree, education is a very real problem in our area as to how we communicate with people and try and tell them what we want to do as the next steps*".

Clinicians highlighted that sometimes educational barriers can be easily concealed within clinic setups, reporting how the COVID-19 pandemic uncovered a high proportion of their clinical demographic being unable to read or write: "*in sort of March, April 2020 when we first went into lockdown, we suddenly weren't seeing people in clinic and I decided I was sat there with not very much to do… I started going through all our referrals and I sat and I would just, I knew everyone was at home on lockdown, so rather than booking an*

appointment I would just telephone people out the blue and go well you're waiting for a cardiology appointment… something became clear to me that a third of our patients locally can't read and I didn't realise that because in clinic I would ask someone, 'Oh, have you got a list of your medications?', and they would say yes, of course. And they'd pull out a prescription and give it to me. Now they were having to read that over the telephone to me. And I suddenly realised that, particularly adult men in our region, there's a huge amount of illiteracy" (clinician 6).

Use and understanding of language was also highlighted as a barrier for non-English speaking patients: "*you've also got to take into account the language barrier*" (clinician 5). It was thought that the main barrier for this population is knowing or understanding the services that exist to offer support, due information being disseminated in English only: "*all the literature we give people, the patient information leaflets, you know, the phone numbers, the help guides, they're all written in English and we just presume and hope that you'll be able to read them perfectly*" (clinician 2). To help mitigate this barrier, translation services can be used: "*make sure you use language line for patients who can't speak English strongly so just to help sort of support your history taking*" (clinician 5).

Despite efforts to reduce the barriers created through a lack of language to describe symptoms in a way that is understood by a Westernised system, even with translation services, some languages do not have the same words or definitions to describe symptoms. For example, clinician 6 spoke about how the word 'pain' is not understood or comprehended the same in different languages: "*the cultural word and the use of the word pain. It doesn't mean pain in the way that you and I might do it in a very, you know, White Western way … Pain is an expression of anything, distress as well as physical, whereas we, you know, we're very taught much taught, I guess that when someone says pain they mean what you know, we interpret as pain. Like if you cut your finger, that's painful…if you said to that Bengali patient*

do you experience any pain, they will always say yes it doesn't necessarily mean what I think I'm trying to" (clinician 6), as well as "*In cardiology, so much of the history is from the story. I think we really do underestimate how much someone in a different culture describes things differently. And if they don't describe the standard way that we're used to describing something, then we just rule that out and say, well, it can't be that*" (clinician 2).

It was also observed that cultural differences may shape patient-clinician interactions. In some cultural contexts, patients may prefer a more directive approach, expecting clinicians to determine the diagnosis and prescribe a course of action, rather than engaging in shared understanding and collaborative decision making: "*I noticed with different cultures, some people are much more deferent to doctors, you know you're trying to get consent for someone … and some cultures are very much, you're the doctor. Whatever you say, I'm not sure that sits very well with me as being consent.*" (clinician 6).

Beyond systemic influences and clinician-level biases, it was also highlighted that patient-led biases may shape and create barriers to the diagnostic process. Accordingly, attention must be paid to how patients' beliefs, expectations and prior experiences can influence symptom reporting and level of engagement: "*we come with our own biases, and you know whether that's because a patient has a certain race or because they're dressed a certain way or we will interpret certain things and part of that's really healthy… But then equally, I think that there are patients who come to us not knowing they have their own bias that, you know, you're not going to be interested in me because you just want to fob me off or you don't want to give me that because it's expensive. So, patients come to us with preconceived ideas and biases all the time. Actually, we probably spend more of our time dealing with patients, biases and dealing with our own*" (clinician 6). Especially regarding patients with pre-existing mental health conditions, it was highlighted a lack of trust in clinicians: "*with the mental health population, I think it's particularly difficult that they aren't*

good to engage in health services in general… They can be very genuinely distrustful of doctors, and certainly confiding things in doctors because, you know, they don't want to be sectioned or something done that, you know, they've had bad experiences in the past" (clinician 6). In particular, patients with health anxiety find it difficult to accept that the symptoms they are experiencing is due to, anxiety rather than a cardiovascular issue: "*if patients come with a preconceived notion of what's wrong with them, then it's harder to try and persuade them that it's something else*"(clinician 2). Other patient biases exist in the form of level of medical knowledge, with patients working in a health care setting commonly presenting with preconceived ideas of what is going wrong and what needs to happen: "*if they're medically knowledgeable, they tend to come with a preconceived list of what's wrong. Most of them want things excluded[…]A little bit of knowledge is a dangerous thing, so I think people who have got an allied healthcare professional role are probably more prone to googling or looking up or trying to find the diagnosis*" (clinician 2).

Access to care is also influenced by NHS guidelines, with clinicians noting that the diagnostic criteria have remained largely unchanged for several decades: "*we can start to think about outside of the very old-fashioned systems we've got at the moment and have a bit more collaboration with patients […]I think the hospital policies and the sort of the pathway that a patient, the journey a patient has from seeing a GP to being referred up to the hospital and seeing the clinician hasn't changed in 80 years of hospital medicine*" (clinician 2). The current NHS guidelines were reported to be governed by finances as opposed to the best level of care outlined by European guidelines: "*The British guidelines are dictated by the finances, so they take into consideration how the money is spent, but the European guidelines is a gold standard. They are higher in kind of quality so when you have GPs who have studied abroad, they expect we do some investigations which are not justified by UK system*" (clinician 3). Financial constraints in healthcare lead to pressure to keep costs down and use NHS

resources efficiently, such as not testing without a clear rationale: "*Saving money for NHS to basically select those people who really need the test*" (clinician 3). These constraints were reported to have a negative impact on patients with a mental health condition: "*this might cause the patient to feel disappointed because the GP will refer you to clinic, you need further investigation, and the patient comes to me and I say we are not doing an investigation, this can then cause additional distress, reinforce anxiety, depression*" (clinician 3). Alongside the reported financial pressures, a substantial rise in referrals has been identified, further constraining service capacity. This has created a significant barrier to care, with waiting times of up to one year reported for access to cardiology services in the East of England: "*they've maybe waited six months or a year to see me*" (clinician 2). It was reported by clinician 3, that as a result service constraints around over testing, patients sometimes resort to private health care where they are offered tests as it is self-funded, in turn impacting trust in the NHS services: "*If I see a patient whose symptoms come from anxiety, say unfortunately your symptoms does not support requesting any test, but this patient goes next day to private clinic when he sees the consultant, because you pay money, you get the test … so I just lose the credibility*".

Theme 6: Collaborative Practice Within and Across Professional Disciplines

This theme explores how collaboration with cardiology colleagues, as well as colleagues from other professions, could influence the diagnostic process for cardiovascular disease. Interviews with clinicians revealed a clear delineation of professional roles and boundaries. Although Clinical Nurse Specialists (CNSs) can assess and diagnose patients, it was reported that, in some instances, their clinical decisions may be overruled by consultants who have not directly assessed the patient: "*That's the bias that can creep in as well because they didn't see the patient, they listened to what I said. They don't have the visual information*

about the patient; they very often say, yeah, it's too young. That's not possible for angina" (clinician 3). Consultant cardiologists reported their role to encompass more managerial aspects, and as a result have less time to spend in the consultation room: "*it's much more a short, you know, as a consultant, I will see a patient maybe for 10 minutes during their entire five day stay in hospital, the junior doctors may well see them five times with a total time of over an hour with them*" (clinician 6).

As a result, the identification of psychological needs was described as largely resting with CNSs "*We rely on this system of having a nurse, especially who's going to go in and spend that time, and they have multiple sessions with the patients. So, they're going to actually focus on those social things and might raise the flag*" (clinician 6). Despite this, it was acknowledged that within diagnostic processes, psychological factors are often given less consideration than physical symptoms during the history-taking phase of diagnostic assessment: "*I think doctors are trained to take the medical and surgical past medical history, and the psychiatric or psychological past medical history is not taken as nearly as importantly*" (clinician 2). This may potentially be explained by a lack of training in basic psychological awareness and skills: "*The majority of people I see with that condition, there's actually nothing seriously wrong with their heart at all, it's just their brains tuned in and noticed they've got a heart and are worried about it and that needs some toolkit of support. Now that might be something we can offer them, but none of us are given any training in that regard*" (clinician 2).

A further barrier identified by clinicians was that of a lack of access to psychological support for patients: "*We don't have good access to psychological supports*" (clinician 2). To overcome this barrier, clinician 3 spoke of a need for psychology to be enmeshed within cardiology services: "*it will be lovely to have a clinic an option to help people refer and redirect signposts to [psychological] services*". Although current procedures are in place for

referrals to be made for further psychological support, "*We do have a referral system that we can refer on to support where we can refer on to for sort of emotional psychological support if we need to. But also, the GP*" (clinician 4), it was also acknowledged by clinician 2 that the psychological support required cannot be provided by cardiologists: "*when I have referred people for psychological support, you know they then end up with you know 12 sessions of Treatment with someone and that's not something I can offer*". This therefore highlights a need for a psychological presence in cardiology settings: "*I think it would completely marry up. … I think that if we had more psychological input and time with our patients, we'll get better compliance*" (clinician 6).

Theme 7: Hopes For the Future

This theme reflects clinicians' perspectives on how cardiology services and the diagnostic process could be improved moving forward. Throughout the conversations with cardiology clinicians, there were multiple areas identified for future development. One area for development was around redesigning care towards psychologically informed pathways: "*you get paid X for a new patient appointment and Y for follow up and that's the way the whole system work and that just games the system to have lots of new patients and discharge as many people as you can. So just making things more creative in terms of the framework of how we manage healthcare is probably going to be better*" (clinician 2), more "*people with chronic conditions seeing them every six months or every year really doesn't actually address what's wrong with them because they don't suddenly need your help on January 21st. You know they need your help when they want it, not when their planned appointment is in six months*" (clinician 2).

The importance and increased direction towards shared decision making was also emphasised: "*we have a habit of just writing to a patient and saying you've got this, I'm going*

to do this, I'm going to do that test, and you'll be thankful. So, I think there's a move towards the patient co-designing… it's when you're trying to formulate a plan of where to go next, either to reach the final diagnosis or even just how you're going to manage things" (clinician 2). Clinicians shared the hopes for technology increasing the ability and space for shared decision-making. Clinician 2 spoke about "*a system where the patients have got an app, my chart it's called, it's been very big in America and that does seem to engage the patients more. Your patients are using that, reading that they can even contribute to it. I think in the future that might allow us then to have a bit more of, you know, giving patients more information, more choice*". During the COVID-19 pandemic, the utility of remote clinics was identified to increase accessibility to the service: "*COVID was useful in trying to push us out of that and make us think of doing things differently like actually. Speaking to someone on the phone rather than having to come to hospital*" (clinician 2), and "*I knew everyone was at home on lockdown, so rather than booking an appointment I would just telephone people out of the blue and go well. You're waiting for a cardiology appointment. I'm sat here. You're sat there, Let's do it*" (clinician 6), which is supported by the idea presented by clinician 2 that modern-day technology decreases the need for inpatient visits: "*some people are even doing their ECGS at home or an Apple Watch um and presenting that to you. So, there's less of a physical need to actually bring people up to clinic to see them*".

Clinicians also reflected on the advice they would offer those newly entering cardiology services. One clinician emphasises the importance of prioritising comprehensive history-taking over reliance on numerical test results, suggesting that careful attention to the patient's narrative can help mitigate potential biases that might arise from an overemphasis on quantitative data alone: "*go to the front to go to the ambulance record and now with our electronic records, the ambulance crews*" (clinician 2). The importance of adhering to established diagnostic checklists was also emphasised, noting that their structured nature

reduces the risk of selective attention. In this way, checklists were framed as a safeguard against the influence of personal bias in clinical decision making: "*some of the things that we have done in medicine that are helping are things like checklists… and that probably cuts down some of the biases of just presuming things*" (clinician 2). Clinician 6 also spoke of the value in learning from colleagues within the field was also emphasised, not only within their own service context but through critical engagement with research and professionals across the wider field: "*the ladies were being treated was different and my older school consultants around me would say things that felt just felt different like oh, she's a woman so she should be treated like this. And that's when it just didn't sound quite right, and it just made my brain go. Why? Hang on, let's look at this. Then I went to go and sort of read articles*".

Interpretation of Patient Narratives

Patient Sample Description

Fourteen patient participants were recruited; five patients were unable to be contacted after the initial recruitment stage, three patients initially consented to take part and then withdrew, and six patients completed the study (**Table 13**).

Table 13

Demographic Information of Patients

Participant	Age	Gender	Ethnicity	Mental Health Condition	Cardiovascular Disease
Patient 1	53	Male	White	Depression/ Anxiety	Atherosclerosis
Patient 2	25	Female	White	Depression	SVT
Patient 3	54	Male	White	Depression/ Anxiety	Angina
Patient 4	64	Male	White	Depression	Atherosclerosis
Patient 5	55	Female	White	Depression/ Anxiety	Stent/ blocked arteries
Patient 6	67	Male	White	Depression	Heart Attack

Overview of Main Themes

Following interviews with six patients, four main themes were identified: 1) diagnostic uncertainty and symptom overlap, 2) communication and clinician interactions, 3) impact of systemic pressures and 4) positioning of mental health in cardiology services.

The first theme, diagnostic uncertainty and symptom overlap, reflects the challenges reported around interpreting symptoms and misattributing symptoms which overlap with mental health and cardiovascular diagnoses. The second theme highlights the importance of good communication, combining narratives around what makes a useful and supportive diagnostic process. The third theme, the impact of systemic pressure, brings together comments around how constraints on time and money influence the diagnostic process. The fourth theme explores the positioning of mental health in cardiology service, bringing together the narratives around when mental well-being has been privileged or silenced within the cardiology diagnostic pathways. Each theme is explored in detail in the following sections.

Theme 1: Diagnostic Uncertainty and Symptom Overlap

This theme captures the challenges patients described in interpreting symptoms as due to cardiovascular difficulties or other causes. A central theme in patients' accounts was the challenge of recognising cardiac symptoms as distinct from their pre-existing mental health condition. Many participants described difficulty distinguishing cardiac symptoms from those associated with pre-existing mental health conditions, particularly anxiety, highlighting the significant overlap between psychological and cardiovascular presentations: "*if you know some of the symptoms that you see from like the depression side, where you can get the anxiety and, you know, you sort of get your palpitations, it can be very similar. Very*

similar… people are not educated enough about these things. People don't talk about mental health" (patient 1).

Additional barriers to earlier help-seeking were rooted in personal beliefs and assumptions. Many participants internalised the notion that cardiovascular disease is predominantly present in an older demographic, leading them to minimise or rationalise their symptoms. This assumption functioned as an internal barrier, postponing engagement with healthcare services: "*I felt that they sort of didn't take you quite as seriously because I was quite young. Well, I'm quite young, you know. You sort of see sort of assume it's going to be older people that has heart problems.*" (patient 1), or as reported by patient 4 "*Bottom line I just put it down to age, you know. I am not old" and further by patient 2 "I felt like I it's hard to say, but it's hard to put into words like I feel like I'm only 25 and it just it did. It was a bit strange for me to be honest, but I sort of went into work telling people and people were just like you're too young. And I think I do feel too, too young to have something like this, to be honest*".

After recognising that their symptoms required further medical investigation, participants described contacting their GP as the first step towards accessing specialist care, often resulting in referral to cardiology services: "*And then I went to get help from the GP…referred me on to a cardiologist*" (patient 1). However, many reported that the period between referral and receiving a cardiology appointment involved prolonged waiting times: "*when I realised there was something wrong obviously that was on my mind a lot and that the NHS I didn't hear back at all as to when I would get an appointment even to tell me if there was a wait time or not, which was a bit frustrating*" (patient 2), and "*You try to do something and then you have to wait three months for something else*" (patient 3). This delay was frequently experienced as anxiety-provoking, intensifying uncertainty and contributing to increased rumination and overthinking about potential diagnoses: "*So that was a bit hard*

because obviously you can imagine I'm a bit, I'm a bit of an overthinker anyway. So as soon as I found out there was actually something that needed checking out. I did want to be seen like or as anyone would do with your heart. It's important, isn't it?" (patient 2).

In addition to prolonged waiting times for initial consultations, participants also described uncertainty surrounding the diagnostic testing process itself. This uncertainty arose when early investigations were inconclusive or when multiple tests were required to obtain a comprehensive understanding of their condition: "*I did all the usual stuff like blood tests and things like that, but it did. Mine didn't show up*" (patient 1), and "*because all these various tests were being done, you know, ECGs and God knows what. And as I say, they were proving to not show anything until I had this stress test, basically, which then, you know, showed everything clearly*" (patient 6). Several patients emphasised the need for greater efficiency in the organisation and sequencing of tests, expressing a preference for more streamlined diagnostic pathways to reduce prolonged ambiguity and distress: "*I think I needed to do the test, which proves that things are wrong in a shorter space of time*." (patient 6).

Theme 2: Communication and Clinician Interactions

This theme explores how communication and rapport with clinicians shape the diagnostic experience for patients. Overall, patients spoke favourably about their interactions with cardiology clinicians, with experiences of being listened to and treated without judgement emerging as defining features of effective care. These relational qualities appeared to play a crucial role in shaping patients' diagnostic experiences: "*doctors and nurses have been grea*t" (patient 2), and "*I was treated really well by NHS and stuff, yeah, I can't really fault it at all*" (patient 4).

Despite generally positive interactions, patients articulated clear suggestions for enhancing the diagnostic experience. Central to these recommendations was the need for attentive listening "*listen to the patient, listen to what they're saying. I get the impression that sometimes health-care professionals are not really allocated enough time to listen fully to patients' issues*" (patient 6), and transparent communication, "*I really feel that communication is key sometimes and it just wasn't there for that*" (patient 2). Participants stressed the value of explanations delivered in accessible language, free from jargon, and accentuated the importance of adequate consultation time to meaningfully process information and ask questions: "they *used these big words that you think what hell does that mean? And they just haven't got the time. You know, I only give you sort of 15 minutes sort of window. They haven't got that time to sort of explain…Probably just to give them more time and rather than trying to rush them to get to the next person, especially GP surgeries*" (patient 1).

Theme 3: Impact of Systemic Pressures

This theme reflects how systemic pressures, such as time and financial constraints, impact accessing and navigating cardiology services. Patients frequently contextualised their diagnostic experiences within the wider systemic pressures facing the NHS, suggesting that delays, fragmented pathways, and time-limited consultations were not individual shortcomings but reflections of broader structural strain: "*it's just everything is just so stretched to its breaking point*" (patient 5), resource pressures were also highlighted by patient 1, "*I think there needs to be more people doing the role and them having more time to do it. I just don't think they've got enough time to sit down with each and every person that's got that problem to discuss their problem. I think they're so overworked with and overwhelmed by how much of it is about*".

As a consequence of the systemic constraints currently facing the NHS, participants described tangible impacts on the diagnostic process, including within cardiac care pathway. In particular, patients highlighted extensive waiting lists that delayed access to cardiology specialists, alongside limited communication regarding the nature or duration of these delays. This lack of clarity was often experienced as compounding uncertainty and anxiety during an already distressing period: "*I don't know. I'd have a letter to say when there's a bit of a backlog, we'll see you in 10, 11-12 months. But that didn't even happen*" (patient 2). Patient 6 reflected that the diagnostic process appeared to accelerate only once a clear problem had been identified: "*things were quicker then, yeah, because obviously they realised there were problems. After the angiogram as well, you know, they could obviously see what they were dealing with, and that was dealt with pretty quickly*".

Some patients described additional challenges in navigating the NHS system. For example, one patient reported being missed off the testing list "*One of them I had to sort of chase up because I think I've been missed off the list*" (patient 4), while another described waiting for a year, only to discover that they had been referred to the wrong cardiology department: "*Doctor said that A&E actually referred me to like a heart chest pain specialist and that's the wrong person to see*" (patient 2). Such experiences reflected overburdened administrative processes within the diagnostic pathway: "*I would say maybe to contact me, contact the hospital a bit more. Find out. Like it's obviously you're not going to. You're not going to hear anything for a while. But I would say definitely reach out and try and go through channels to find out where you're at with things rather than sitting there and chewing on it and waiting for people*" (patient 2). However, this sense of personal responsibility was complicated by feelings of reluctance to seek further assistance, as some participants expressed concern that others needs might be greater in an already overstretched

system: "*I try and work on it for myself so then I don't hold up the system for someone else that maybe doesn't have some of the tools that I already have*".

As a result of these factors, it was a common experience for the preliminary stages of the diagnostic process to be completed by private health care companies "*I was very fortunate enough to have private health care through my parents. And so that led me to be able to be seen much quicker*" (patient 2), with a common reason for seeking private health care as due to the long waiting times of the NHS, "*I've tried the NHS, but they are just useless… with private you book an appointment and you are seen two days later*" (patient 3), and others spoke of being refused tests "*NHS wouldn't do the scan. They wouldn't pay for it. That's when I went private for the doctor and he suggested to go for this scan. That's when they found it*." (patient 1).

Theme 4: Positioning of Mental Health in Cardiology Services

This theme examines how mental health was positioned in cardiology diagnostic processes, including the extent to which mental health difficulties were discussed during this process. A strong and consistent narrative across patient accounts concerned the perceived separation of mental health and cardiovascular care within the diagnostic process. In particular, participants reported that at no point during their cardiology assessments were they asked about their mental health, despite having pre-existing mental health conditions: "*I don't think one person has asked me once how I feel*" (patient 5), and "*Yeah, there's nothing to do with mental health*" (patient 4). Even when mental health difficulties were acknowledged, responsibility for their management was typically deferred to primary care, underscoring the limited integration of psychological support within cardiology services: "*But my experiences they don't really care as it is not what they are there to do, they just say if you have any problems go and see you GP*" (patient 3). Patient 1 shared concerns regarding GPs having an

overreliance on medication in comparison to a form of talking therapy: "*people was more interested in sort of medicating rather than doing anything else. It was only when I went back and saw somebody else who suggested going for their talking therapy*".

As a result, a need for greater integration between mental health and cardiology services was highlighted, to help bridge the gap for people experiencing the cardiovascular diagnostic pathway with an existing mental health condition: "*I think it can only help. Because I think if people understand what's going on with their body and then it maybe alleviates some of that stress and anxiety and worry*" (patient 5). A need for physical health clinicians to receive training to support people was mental health difficulties during consultations was also highlighted, "*I think every professional or every professional in whatever area it is should have a basic understanding of dealing with people who have mental health issues…rather than it just being the case of that's nothing to do with me go and see your GP*" (patient 3). Patients expressed that discussing their mental health within cardiovascular consultations would be beneficial, particularly in understanding how psychological difficulties intersect with their cardiac symptoms. Many highlighted a perceived lack of adequate support for individuals managing both mental health and cardiovascular conditions, "*Absolutely not. There's just not enough of you. That's the NHS in general, isn't it? At the end of the day, the NHS is failing miserably because not because of people not wanting to do it, there's just not enough people to do it*" (patient 5), suggesting a need for more integrated approaches to care "*I think it's a good thing to ask people those questions [about mental health] because maybe they're not asked enough or people are not given enough opportunity to speak to someone… that I wouldn't want to raise with my children and families because of worrying them*" (patient 5).

Integrated Interpretation of Clinician and Patient Narratives

Several shared narratives emerged across patient and clinician accounts, highlighting points of convergence in their experiences of the diagnostic process. To integrate findings from clinician and patient narratives, a display table was developed to include the relevant quotes for each theme, which have been explored individually in the previous sections (**Table 14**).

Theme 1: Diagnosis as a Relational and Collaborative Process

Clinicians emphasised the importance of history taking as central to understanding a patient's presentation and making sense of their symptoms. This process was described as collaborative, relying on patients sharing their experiences in detail to support clinical interpretation. Patients similarly highlighted the value of being listened to, describing feeling heard and understood as key indicators of a positive diagnostic encounter. Across both accounts, diagnosis was constructed as a relational process shaped through dialogue.

However, limitations to this process were acknowledged on both sides. Clinicians spoke about the time pressures within consultations, particularly when presentations were complex or involved co-existing mental health conditions. Patients likewise described restricted appointment times as limiting their ability to fully explain their difficulties, understand clinical explanations and ask questions. Together, these narratives illustrate how collaborative diagnostic processes are valued but often constrained by time limitations.

Theme 2: Mental Health within Cardiac Knowledge and Practice

Both clinicians and patients demonstrated an awareness of the overlap between symptoms associated with mental health conditions, such as depression and anxiety, and

those indicative of cardiovascular disease. This shared recognition was described as adding complexity to the diagnostic process. Patients spoke about delaying help-seeking behaviour, attributing physical symptoms to their existing mental health difficulties. Clinicians similarly reflected how such overlap could complicate consultations, shaping the narratives presented and making history taking and clinical formulation more challenging. Across both accounts, symptom ambiguity was positioned as a factor that could blur distinctions between psychological and cardiac presentations, especially when presenting symptoms don't align with the textbook definition.

Despite clinicians demonstrating awareness of how mental health conditions may intersect with cardiovascular disease, both clinicians and patients reported that mental health was not routinely addressed within cardiology consultations. Clinicians attributed this to structural constraints, including limited appointment time and a lack of available resources to provide psychological support within the service. Across both accounts, there was a shared view that greater integration of psychological services within cardiovascular care would be beneficial. Clinicians suggested that this could support treatment adherence. Patients shared that a dedicated space to express their concerns and anxieties in relation to their cardiovascular and mental health difficulties would be valued.

Table 14

Synthesis of Themes Identified by patients and clinician.

Theme	**Quotes from Patient**	**Quotes from Clinician**
Diagnosis as a relational and collaborative process	• "*I found it helped a lot because I was able to talk to somebody. Sometimes it was like I was talking to my friend as I was able to talk about things and felt listened to*" (patient 1) • "*He was the best GP I have ever spoken to … it was like talking to someone who actually wanted to listen and understand you*" (patient 3) • "*You get 5 minutes, the number of times I have gone in there with multiple issues, but they tell me they only have time to acknowledge one and will have to book another appointment for the next one*" (patient 3) • "*They use these big words that you think what hell does that mean? And they just haven't got the time. You know, they only give you sort of 15 minutes sort of window. They haven't got that time to sort of explain*" (patient 1)	• "*It's a test at the end of the day. It's just a test, you know, its spending time talking to someone, hearing what they have to say*" (clinician 2) • "*Listen to the patient, he's telling you the diagnosis*" (clinician 2) • "*We are Privileged because we've got more time for a patient. Consultants got like 20 minutes. We've got 40 minutes*" (clinician 3) • "*I need to get answered from the patient to make a diagnosis, so if they're not a very good historian, if they're not very good at communicating or explaining their symptoms, it can be very difficult to make a diagnosis in clinic*" (clinician 5) • "*Major depressive episodes … that's a huge burden to both how we get a history because people don't tell us about the things in the way that we're expecting and particularly when we're a consultant who's rushed and hurried and not spending that time, that's then difficult*" (clinician 6).
Mental health within cardiac knowledge and practice	• "*If you know some of the symptoms that you see from like the depression side where you can get the anxiety and. You know you sort of get your palpitations, it can be very similar. Very similar*" (patient 1) • "*I think it did, actually… the first time I didn't go and seek any help, to be honest. So, it probably didn't impact the time it took me to actually speak to someone*" (patient 2)	• "*When it comes to anxiety, it's a difficult one because sometimes I don't know if it's true angina or just anxiety causing symptoms*" (clinician 3) • "*You can get physical symptoms from anxiety, and I think patients with anxiety, underlying mental health conditions often are looking for further investigations*" (clinician 5) • "*There are people that are currently admitted with possible chest pain and acute coronary syndrome that*

Theme	Quotes from Patient	Quotes from Clinician
	• "*We never discussed anything about the like, the mental side*" (patient 1) "*I think it can only help. Because I think if people understand what's going on with their body and then it maybe alleviates some of that stress and anxiety and worry"* (patient 5).	*they can't be diagnosed because they can't cooperate*" (clinician 1) • "*People with mental health conditions can be very hard to get a good story from. They're very withdrawn and maybe just don't want to talk or don't want to talk a lot and just want to be left alone*" (clinician 2) • "*I think if it's if their symptoms a little bit less clear and you can't be 100% certain and on cardiac, so you've got an atypical presentation and they're very anxious*" (clinician 5) • "*we're biased in making a diagnosis and we miss it, and I think we do miss it more in the diagnosis more in women for a variety of reasons. Medicine historically has not been great in looking after women. And you know, our textbooks are full of gender and cultural biases, and I think that's something that's going to hopefully get changed in the future*" (clinician 2) • "*You see a lot of ladies present with just breathlessness in the absence of chest pain, who end up having heart disease. So yeah, with women, it can be a little bit more complicated*" (clinician 5) • "*I think doctors are trained to take the medical and surgical past medical history and the psychiatric or psychological past medical history is not taken as nearly as importantly*" (clinician 2) • "*it's much more a short, you know, as a consultant, I will see a patient maybe for 10 minutes during their entire five-day stay in hospital… So, my interactions are, you know, more superficial than you might imagine*" (clinician 6) • "*I think that if we had more psychological input and time with our patients, we'll get better compliance, we'll*

Theme	Quotes from Patient	Quotes from Clinician
		get better for them. Understanding of their disease and therefore more chance of them quitting smoking, taking up the healthier habits" (clinician 6).
Structural pressures shaping access and delivery of diagnosis	• "*You try to do something and then you have to wait three months for something else. Whereas with private you book an appointment, and you are seen two days later*" (patient 3) • "*When I realised there was something wrong, obviously that was on my mind a lot and that the NHS I didn't hear back at all as to when I would get an appointment, even to tell me if there was a wait time or not, which was a bit frustrating*" (patient 2) • "*NHS wouldn't do the scan. They wouldn't pay for it. That's when I went. I went private for the doctor, and he suggested to go for this scan. That's when they found it*" (patient 1) • "*I've tried the NHS, but they are just useless to be honest… So, it has put me off, it's just, everything about the NHS*" (patient 3) • "*I've not crossed anybody that's treated any differently, no*" (patient 5).	• "*Based upon overwhelming referral numbers and having to somehow meet capacity and demand. You know, some of our colleagues are proudly rejecting 50% of all referrals into our service and that's something we definitely didn't used to do when I started as a consultant 13 years ago. Those patients would have been seen and assessed and once in a while you pick something up that you weren't expecting from the referral. So, as the service gets more pressure and we reject more stuff, I think that's that will open up this problem that you talk about of patients with mental health conditions not getting diagnosed*" (clinician 6) • "*There is a kind of little bit of pressure about saving money for the NHS to basically select those people who really need the test*" (clinician 3) • "*it's also the challenging is that the European guidelines are different than NICE guidelines, which are British guidelines. The British guidelines are dictated by the finances*" (clinician 3) • "*We follow guidelines, but obviously as a practitioner, sometimes you need to think outside the guidelines or work slightly differently*" (clinician 5) • "*The biggest mental health challenge I have treating patients is if they've got health anxiety. Because they find it very hard to be happy with you just taking a history and telling them what's wrong with them*" (clinician 2)

Theme	Quotes from Patient	Quotes from Clinician
		• "*Physicians have historically underplayed and underdiagnosed women's cardiovascular disease*" (clinician 2) • "*I think they have a harder time getting into the systems because they probably have to present to a GP multiple times to get referrals and things and then we're probably inherently slightly more dismissive of ladies and their symptoms because they don't sound so much like the textbook*" (clinician 6).
Hope for the future	• "*I think every professional or every professional in whatever area it is should have a basic understanding of dealing with people who have mental health issues… whatever it is, people that are dealing in the medical profession should have a better understanding of mental health rather than it just being the case of that's nothing to do with me go and see your GP*" (patient 3) • "*I think it's a good thing to ask people those questions because maybe they're not asked enough or people are not given enough opportunity to speak to someone… anything that I wouldn't want to raise with my children and families because of worrying them, you know*" (patient 5) • "With private, you book an appointment, and you are seen two days later" (patient 3).	• "*So even if we identify that a patient's condition might be either purely psychological or coloured by the psychology problems… and that needs some toolkit of support. Now that might be something we can offer them. Um, but none of us are given any training in that regard*" (clinician 2) • "*I think that if we had more psychological input and time with our patients, we'll get better compliance, we'll get better for them. Understanding of their disease and therefore more chance of them quitting smoking, taking up the healthier habits*" (clinician 6) • "*I'm not sure that I've ever in my time as a consultant had something at an institutional level or as a team departmental level where we've tried to address it and improve it. That's just it, you know, that's a shame…It's not even that it's lack of willpower to do the harder things, particularly. Over the years, you know, our waiting times are going up and up and up and it feels like there's not enough of us to do the work that's needed as it is*" (clinician 6)

Theme 3: Structural Pressures Shaping Access and Delivery of Diagnosis

The strongest theme intertwined in the narratives of all participants was the impact of systemic pressures. For example, patients described extensive waiting periods between referral from their GP and being seen within the cardiology services. These delays were experienced as prolonging uncertainty. This uncertainty was also acknowledged by clinician 2, highlighting the need for efficiency during diagnostic processes. Clinician 2 highlighted this using a statement he had once heard from a colleague: "*Last Christmas 40 patients in our trust spent Christmas Day not knowing that they didn't have cancer…They'd had a test to see whether they had cancer, and we hadn't written back to them to say, guess what, you're all right, you don't have cancer. So, you use that metric to say, you know, they sat on Christmas Day around their family and friends thinking, do you know what, I've probably got cancer.*"

From a clinician's perspective, the pressure on services was also acknowledged, with several noting increased referral rates and the resulting need to triage more strictly. Clinicians described situations in which referrals were declined when symptoms appeared more consistent with a mental health presentation. However, it was recognised that such decisions carried inherent risk, including the possibility that cardiovascular disease could be overlooked if symptoms were prematurely attributed to psychological causes. Across both accounts, service burden was positioned as shaping not only access to care, but also the interpretative thresholds applied within the diagnostic process.

Clinicians described experiencing pressure to avoid ordering investigations solely to reassure anxiety, noting the influence of financial constraints and adherence to NICE guidelines within the broader economic context of the NHS. Decisions not to proceed with certain tests were framed as clinically guided. However, clinicians acknowledged the tension this creates, particularly when patients remain concerned about their symptoms. Patients

described instances where investigations were declined on the basis that they were not clinically warranted, leading some to seek private healthcare in order to access tests more quickly. Shorter waiting times and rapid access to testing in the private sector were contrasted with NHS pathways which, for some patients, contributed to reduced confidence in the NHS. Seeking private care was described by several patients as a proactive strategy to gain clarity and reassurance, and in some cases was pursued at the outset of the diagnostic process.

Clinicians also reflected on patient characteristics that may be associated with an increased risk of missed diagnosis. In particular, pre-menopausal women were identified as potentially more vulnerable, partly due to symptom presentations that may diverge from traditional descriptions of cardiovascular disease. This was framed as a challenge within clinical assessment rather than intentional bias. Nevertheless, patients themselves generally reported that they did not perceive differential treatment based on aspects of their identity, including gender or ethnicity.

Theme 4: Hopes for the Future

A common aspiration across clinician and patient accounts concerned the future development of cardiology services to include greater psychological awareness, training and integration. Clinicians emphasised that, beyond limited consultation time, they often lacked formal training to address psychological difficulties within cardiac settings. This was described not as a reluctance, but as a resource that has not been offered. Patients similarly identified this as an area for development, suggesting that enhancing clinicians' psychological awareness could improve diagnostic encounters and ongoing care. In particular. Participants proposed that equipping cardiology clinicians with basic psychologically informed skills would be beneficial, especially in the absence of integrated psychological services.

In addition to advocating for enhanced psychological training, the cardiology clinicians proposed that the integration of dedicated psychological services within psychological pathways. Clinicians suggested that embedded psychological support could improve treatment adherence and increase the likelihood of patients engaging in lifestyle-changes aimed at reducing cardiovascular risk. This perspective resonated with patients' accounts, in which the opportunity to discuss mental health within cardiology consultations was considered a useful addition to the diagnostic process, addressing the emotional aspects of cardiac care alongside physical treatment.

Despite identifying clear areas for development, there was a shared sense that implementing meaningful change lay beyond their immediate influence. While participants were able to articulate the improvements they would like to see, these were often framed against systemic barriers that felt difficult to overcome. Clinicians spoke of increasing referral volumes and service demands, potentially attributed to greater public awareness, which contributed to feelings of being overburdened and limited in their capacity to challenge or reshape existing processes. Patients, positioned further from actively changing the system, similarly conveyed a sense of limited agency. For some, diminished confidence in the current NHS system was reflected in the decision to seek private healthcare as a means of accessing more timely investigation.

Integrated Interpretation of Quantitative and Qualitative Findings

Integration of the findings from the quantitative and qualitative analysis is presented in **Table 15**. Overall, the qualitative findings provided a contextual insight into the increase in cardiovascular risk for people with a common mental health condition and certain demographic profiles.

Mental Health and Cardiovascular Risk

Qualitative accounts from both patients and clinicians highlighted the complexity of disentangling symptoms when there is an overlap between conditions, such as chest pain. The quantitative analysis identified certain demographic characteristics associated with an increased risk of a diagnosis of cardiovascular disease 60 days after a mental health diagnosis in some characteristics (younger age, female sex and white ethnicity). These characteristics were the most consistently observed to significantly increase risk for all time intervals, from 30 to 365 days (**Appendix J).**

The qualitative accounts draw attention to the possibility of delayed help-seeking and personal biases, which can subsequently increase diagnostic challenges of cardiovascular disease following a common mental health diagnosis. However, these patterns were not described as being reflective of what is seen in cardiology clinics in practice. Clinicians reported that they more commonly encounter patients of older ages and often see women presenting after menopause. Although clinicians noted that many of the patients attending their clinics were of white ethnicity, this was largely attributed to the demographic composition of the local population rather than reflecting a perceived increased clinical risk.

Table 15
Joint Table to Show the Integrated Findings of Quantitative and Qualitative Analyses

Integrative Theme	Quantitative Findings (Logistic Regression)	Qualitative Findings (Patients & Clinicians)	Integrated Interpretation
Mental health and cardiovascular risk	Increased risk of developing a cardiovascular disease following a diagnosis of anxiety, depression or comorbid anxiety or depression was observed in individuals younger in age (Mean age = 58.2, SD =8), of female sex, and of white ethnicity.	Patients and clinicians described significant symptom overlap between anxiety/depression and cardiovascular symptoms. Patients often delayed help-seeking due to attributing symptoms to mental health, while cardiology clinicians noted difficulty in history taking and diagnosing testing due to symptoms of mental health conditions.	The period following a mental health diagnosis may represent a window of increased risk of developing a cardiovascular disease. Delay in identification can occur through misattribution of symptoms by patients and the physical manifestations of mental health conditions, impacting the diagnostic process for cardiovascular disease.
Patient - Clinician Diagnostic Engagement	Educational attainment was not consistently associated with an increased risk of developing cardiovascular disease following a mental health condition. A statistically significant association was only observed for depression in relation to cerebrovascular disease, with 'other' forms of education (such as apprenticeships) associated with a higher risk.	Diagnosis was described as a collaborative process relying on history taking and patient narratives. Both clinicians and patients emphasised the importance of communication and feeling heard during consultations. However, the level of education and not having English as the first language was reported to impact this process, if people did not have the language to describe their symptoms in line with British norms.	Diagnostic processes are shaped not only by clinical risk factors but also by relational interactions between clinicians and patients. The understanding and interpretation of symptoms can be impacted by the patient’s ability to describe their symptoms.

Integrative Theme	Quantitative Findings (Logistic Regression)	Qualitative Findings (Patients & Clinicians)	Integrated Interpretation
Systemic and Social pressures Impacting Access to Care	Social pressures such as Income level, deprivation, educational attainment, and employment status were not consistently associated with the risk of developing cardiovascular disease following a diagnosis of a common mental health condition. Significant associations were observed only in specific models: being employed as associated with a lower risk of developing ischemic heart disease among individuals with depression, while 'other' education (such as apprenticeships) was associated with a higher risk of cerebrovascular disease.	Patients described long waiting times and referral delays. Clinicians similarly reported increasing referral volumes and service pressures, which influenced triage decisions and diagnostic thresholds. Clinicians also spoke to the impact of social pressures, such as deprivation and education, on lifestyle choices and compliance with medication.	Systemic and social pressures impacting care were identified through the logistic regression but further explained by the thematic analysis. Structural pressures within healthcare systems intersect with social determinants of health, shaping both access to diagnostic services and the pace at which cardiovascular disease is identified. Social pressures may also impact the diagnostic process, including impact on lifestyle choices and treatment compliance.
Positioning of Mental Health Within Cardiac Care	Findings from the logistic regression highlighted the demographic characteristics (being middle aged, of female sex, and of white ethnicity) associated with a higher risk of developing a cardiovascular disease 60-days after a diagnosis of a mental health condition This suggests that people with mental health conditions may present in cardiology services, highlighting a need for the integration of psychological perspectives.	Both clinicians and patients reported that mental health was rarely discussed during cardiology consultations. Clinicians spoke of limited time and training, while both groups suggested integrating psychological services within cardiology pathways would be beneficial.	Although mental health is epidemiologically linked to cardiovascular risk, psychology remains unintegrated within the service structure. This highlights a gap between current evidence and service delivery structures.

Patient-Clinician Diagnostic Engagement

In light of the differing risk profiles identified in the quantitative analysis, both clinicians and patients emphasised the importance of thorough history taking and attentive listening during consultations. This process was described as central to understanding patients' presentations and making sense of potentially overlapping psychological and cardiovascular symptoms. However, clinicians acknowledged that these discussions can be particularly complex when patients have pre-existing mental health conditions. To better accommodate these complexities, clinicians and patients suggested sufficient time in appointments for patients to describe their experiences and difficulties.

Systemic Pressures and Access to Care

Although socioeconomic dimensions such as employment status, income or educational attainment were not consistently associated with increased risk of cardiovascular diagnosis in the regression models, clinicians described how social and educational factors may still shape cardiovascular risk in practice. In particular, clinicians spoke about how lower levels of health education and higher levels of deprivation can influence lifestyle behaviours and individuals' ability to recognise cardiac symptoms. These accounts highlighted a perceived need for greater community-level education and preventative initiatives, particularly in areas experiencing higher levels of deprivation.

In addition, although the demographic profiles with higher likelihood of receiving a first diagnosis of cardiovascular condition following a first diagnosis of mental health condition identified in the quantitative analyses differed from those described in the qualitative accounts, both clinicians and patients highlighted systemic barriers that may delay

access to cardiovascular care. Across interviews, the financially stretched and overburdened NHS was a recurring feature of both clinical and patient narratives. In particular, increasing waiting times and stricter referral screening processes were described as consequences of rising referral volumes in recent years. When considered alongside the quantitative findings suggesting that cardiovascular risk may emerge more rapidly following a mental health condition for some people, these systemic pressures may have implications for the diagnostic pathway. Specifically, delays in accessing specialist care or the rejection of referrals could potentially prolong the diagnostic process for individuals already at increased risk.

Positioning of Mental Health Within Cardiac Care

Despite the statistical association between mental health diagnoses and cardiovascular diagnoses, qualitative findings indicated that mental health was rarely addressed within cardiology consultations. Clinicians attributed this largely to limited consultation time and lack of training in managing psychological difficulties within cardiac settings. Nevertheless, both clinicians and patients emphasised the potential value of integrating psychological services within cardiology pathways. Clinicians suggested that the presence of psychological support could improve treatment adherence and patients reported that they would value this space as it would a dedicated space to discuss worries related to their diagnosis or treatment. Together, these accounts highlight a disconnect between the epidemiological link between mental and cardiovascular health and the extent to which psychological factors are currently incorporated into cardiology

Discussion

Study Overview

This study aimed to identify how individual characteristics influence the diagnostic process for coronary heart disease following a diagnosis of a mental health condition. It also aimed to explore how cardiovascular diagnoses are experienced by individuals with pre-existing mental health conditions and by clinicians working within cardiology services. To address this aim, a sequential mixed-methods design was employed. The quantitative phase used logistic regression analysis to investigate the risk of diagnosis of cardiovascular disease following a diagnosis of anxiety, depression or comorbid anxiety-depression, which could subsequently lead to diagnostic challenges. The qualitative phase then explored patient and clinician perspectives on cardiovascular diagnostic processes through semi-structured interviews.

The quantitative findings consistently suggested that individuals diagnosed with a common mental health condition were at an increased risk of developing a cardiovascular disease within a 60-day window if they were of female sex, white ethnicity and younger in age. Although some socioeconomic factors, such as income, employment and education, were seen to increase cardiovascular risk in some predictors, this was not consistently found across the models. These findings contribute to a growing body of epidemiological research demonstrating the relationship between mental health conditions and cardiovascular disease risk.

The qualitative findings provided insight into cardiovascular diagnostic processes in practice for individuals with mental health conditions. Across patient and clinician accounts, diagnosis was described as a collaborative process, which can be complicated by symptom overlap between psychological distress and cardiovascular symptoms, as well as broader systemic pressures within cardiology services and the NHS more generally. Patients

highlighted the importance of good communication and adequate consultation times in positive diagnostic experiences. In addition, both clinicians and patients noted that mental health was rarely addressed directly within cardiology consultations, despite recognising the relevance of psychological factors to cardiovascular health.

The integrated findings suggest that the period following a mental health diagnosis may represent a diagnostically vulnerable window for cardiovascular disease. While quantitative analyses highlight patterns of risk, the qualitative findings highlight how diagnostic processes are shaped by symptom interpretation and service navigation.

Taken together, the findings of this study can be interpreted through two complementary perspectives. From a clinical standpoint, cardiology is often oriented towards prevention, focusing on identifying and mitigating risk factors to avoid adverse cardiovascular outcomes. In contrast, psychological perspectives tend to emphasise understanding lived experience and identifying ways to implement change to improve service user experience. By combining these approaches, this study illustrates how cardiovascular risk following a common mental health diagnosis is shaped not only by biological vulnerability, as highlighted in previous literature (Kahl et al., 2023), but also by how symptoms are interpreted and communicated within NHS systems.

Interpretation of Integrated Findings

Mental Health and Cardiovascular Risk

The findings from the current study highlighted the complexity of the association between mental and cardiovascular health. The increased odds of a diagnosis of a cardiovascular condition after a mental health condition, especially in individuals who are of female sex, white ethnicity, or younger age, can reflect increased risk following a mental health diagnosis. The overlap of symptoms between MHC and CVD might contribute to

diagnostic challenges. These findings align with previous research indicating that certain groups may be at greater risk of diagnostic challenges for CVD, often due to symptom presentation not aligning with traditional clinical expectations (DeVon et al., 2014; Manghera & Lall, 2025).

From a clinical perspective, diagnostic challenges have frequently been understood in relation to atypical symptom presentation or deviations from established diagnostic profiles. For example, women and younger individuals may present with less typical symptoms of cardiovascular disease, which can lead to misinterpretation within clinical settings (van Oosterhout et al., 2020). However, qualitative findings from this study suggest that diagnostic challenges are not solely attributable to clinical factors but are also influenced by psychological processes that shape how symptoms are experienced and acted upon.

In particular, both patients and clinicians described the significant overlap between symptoms associated with common mental health conditions and those indicative of cardiovascular disease. This overlap appeared to contribute to the misattribution of symptoms, with patients often interpreting cardiac symptoms as manifestations of anxiety. This is consistent with previous research on symptom attribution (Gonzalez-Ibarra et al., 2024) and interoceptive accuracy (Dunne et al., 2021), which has demonstrated that individuals with existing mental health conditions may be more likely to interpret physical symptoms through a psychological lens, particularly when those symptoms are familiar or consistent with prior experiences of anxiety or low mood.

Such misattribution has important implications for help-seeking behaviour. Patients in this study described delaying seeking medical attention, either because symptoms were perceived as not serious or attributed to an existing mental health condition. From a psychological perspective, this highlights the role of cognitive and perceptual processes in shaping responses to bodily sensations, including the influence of prior experiences. These

findings are supported by the literature on health behaviour, which suggests that symptom interpretation is a determinant of whether individuals seek care (Scott & Walter, 2010).

From a clinical perspective, these findings underscore the need for increased awareness of cardiovascular risk among individuals with mental health conditions, particularly within demographic groups identified as being at higher risk of diagnostic challenges. However, from a psychological perspective, they also highlight the importance of supporting individuals in accurately recognising and interpreting symptoms. This may include improving public and patient education around cardiovascular symptoms, particularly those that fall outside of traditional textbook presentations, and increasing awareness around how mental health conditions may influence symptom perception (Luepker et al., 2000).

Patient-Clinician Diagnostic Engagement

The findings of this study highlight the important role of patient-clinician interactions in shaping cardiovascular diagnostic processes, particularly in the context of pre-existing mental health conditions. While the quantitative findings identified demographic patterns associated with increased risk of diagnostic challenges for cardiovascular disease in people with a pre-existing mental health condition, the qualitative findings suggest that diagnosis is not solely determined by clinical indicators but is also shaped by how symptoms are communicated and interpreted in clinical encounters.

From a clinical perspective, diagnostic interactions are often framed as processes of information gathering and decision-making, with history playing a key role in identifying potential cardiovascular risk (Peterson et al., 1992). Existing literature has emphasised the importance of accurate and efficient clinical assessment in supporting timely diagnosis and management of cardiovascular disease (Mol et al., 2016). However, the present findings suggest that in practice, diagnostic interactions are more complex and relational in nature.

Clinicians described diagnosis as a collaborative process, reliant on the patient's ability to articulate their experiences and the clinicians' ability to interpret this within a broader clinical context.

From a psychological perspective, this process can be understood as a form of shared meaning-making, in which patients and clinicians work together to interpret symptoms that may be ambiguous or overlapping (Elwyn et al., 2012). It could be suggested that the use of clinical formulation, as used in psychological practices, may help to support and promote a diagnostic process based on shared understanding, positioning the patient as the expert of themselves and the clinician as the expert of the science (Thrower et al., 2024). This is particularly relevant in cases where individuals present with co-existing mental health conditions, as symptoms such as chest pain, breathlessness, or palpitations may be interpreted differently depending on both patient and clinician cognitive biases. Previous research has highlighted how patient narratives and clinician interpretations interact to shape diagnostic outcomes (Charon, 2001).

However, the findings also highlight constraints on this collaborative process. Both clinicians and patients emphasised the importance of listening and communication, facilitated by having sufficient time within consultations to explore symptoms in depth. Patients described feeling better understood when allowed to fully explain their experiences. These findings are consistent with existing literature on patient-centred care, which emphasises the importance of communication and relational engagement in improving diagnostic accuracy and patient outcomes (Sharkiya, 2023).

Despite this, systemic pressures within healthcare services were described as limiting the extent to which such interactions can occur. Clinicians reported working within time-constrained consultations, with growing pressure as the number of referrals increases, while patients described feeling like they did not have enough time to understand what was going

on. From a clinical perspective, this may reflect the need to prioritise efficiency and manage increasing service demand. However, from a psychological perspective, limited consultation time may reduce opportunities for patients to articulate symptoms clearly, potentially contributing to misunderstandings (Elmore et al., 2016).

In the context of mental health, these constraints may be particularly significant. The presence of a mental health diagnosis may influence both how patients present their symptoms and how clinicians interpret these symptoms. Previous research has suggested that psychological diagnoses can influence how clinicians understand symptoms, sometimes leading to the attribution of physical symptoms to mental health causes (Jones et al., 2008). The findings of this study suggest that this relationship may further complicate the diagnostic process, particularly when combined with limited time and increasing service demand.

Systemic and Social Pressures Impacting Access to Care

The findings of this study highlight the significant role of systemic and structural factors in shaping access to cardiovascular diagnostic services, particularly for individuals with pre-existing mental health conditions. Whilst the importance of symptom interpretation and clinician-patient communication has been emphasised, the findings suggest that these processes are embedded within a wider healthcare context that can facilitate or constrain access to care.

From a clinical perspective, healthcare systems such as the NHS are designed to balance the timely identification of serious conditions with the need to manage finite resources. However, the qualitative findings suggest that increasing systemic pressures may impact the effectiveness of this balance. Both clinicians and patients described the growing demand for cardiology services, including increased referral rates and longer waiting times. These pressures were reported to contribute to more stringent gatekeeping, with referrals

more frequently reviewed or rejected based on initial assessments. While such processes may be necessary to prioritise clinical need, they may also increase the risk of diagnostic challenges (Sripa et al., 2019), particularly in cases where symptom presentation is ambiguous due to a pre-existing mental health condition.

In addition, participants described extended waiting times between referral and specialist assessment by cardiology services. These delays may have important implications for both clinical outcomes and patient experiences of care. From a clinical perspective, prolonged waiting times may delay the identification and management of cardiovascular disease, particularly as individuals with a pre-existing mental health condition have already been identified as being at increased risk (Correll et al., 2017). From a psychological perspective, waiting periods were described as increasing levels of worry and uncertainty, potentially exacerbating existing mental health difficulties and thus increasing difficulties within the diagnostic process through engagement and communication (Reichert & Jacobs, 2018).

The findings also highlight the influence of financial and structural constraints on clinical decision-making. Clinicians described pressures to avoid unnecessary testing, guided by both resource limitations and adherence to clinical guidelines. Whilst such approaches aim to ensure appropriate use of healthcare resources, they might also contribute to undertesting or not providing the same level of care as might be recommended by the European Society of Cardiology guidelines, which are considered to outline the most comprehensive standard of care (Naraen et al., 2023). In particular, there could be a risk of people with a pre-existing mental health condition receiving fewer cardiac investigations compared to those who do not, due to difficulties in communicating symptoms (Abdullayev et al., 2024). This could therefore increase the vulnerability in this population for challenges in diagnostic and treatment processes (Oswald et al., 2025). In response to the increasing constraints on the

NHS, some patients reported seeking private healthcare in order to access diagnostic tests more quickly. This reflects a growing disparity in access to care, whereby individuals with the means to do so may bypass delays within the NHS (Propper, 2024).

From a psychological perspective, the decision to seek private care may also reflect a loss of confidence in the NHS, especially when individuals experience uncertainty or do not feel like their difficulties are being taken seriously. Previous research has suggested that trust in healthcare services is an important factor influencing engagement and help-seeking behaviour (Calnan & Rowe, 2006), and the present findings indicate that systemic delays and barriers may undermine this trust.

In addition to resource pressures, the findings suggest that access to care is also shaped by the structure and application of clinical guidelines. Clinicians described how diagnostic pathways are guided by established criteria, NICE guidelines (National Institute for Health Care Excellence, 2020), which may not account for the complexity of presentations involving both mental and physical health symptoms. It was noted that some diagnostic frameworks have remained unchanged for a substantial period of time, potentially limiting their responsiveness to evolving clinical evidence. From a clinical perspective, guidelines provide important standardisation of care and support decision-making (Guerra-Farfan et al., 2023). However, from a psychological perspective, rigid application of guidelines may not fully capture individuality, especially in the presence of transdiagnostic symptoms (Hughes et al., 2013).

Positioning of Mental Health Within Cardiac Care

The findings of this study highlight a notable gap between the recognised relationship between mental health and cardiovascular disease and the extent to which mental health is integrated within cardiology services. Whilst the quantitative findings demonstrated an

increased risk of diagnostic challenges of cardiovascular disease in some groups of people with a pre-existing mental health condition, the qualitative findings revealed that mental health was rarely discussed explicitly within cardiology consultations. This suggests a disconnect between epidemiological evidence and clinical practice.

From a clinical perspective, cardiology services have traditionally prioritised the identification and management of biological risk factors, reflecting a predominantly biomedical model of care (Rozanski et al., 2005). However, the findings of this study suggest that this approach may be insufficient for capturing the complexity of presentations in individuals with a pre-existing mental health condition. A biopsychosocial perspective provides a useful framework for understanding this complexity, recognising that cardiovascular health is shaped not only by biological processes (Powell-Wiley et al., 2022), but also by psychological factors (Dimsdale, 2008), such as symptom interpretation (Petrie & Weinman, 2006), and social factors (Kahl et al., 2023), as well as access to care (Brandt et al., 2023) The present findings support the relevance of this model, demonstrating how psychological processes and social context intersect with clinical pathways to influence diagnostic experiences.

Despite growing recognition of the importance of mental health support within cardiovascular care, the qualitative findings suggest that mental health remains relatively peripheral within cardiology services. Although clinicians acknowledged the impact of psychological factors on symptom presentation and patient engagement, responsibility for addressing mental health was often positioned outside of cardiology, typically being redirected to primary care services. This division reflects broader structural boundaries within healthcare systems, where mental and physical health are often treated as separate specialities (Patel et al., 2018). This separation may limit opportunities to address the interplay between mental and cardiovascular health within the diagnostic processes.

Recent developments in clinical guidance from the European Society of Cardiology (Bueno et al., 2025) have recommended the incorporation of psycho-cardio pathways, signalling a shift towards greater recognition of the role of mental health in cardiovascular care. However, these developments have tended to emphasise psychiatry input, focusing more on pharmaceutical support for mental health (Bueno et al., 2025). The findings of this study suggest that there is also a need to consider the role of psychological support more broadly, particularly in relation to service engagement and treatment compliance. Within clinical health psychology services, therapies such as acceptance and commitment therapy (Graham et al., 2016) and cognitive behavioural therapy (Freedland et al., 2015) have been found to significantly improve mental well-being and improve treatment compliance.

Further, clinicians highlighted that, beyond time constraints, they did not feel like they had enough training to be able to provide basic psychological support within cardiology consultations. This suggests a need for increased training in psychologically informed care, enabling clinicians to recognise and respond to psychological aspects of cardiovascular presentations. In other physical health settings where psychology is more integrated, training in basic psychological concepts is provided to physical health clinicians to help equip them for these interactions. This comes from the existing literature in clinical health psychology that emphasises the benefits of integrating psychological principles into physical healthcare settings, which has been seen to improve patient outcomes (Garzonis et al., 2015). Developing these competencies within cardiology services may help to bridge the gap between clinical and psychological perspectives.

Clinical Implications

The findings of this study have several implications for clinical practice and healthcare service design, particularly when considering the relationship between common mental health conditions and cardiovascular disease. Taken together, the results suggest that improving cardiovascular outcomes for individuals with mental health conditions requires attention to both clinical prevention strategies and psychologically informed approaches to patient care. These perspectives represent complementary pathways for improving both the early identification of cardiovascular risk and the quality of care experienced by patients navigating diagnostic care.

From a clinical perspective, the findings reinforce the importance of preventative approaches to cardiovascular disease among individuals with mental health conditions. The quantitative analyses indicated that individuals diagnosed with anxiety, depression, or comorbid anxiety-depression were at increased risk of experiencing diagnostic challenges for cardiovascular disease if they were of younger age, white ethnicity or female sex. These findings also suggest that clinicians working in primary care, mental health services, and cardiology may benefit from increased awareness of cardiovascular risk among individuals with common mental health conditions. Greater attention to cardiovascular risk monitoring in these populations, including routine screening and proactive management of risk factors, may support earlier detection and intervention.

In addition, the findings highlight the importance of broader community education regarding the warning signs of cardiovascular disease. Patients described how they attributed symptoms to anxiety or dismissed them due to their age, contributing to delays in help-seeking. Accessible and disseminated information around cardiovascular health often focuses on textbook definitions, however the findings suggest that a greater emphasis may be needed on recognising a wider range of symptoms and presentations. This is especially important

among individuals with mental health conditions, as there is substantial evidence highlighting the increased cardiovascular risk in this population (Shen et al., 2023). Community-based education initiatives may therefore play an important role in helping individuals recognise potential warning signs and seek timely medical support.

However, the qualitative findings suggest that preventative clinical strategies alone may not fully address the complexities of cardiovascular diagnosis in individuals with mental health conditions. From a psychological perspective, the results align with previous research highlighting the importance of understanding how patients interpret bodily sensations and communicate their experience to clinicians (Moss-Morris, 2013). Symptom overlap between anxiety, depression and cardiovascular disease was frequently described by participants as complicating both help-seeking and diagnostic processes for cardiovascular disease. This therefore emphasises the importance of effective communication, including both verbal and non-verbal forms, to ensure that patients feel heard and for clinicians to get a clear understanding of symptom presentation (Sharkiya, 2023).

Both clinicians and patients emphasised the value of thorough history taking and the importance of listening during the diagnostic processes. However, systemic pressures within healthcare services were described as limiting the time available for such discussions. Ensuring clinicians have sufficient time within consultations to explore both physical and psychological aspects of symptom presentation may support accurate diagnostic processes and improve patient experiences of care (Mercer et al., 2007)**.** In cases where individuals present with a pre-existing mental health condition, slightly longer appointment times may be particularly beneficial in allowing clinicians to explore symptoms, disentangling those that overlap with cardiovascular disease (Bhatta et al., 2025).

The findings point towards the potential benefits of integrating psychological perspectives more fully within cardiology services. In the first instance, clinicians highlighted

a need for training in basic psychological concepts to help inform their practice and best support this population. However, more broadly speaking, a need was highlighted for psychological services to be integrated into cardiology pathways. It was suggested that psychological support could provide patients with a space to discuss worries related to the diagnostic and treatment processes. Such support may also help to improve treatment adherence and support lifestyle changes associated with cardiovascular risk reduction (Bosworth et al., 2018). Integrating psychological expertise within cardiac care may therefore support preventative clinical strategies by addressing the emotional and behavioural components of cardiovascular health (Borkowski & Borkowska, 2024).

At a policy level, this suggests a shift towards service models that recognise the interplay between physical and mental health, in order to provide more flexible and holistic assessment and treatment management pathways. In practice, this requires targeted resource allocation to ensure services are equipped, in terms of staffing and time, to support clinical complexity and support patients who may find it difficult to communicate their difficulties, such as if they have a mental health condition. From the perspective of prevention, resources should also be allocated for community-based education programmes to educate people on cardiovascular health and when to reach out for medical support, as increased education has been seen to improve help-seeking behaviour (Awan et al., 2025; Williamson et al., 2025).

Furthermore, there is also a need for a regeneration of the tools and frameworks used within cardiac diagnostic processes, to enable a more person-centred approach, which acknowledges the psychological and social impact on physical health. For example, expanding beyond the diagnostic checklist to incorporate both physical and psychological factors. Thought also needs to be given to how the patient's voice can be amplified, especially in populations that struggle to verbally communicate their difficulties (e.g. due to illiteracy or a learning disability). For example, James et al. (2026) have started to explore the

attitudes towards using phone application for health care communication and management. Most importantly, policies and pathway guidance need to be responsive to the diverse needs of patient populations, particularly those at risk of experiencing diagnostic inequities.

Reflexive Considerations

Reflecting on the research process for this study, it is important to consider the limitations of the qualitative data in relation to the recruitment and interviewing of clinicians within the NHS. As interviews were conducted in the context of clinicians' professional roles, recruited directly through cardiology services, this may have influenced what clinicians felt comfortable sharing. Clinicians may have been cautious in discussing aspects of practice, including potential biases or systemic issues, particularly where these related directly to their role or organisation. In addition, variation in levels of professional experience may have shaped participants' willingness to express critical perspectives, whereas clinicians with greater experience or in more senior positions may have felt more confident in sharing their reflections on practice and service provision. This may also relate to differing levels of responsibility, with more senior clinicians potentially having greater involvement in service development and reflective practice, which could influence the depth of their responses.

In response to this, future research should consider recruiting clinicians through alternative routes, such as social media or professional networks that are less directly tied to clinicians' immediate workplace. Using this approach might help to create a context in which clinicians feel more able to share their perspectives openly.

In addition, reflections during the interview process highlighted the challenges associated with recruiting patients who had first been diagnosed with a common mental health condition and subsequently developed a cardiovascular disease. This was particularly notable given that clinicians described this as a relatively common presentation in practice.

Consideration was therefore given to potential barriers to participation, including perceived stigma surrounding both mental and physical health conditions, as well as the practical demands of engaging in research. The impact of physical health limitations was also taken into account, particularly in relation to travel and attendance at in-person interviews. In response, a remote option for participation was introduced. The provision of telephone interviews resulted in increased uptake, suggesting that flexible and accessible modes of participation may help to reduce barriers and facilitate greater engagement among this population.

All patient participants who consented to take part in the study were of white ethnicity. This reflects the limited ethnic diversity of the region in which the study was conducted, a point also highlighted by clinicians during interviews. However, it is important to consider that this lack of diversity may not be solely attributable to regional demographics. Cultural differences in attitudes towards healthcare and participation in research may have also influenced recruitment. For example, clinicians reflected that in some cultural contexts, the authority of clinicians may be less likely to be questioned, which could impact individuals' willingness to openly discuss their experiences of care. Additionally, varying levels of stigma surrounding mental health across different cultural groups may have affected both engagement with the study and openness in discussing psychological wellbeing, particularly when recruitment was conducted through cardiology services.

These factors highlight the need for more inclusive and culturally sensitive research approaches. Future studies should consider alternative recruitment strategies to better capture the experiences of individuals from diverse backgrounds. Ensuring representation across cultures and ethnicities is imperative for developing policies and clinical practices that are responsive to the needs of the wider population.

Strengths and Limitations

Strengths

A key strength of this study is the use of a sequential mixed methods design. While the quantitative phase identified characteristics with increased risk of cardiovascular disease diagnosis following mental health diagnosis, the qualitative findings provided insight into how diagnostic processes evolve in clinical practice. By integrating these findings, the study demonstrates how epidemiological risk interacts with diagnostic processes, to not only identify biological mechanisms and associations but also acknowledging the psychological and social aspects of patient experience that can influence diagnostic outcomes.

In addition, this study incorporates the perspectives from both clinicians and patients, providing a more comprehensive understanding of the diagnostic process. By capturing the experiences of patients alongside the professional insights of clinicians, the study was able to explore how diagnosis is perceived and navigated from multiple viewpoints. This dual perspective enabled the identification of factors which delay help-seeking behaviour for cardiovascular disease in patients with a pre-existing common mental health condition, which is often unintentionally silenced through the use of a medical model approach.

This study contributes to a relatively underexplored area of research by examining the characteristics associated with a shorter interval between a diagnosis of a common mental health condition and the subsequent diagnosis of cardiovascular disease. Through integrating quantitative and qualitative perspectives, this study provides a more comprehensive understanding of the factors that may influence diagnostic pathways in this population. Taken together, it helps to identify key themes and highlight areas requiring further research and development, contributing to the growing evidence base needed to improve understanding and better support communities affected by both mental health conditions and cardiovascular disease.

Limitations:

Several limitations should be considered when interpreting the findings of this study. Firstly, the quantitative component relied on data from the UK Biobank, which is known to consist predominantly of participants of white ethnicity. The lack of ethnic diversity limits the extent to which findings can be generalised to more diverse populations. Additionally, although the UK Biobank overall includes a large number of participants, the subset relevant to the specific characteristics examined in this study was relatively small. Consequently, the statistical power of the analyses may have been limited, and a larger sample size would likely allow for more subgroup analyses in order to explore intersectional models of analysis. In addition to limited statistical power, due to the cross-sectional study design, the inference of causality is not possible. It is also important to acknowledge that the study cannot determine whether a missed or delayed diagnosis is being observed.

Possibly as a result of limitations related to the sample size and demographic diversity of participants within the UK Biobank data, there was limited scope to detect statistically significant effects in logistic regression analyses examining intersectional characteristics. As a result, there remains a gap in understanding how intersecting demographic factors influence the diagnostic process in this population.

A further limitation relates to the definition of the CVD outcome. The CVD outcome, identified using ICD codes rather than clinical adjudication, is susceptible to misclassification and may not fully capture diagnostic accuracy. Coronary artery disease and stroke were grouped because of their shared atherosclerotic aetiology, consistent with the approach adopted by Ajoolabady et al. (2024), and to ensure sufficient statistical power given the relatively small number of incident CVD cases. Nevertheless, these conditions differ in their clinical presentation and diagnostic pathways. In particular, stroke often presents as an acute event without a prolonged symptomatic prodrome, making it less directly aligned with the

thesis focus on symptom appraisal and potential misattribution. Conversely, heart failure was excluded because of its distinct structural pathophysiology despite often being ischaemic in origin and characterised by a more gradual symptom trajectory. Consequently, future research should examine individual cardiovascular outcomes, where sample size permits, or group conditions according to their clinical presentation and diagnostic pathways to better understand mechanisms underpinning diagnosis following a mental health condition.

In addition, the sample size from the qualitative component of this study was also relatively small, reflecting the challenges of recruitment in this population. Moreover, all qualitative participants were also of white ethnicity, which, although it allows for comparison between quantitative and qualitative datasets, limits the generalisability of findings. The majority of patients also reported accessing private healthcare in addition to NHS services. This suggests that the sample largely reflects individuals from a particular demographic and socioeconomic background. Consequently, the study may not fully capture the experiences of individuals from lower socioeconomic groups, where private healthcare is not an option, or from ethnically diverse communities, who may encounter different barriers during the diagnostic process.

Further, the qualitative component faced challenges in recruitment. Participants were recruited through NHS cardiology clinics, meaning that the sample only included individuals who had already engaged with healthcare services. This recruitment pathway may exclude individuals who do not access healthcare or are undiagnosed. As a result, perspectives from individuals who remain outside of healthcare pathways may not be represented, potentially limiting the breadth of experiences captured.

Although the qualitative component of the study tried to explore the impact of bias on diagnostic experiences, this was based on subjective perceptions rather than cognitive processes. Although participants discussed perceived biases related to demographic

characteristics and MHC, the study did not explicitly investigate clinicians' cognitive biases in diagnostic reasoning, such as anchoring bias, confirmation bias, or premature closure. These cognitive processes may independently contribute to diagnostic challenges and inequities in cardiovascular care among people with mental health conditions. Consequently, while this study provides insight into how participants perceived the influence of personal and structural biases on healthcare experiences, it cannot determine the extent to which cognitive biases influenced clinical decision-making. Future research should examine the interaction between demographic biases, systemic factors, and clinicians' cognitive reasoning processes to better understand how diagnostic decisions are formed and how challenges in cardiovascular diagnosis among individuals with mental health conditions might be reduced.

Future Research Directions

The findings of this study highlighted several areas where further research would contribute to a deeper understanding of the relationship between mental health conditions and cardiovascular disease, as well as the diagnostic processes experienced by patients and clinicians.

Firstly, future research would benefit from adopting more longitudinal approaches that follow individuals over time and across a broader range of demographic groups. While the present study provides insight into the relationship between common mental health conditions and subsequent cardiovascular risk, the demographic composition of the datasets, with only people of white ethnicity, limits the ability to fully capture experiences across more diverse populations. Longitudinal studies that include greater representation of individuals from varied socioeconomic, ethnic, and geographic backgrounds may provide a more comprehensive understanding of how intersectionality impacts the diagnostic experience and cardiac risk profiles of cardiovascular disease for people with a pre-existing mental health condition.

Secondly, further investigation into symptom overlap between mental health conditions and cardiovascular disease is warranted. The qualitative findings in this study highlighted how patients often struggled to differentiate between symptoms associated with anxiety or depression and those potentially indicative of cardiovascular disease. Future research could explore the role of interoception and interoceptive awareness in shaping how individuals perceive and interpret bodily sensations. Understanding how people detect and make sense of their internal signals may provide insight into delayed help-seeking behaviours and difficulties communicating symptoms to clinicians, both of which may influence the diagnostic process. This element was initially considered as part of the current study, but the findings were not statistically significant, possibly due to limitations in sample diversity. Integrating psychological research on interoception with clinical research on cardiovascular disease may therefore offer valuable insight into how diagnostic pathways could be improved.

In addition, research is needed to explore how patient-centred care can be maintained within healthcare systems facing increasing financial and service pressures. Both clinicians and patients in this study described systemic constraints within NHS services, including limited consultation time and increasing referral demands. Future research could examine how healthcare systems can balance efficiency with the provision of supportive care, ensuring that policy decisions remain guided by evidence of best practice and patient outcomes rather than solely by financial considerations.

Finally, future research could explore differences in patient experiences between private and publicly funded healthcare systems. In this study, some participants reported seeking private healthcare to access diagnostic tests more quickly, often due to the long waiting times of the NHS. Comparative research examining patient experiences across these different pathways could help identify which aspects of care are beneficial or problematic, such as

waiting times and continuity of care. Understanding these differences may help inform improvements within public healthcare systems while preserving equitable access to care.

Conclusion

This study aimed to identify how individual characteristics and their intersection influence the diagnostic process for cardiovascular disease following a diagnosis of a mental health condition, and how clinician and patient biases may influence the diagnostic process. By adopting a sequential mixed-methods design, the study combined quantitative analysis of the risk of diagnostic challenges for cardiovascular disease following a common mental health condition with qualitative exploration of diagnostic experiences. This approach allowed for a more comprehensive understanding of how epidemiological risk patterns intersect with clinical practice in the NHS. Nevertheless, the limited sample size precluded the use of intersectional analysis models, reflecting an ongoing limitation within this area of research.

The quantitative findings demonstrate that individuals diagnosed with a cardiovascular disease subsequent to a common mental health condition were at an increased risk of diagnostic challenges if they were younger in age, of white ethnicity or of female sex. These findings contribute to increasing evidence highlighting the close relationship between mental health and cardiovascular health, highlighting a need for additional consideration to account for this risk in clinical practice.

The qualitative findings provided further insight into how this risk is experienced and managed within clinical settings. Participants highlighted how difficulties distinguishing between these symptoms could delay help-seeking or complicate clinical assessment. In addition, the findings emphasise the importance of clinician-patient communication, particularly the value of listening and thorough history taking. However, systemic pressures

within healthcare services, including limited consultation time and increasing referral volumes, were described as constraining these interactions and potentially affecting the diagnostic process.

Taken together, the findings suggest that the risk of diagnostic challenges for cardiovascular disease following a mental health diagnosis cannot be understood solely through a clinical lens focused on biological risk factors. Instead, diagnostic pathways should be approached through a biopsychosocial lens, acknowledging the interaction between clinical prevention strategies, psychological processes related to symptom interpretation, as well as the structural context of the NHS. Therefore, this study highlights the need for more of a psychological presence within cardiology settings to improve cardiovascular care for individuals with pre-existing mental health conditions.

Ultimately, improving cardiovascular outcomes for this population may require a more integrated approach that combines preventative clinical strategies with psychologically informed models of care. By bringing together clinical and psychological perspectives, it moves beyond purely clinical models of risk towards a more holistic understanding that recognises the role of psychological processes in cardiovascular health, especially in patients with a pre-existing mental health condition. Enhancing clinician awareness of cardiovascular risk among individuals with mental health conditions and providing better education in the community for people to be better informed may help support earlier recognition of cardiovascular disease in people in this population.

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Appendix

Appendix A: CASP Checklist for Cohort Studies

Section A: Are the results valid?	
1. Did the study address a clearly focused issue?	☐ Yes ☐ No ☐ Can't Tell
CONSIDER: *A question can be 'focused' in terms of* • *the population studied* • *the risk factors studied* • *is it clear whether the study tried to detect a beneficial or harmful effect* • *the outcomes considered*	
2. Was the cohort recruited in an acceptable way?	☐ Yes ☐ No ☐ Can't Tell
CONSIDER: • *Look for selection bias which might compromise the generalisability of the findings:* • *was the cohort representative of a defined population* • *was there something special about the cohort* • *was everybody included who should have been*	
3. Was the exposure accurately measured to minimise bias?	☐ Yes ☐ No ☐ Can't Tell
CONSIDER: *Look for measurement or classification bias:* • *did they use subjective or objective measurements* • *do the measurements truly reflect what you want them to (have they been validated)* • *were all the subjects classified into exposure groups using the same procedure*	
4. Was the outcome accurately measured to minimise bias?	☐ Yes ☐ No ☐ Can't Tell
CONSIDER: *Look for measurement or classification bias:* • *did they use subjective or objective measurements* • *do the measurements truly reflect what you want them to (have they been validated)* • *has a reliable system been established for detecting all the cases (for measuring disease occurrence)* • *were the measurement methods similar in the different groups* • *were the subjects and/or the outcome assessor blinded to exposure (does this matter)*	
5. (a) Have the authors identified all important confounding factors?	☐ Yes ☐ No ☐ Can't Tell

CONSIDER: • *list the ones you think might be important, and ones the author missed*	
b) Have they taken account of the confounding factors in the design and/or analysis?	☐ Yes ☐ No ☐ Can't Tell
CONSIDER: • *look for restriction in design, and techniques e.g. modelling, stratified-, regression-, or sensitivity analysis to correct, control or adjust for confounding factors*	
6. a) Was the follow up of subjects complete enough?	☐ Yes ☐ No ☐ Can't Tell
CONSIDER: • *the persons that are lost to follow-up may have different outcomes than those available for assessment* • *in an open or dynamic cohort, was there anything special about the outcome of the people leaving, or the exposure of the people entering the cohort*	
b) Was the follow up of subjects long enough?	☐ Yes ☐ No ☐ Can't Tell
CONSIDER: • *the good or bad effects should have had long enough to reveal themselves*	
Section B: What are the results?	
7. What are the results of this study?	☐ Yes ☐ No ☐ Can't Tell
CONSIDER: • *what are the bottom line results* • *have they reported the rate or the proportion between the exposed/unexposed, the ratio/rate difference* • *how strong is the association between exposure and outcome (RR)* • *what is the absolute risk reduction (ARR)*	
8. How precise are the results?	☐ Yes ☐ No ☐ Can't Tell
CONSIDER:	

• *look for the range of the confidence intervals, if given*	
9. Do you believe the results?	☐ Yes ☐ No ☐ Can't Tell
CONSIDER: • *big effect is hard to ignore* • *can it be due to bias, chance or confounding* • *are the design and methods of this study sufficiently flawed to make the results unreliable* • *Bradford Hills criteria (e.g. time sequence, dose-response gradient, biological plausibility, consistency)*	
Section C: Will the results help locally?	
10. Can the results be applied to the local population?	☐ Yes ☐ No ☐ Can't Tell
CONSIDER: • *Is a cohort study the appropriate method to answer this question* • *If the subjects covered in this study could be sufficiently different from your population to cause concern* • *If your local setting is likely to differ much from that of the study* • *If you can quantify the local benefits and harms*	
11. Do the results of this study fit with other available evidence?	☐ Yes ☐ No ☐ Can't Tell
12. What are the implications of this study for practice?	☐ Yes ☐ No ☐ Can't Tell
CONSIDER: • *one observational study rarely provides sufficiently robust evidence to recommend changes to clinical practice or within health policy decision making* • *for certain questions, observational studies provide the only evidence* • *recommendations from observational studies are always stronger when supported by other evidence*	

APPRAISAL SUMMARY: *List key points from your critical appraisal that need to be considered when assessing the validity of the results and their usefulness in decision-making.*		
Positive/Methodologically sound	**Negative/Relatively poor methodology**	**Unknowns**

Appendix B: CASP Checklist for Cross-Sectional Studies

Section A: Are the results valid?	
1. Did the study address a clearly focused issue?	☐ Yes ☐ No ☐ Can't Tell
CONSIDER: *A question can be 'focused' in terms of* • *the population studied* • *the risk factors studied* • *is it clear whether the study tried to detect a beneficial or harmful effect* • *the outcomes considered*	
2. Did the authors use an appropriate method to answer their question?	☐ Yes ☐ No ☐ Can't Tell
CONSIDER: • *Is a descriptive/cross-sectional study an appropriate way of answering the question* • *did it address the study question*	
3. Were the subjects recruited in an acceptable way?	☐ Yes ☐ No ☐ Can't Tell
CONSIDER: *We are looking for selection bias which might compromise the generalisability of the findings:* • *Was the sample representative of a defined population* • *Was everybody included who should have been included*	
4. Were the measures accurately measured to reduce bias?	☐ Yes ☐ No ☐ Can't Tell
CONSIDER: *Look for measurement or classification bias:* • *did they use subjective or objective measurements* • *do the measurements truly reflect what you want them to (have they been validated)*	
5. Were the data collected in a way that addressed the research issue?	☐ Yes ☐ No ☐ Can't Tell

CONSIDER: • *if the setting for data collection was justified* • *if it is clear how data were collected (e.g., interview, questionnaire, chart review)* • *if the researcher has justified the methods chosen* • *if the researcher has made the methods explicit (e.g. for interview method, is there an indication of how interviews were conducted?)*	
6. Did the study have enough participants to minimise the play of chance?	☐ Yes ☐ No ☐ Can't Tell
CONSIDER: • *if the result is precise enough to make a decision* • *if there is a power calculation. This will estimate how many subjects are needed to produce a reliable estimate of the measure(s) of interest.*	
7. How are the results presented and what is the main result?	☐ Yes ☐ No ☐ Can't Tell
CONSIDER: • *if, for example, the results are presented as a proportion of people experiencing an outcome, such as risks, or as a measurement, such as mean or median differences, or as survival curves and hazards* • *how large this size of result is and how meaningful it is* • *how you would sum up the bottom-line result of the trial in one sentence*	
8. Was the data analysis sufficiently rigorous?	☐ Yes ☐ No ☐ Can't Tell
CONSIDER: • *if there is an in-depth description of the analysis process* • *if sufficient data are presented to support the findings*	
9. Is there a clear statement of findings?	☐ Yes ☐ No ☐ Can't Tell
CONSIDER: • *if the findings are explicit* • *if there is adequate discussion of the evidence both for and against the researchers' arguments* • *if the researchers have discussed the credibility of their findings* • *if the findings are discussed in relation to the original research questions*	
10. Can the results be applied to the local population?	☐ Yes ☐ No ☐ Can't Tell

CONSIDER: • *the subjects covered in the study could be sufficiently different from your population to cause concern.* • *your local setting is likely to differ much from that of the study*	
11. How valuable is the research?	☐ Yes ☐ No ☐ Can't Tell
CONSIDER: • *one descriptive/cross-sectional study rarely provides sufficiently robust evidence to recommend changes to clinical practice or within health policy decision making* • *if the researcher discusses the contribution the study makes to existing knowledge (e.g., do they consider the findings in relation to current practice or policy, or relevant research-based literature?)* • *if the researchers have discussed whether or how the findings can be transferred to other populations*	

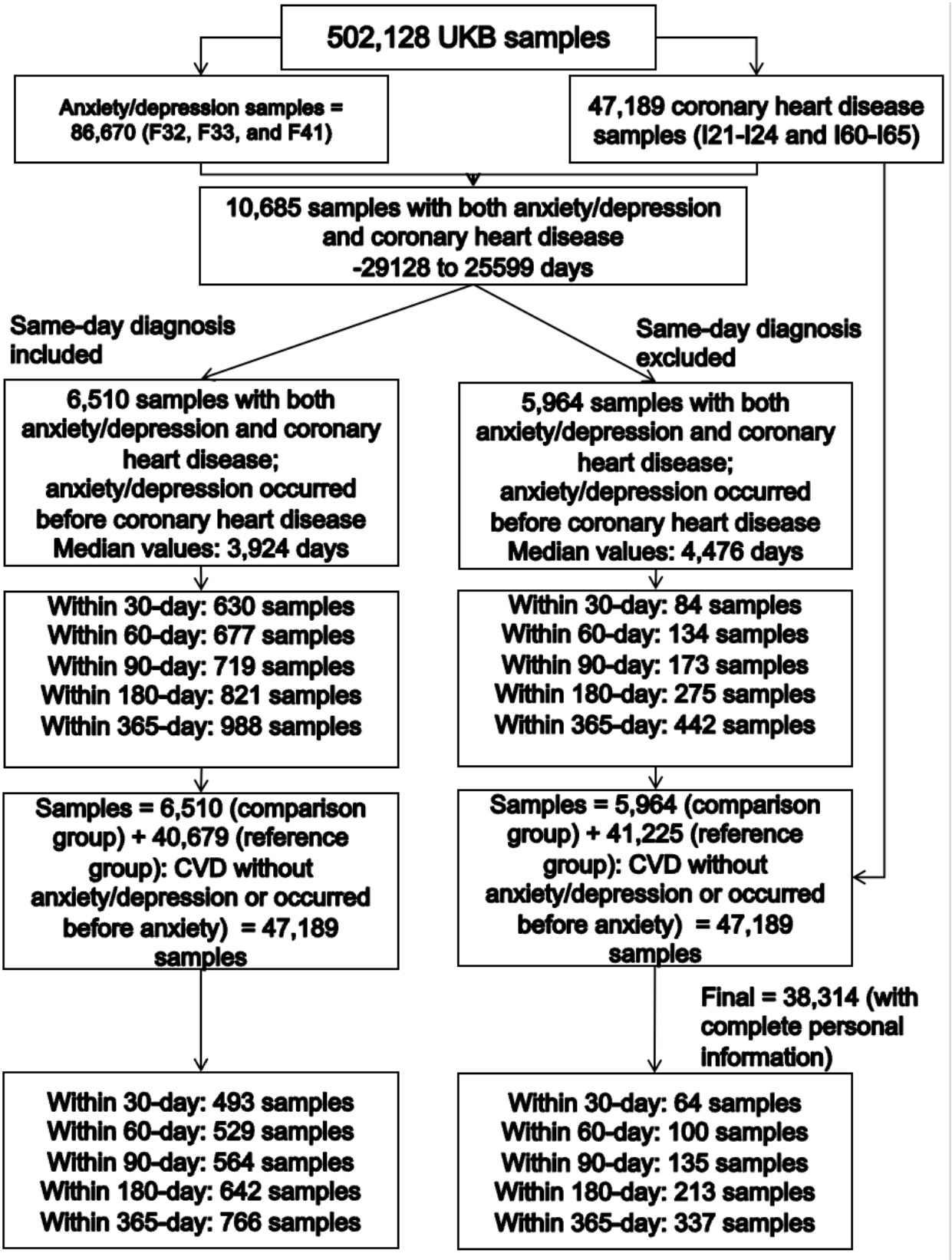
APPRAISAL SUMMARY: *List key points from your critical appraisal that need to be considered when assessing the validity of the results and their usefulness in decision-making.*		
Positive/Methodologically sound	**Negative/Relatively poor methodology**	**Unknowns**

Appendix C: Summary of Key Findings from the Literature Review

Study	Key Findings	Statistical Tests Used
Andrews et al. (2021)	Higher perceived neighbourhood disorder associated with higher depression scores (β = 3.6, p < .01); linked to higher IL-18 (inflammation marker).	Multivariable linear regression
Bafna et al. (2025)	No significant association between depression/anxiety and coronary artery plaque (OR = 1, p > .05).	Logistic regression
Bobo et al. (2020)	Depression associated with increased risk of HF (HR 1.3, p < .05); HF also predicted later depression (bidirectional).	Cox regression
Brann et al. (2024)	Perinatal depression was associated with higher risk of maternal cardiovascular disease (adjusted HR = 1.34; 95% CI= 1.18–1.53).	Cox regression
Haigh et al. (2020)	Depressive symptoms predicted incident CVD (HR = 1.60, 95% CI= 1.10–2.30).	Cox proportional hazards
Han et al. (2021)	Depression associated with increased mortality and CV comorbidities; specific disease trajectories identified.	Latent class analysis, survival models
Hsu et al. (2021)	Bipolar disorder increased IHD risk (HR = 1.37, 95% CI= 1.25–1.50, p < .001).	Cox regression
Johar et al. (2024)	Changes in 10-year predicted CVD risk across subgroups; risk increased in men, decreased in women (p < .05).	Paired t-tests, regression
Kim et al. (2024)	Depression and antidepressant use independently increased atherosclerotic CVD risk (HR = 1.18 and HR = 1.15 respectively).	Multivariable Cox models
Kwobah et al. (2023)	Psychotic patients had higher Framingham scores than controls	Descriptive comparisons
Lee et al. (2025)	Mental disorder associated with higher risk of chronic conditions (adjusted HRs range: 1.4–2.0 for different outcomes).	Cox regression with competing risks
Liu et al. (2025)	Specific depressive symptoms (especially somatic) predicted higher cardiovascular risk in a sex-specific manner.	Stratified Cox Regression
Lu et al. (2024)	Persistent depressive symptoms over 8 years (particularly somatic) significantly increased risk of cardiac events (HRs 1.4–1.6).	Trajectory modelling and Cox regression
Nmezi et al. (2022)	Depression scores were negatively associated with cardiovascular health score (β = -0.23, p < .01), with acculturation acting as a modifier.	Multiple Regression

Study	Key Findings	Statistical Tests Used
Oliveira et al. (2022)	High prevalence of cardiovascular risk factors in women, with poor knowledge and limited engagement in preventive care. No inferential statistics reported.	Descriptive Statistics
Patterson et al. (2022)	Depression and anxiety were associated with lower cardiovascular health scores ($\beta = -0.37$, $p < .001$).	Multivariate Regression
Shen et al. (2023)	Psychiatric disorders were associated with increased cardiovascular risk across three countries (adjusted HRs 1.2–1.5).	Cox regression (matched cohort design)
Vyas et al. (2023)	CVD events in young adults with depression increased significantly in a 10-year comparison of two U.S. national hospitalization cohorts ($p < .001$).	Chi-square, trend analysis
Wooldridge et al. (2023)	Exposure to more adverse childhood experiences (ACEs) was associated with a higher number of cardiovascular risk factors (p for trend < .001).	Latent class analysis and ANOVA
Wu et al. (2022)	Anxiety was associated with a higher risk of CVD in a Chinese cohort (HR = 1.13; 95% CI= 1.08–1.19).	Cox regression
Yu et al. (2022)	Depression significantly increased the risk of CVD; effects were more pronounced in younger adults and women (HR = 1.28, CI= 1.03-1.26, $p < .01$).	Cox regression with interaction terms

Appendix D: Breakdown of the UK Biobank Samples Based on Same-Day Diagnosis Versus Non-Same-Day Diagnosis



Appendix E: Patient Information Sheet

University of Essex

Participant Information Sheet

Title of Study:
The Role of Intersectionality and Interoception on the Diagnostic Delay of Coronary Heart Disease in Patients with a Pre-Existing Mental Health Condition

Researcher: Katie Baker (kb23658@essex.ac.uk)

Institution: University of Essex

Ethics Approval Code: 343468

Invitation
My name is Katie Baker and I am a Trainee Clinical Psychologist at the University of Essex. I would like to invite you to take part in a study. This study is examining the diagnostic experiences and challenges associated with coronary heart disease (CHD) in patients who also have mental health conditions. For this research, 'mental health' refers to anyone with a diagnosis of anxiety or depression. This is with the intention that people known to services for mental health difficulties will have a better understanding of the support and resources available to them.

This study seeks to understand how certain demographic and experiential factors, including interoceptive awareness, may affect the timeliness and accuracy of CHD diagnosis. This information sheet outlines the purpose of the study, what your participation involves, and how your insights will contribute to understanding and improving diagnostic practices.

Purpose of the Study
The study aims to understand if and how certain demographic and personal factors, such as age, gender, and ethnicity, may contribute to delays in diagnosing CHD among people with mental health conditions. Additionally, it investigates how awareness of bodily signals, or "interoception," might affect diagnostic accuracy. Findings from this study could help improve diagnostic protocols in healthcare settings.

What is the meaning of "interoception"?
Interoception refers to our ability to identify and interpret our bodily signals.

Why Have I Been Invited to Participate?
You have been invited to participate because you have an experience of living with both a mental health condition and CHD or are at risk of CHD. This research includes both patients and healthcare professionals to gain a broad understanding of diagnostic practices and experiences.

Do I Have to Take Part?
Participation is entirely voluntary. You may choose not to take part, or if you decide to participate, you are free to withdraw at any time without providing a reason. Withdrawing from the study will not impact your care or relationship with your healthcare providers. You can withdraw from the study at any time by contacting the chief investigator or a member of the research team using the contact details at the bottom of this sheet.

What Will Happen if I Take Part?

University of Essex

1. **Interview**: You will be asked to participate in a 30-minute interview about your experience with CHD symptoms, your thoughts on the diagnostic process, and any experiences of delay or challenges with diagnosis.
2. **Questionnaires**: After the interview, you will complete a set of questionnaires measuring both physical and mental wellbeing.
3. **Heartbeat Task**: You will also be asked to participate in a heartbeat task, which will also involve us taking your pulse using a pulse oximeter (a non-invasive method, which just goes on your fingertip).

For accuracy of data collection, interviews will be audio recorded. All data will be transcribed by the Chief Investigator (internal researcher) and data will be stored on an encrypted computer system, not personal devices. Audio recordings will be deleted once the transcription process has been completed.

Where and When Will the Study Take Place?
The interview will be completed at the cardiology clinic you attend, or at the University of Essex, Colchester campus. We aim to complete the study as soon as possible, at a time that is convenient to you. If you contact us using the details below to register your interest in participating in the study, you can arrange a time to complete the interview with the Chief Investigator (Katie Baker).

Duration
The interview and questionnaires should take approximately 50 minutes in total. The heartbeat tracking task will take an additional 10 minutes. We aim to meet participants face-to-face to complete the interviews.

Are There Any Risks in Taking Part?
Talking about health issues, mental health, and experiences of diagnostic delays may cause some emotional discomfort. We aim to create a safe environment, and you are free to pause or withdraw at any point. Support contacts will be provided should you wish to speak to someone after participating.

Are There Any Benefits in Taking Part?
While there may be no direct benefits for you, your participation may help identify potential improvements in diagnostic processes for people with CHD and mental health conditions. This could benefit future patients by leading to more accurate and timely diagnoses.

How Will We Use Information About you?
We will need to use information from you for this research project. This information will include your:

- Initials
- Contact Details
- Age
- Sex
- Ethnicity
- Employment History

People who do not need to know who you are will not be able to see your name or contact details. Your data will have a code number instead.

University of Essex

The University of Essex is the sponsor of this research, and is responsible for looking after your information. We will keep all information about you safe and secure by:

- Encrypted and password protected stored on the University of Essex Network.
- Paper copies of information will be stored in a secure box and destroyed in 3 years.

International transfers
Your data will not be shared outside the UK.

Once we have finished the study, we will keep some of the data so we can check the results. We will write our reports in a way that no-one can work out that you took part in the study.

We will keep your study data for a maximum of 3 years. The study data will then be fully anonymized and securely archived or destroyed.

What are your choices about how your information is used?
You can stop being part of the study at any time, without giving a reason, but we will keep information about you that we already have. You have the right to ask us to remove, change or delete data we hold about you for the purposes of the study. We might not always be able to do this if it means we cannot use your data to do the research. If so, we will tell you why we cannot do this. If you agree to take part in this study, you will have the option to take part in future research using your data saved from this study. Your data will be made publicly available in anonymised form through the data repository, UK data Archive Service.

What Will Happen to the Results of the Study?
Your data will be analysed as part of the study. It may then be published in my thesis. Data used in publications will be in fully anonymised form, this may include anonymised quotes. The findings will be disseminated to healthcare providers, policymakers, and potentially published in medical journals to improve diagnostic practices for CHD in patients with pre-existing mental health conditions. You may request a summary of the findings upon study completion.

Where Can You Find Out More About How Your Information is Used?
You can find out more about how we use your information.

- Our leaflet
- By asking one of the research team
- By sending an email to kb23658@essex.ac.uk
- By ringing us on 07498055217.

Concerns and Complaints
If you have any concerns about any aspect of the study or you have a complaint, in the first instance please contact the Chief Investigator of this study, Katie Baker, using the contact details below. If you are still concerned m if you think your complaint has not been addressed to your satisfaction or you feel that you cannot approach the principle investigator, please contact the departmental Director of Research in the department responsible for this project, Mariachiara DiCesare (m.dicesare@essex.ac.uk). If you are still not satisfied, please contact

University of Essex

the University of Essex REO Research Integrity Manager (reo-integrity@essex.ac.uk). Please include the ERAMS reference which can be found at the footer of this pafe so that the study can be identified, details of the name or description of the study, the researcher(s) involved, and the details of the complaint you wish to make.

What is the Legal Basis for Using Personal Data and Who is the Data Controller?
The University processes personal data for the primary purpose of research under the lawful basis of processing set out in Article 6 (1)(e) of the UK GDPR, 'processing is necessary for the performance of a task carried out in the public interest or in the exercise of official authority vested in the controller'. The University's lawful basis for processing Special Category data is Article 9 (2), (j) 'processing is necessary for archiving purposes in the public interest, scientific or historical research purposes or statistical purposes in accordance with Article 89(1)'. Using this lawful basis requires the University to also meet a substantial public interest condition as set out in Schedule 1, Part 1 of the Data Protection Act 2018. The condition that the University will use is 4. Research, etc. Under UK data protection legislation, the University acts as the Data Controller for personal data collected as part of the University's research. For more information on data protection legislation and your rights visit the University's Data protection and research activity webpage. For any queries, email dpo@essex.ac.uk.

Looking after yourself
Whilst the intention of this study is not to bring any psychological harm to participants. We understand that talking about your experiences might bring up negative emotions. Should you feel like you require further support with your mental wellbeing following completing the study, please let us know and we can support you in accessing the correct support i.e. through your GP surgery. However, should you feel like you are in crisis and require immediate support you can call NHS 111 option 2, to speak with a mental health trained professional or, you can call The Samarian's by calling 116 123. These services are available 24/7.

Who Has Reviewed the Study?
This study has ethical approval from the Ethical Review Board of the NHS (IRAS Project ID: **343468)** and has been granted a favourable ethical opinion by the University of Essex Ethics Committee.

Contact Details:
Chief Investigator: Katie Baker (kb23658@essex.ac.uk)
Research Supervisor: Mariachiara Di Cesare (m.dicesare@essex.ac.uk)

Thank you for considering participating in this study. Your experience and insights are invaluable to us and may contribute to improving the quality of healthcare for individuals with similar health challenges.

As a thank you for taking the time to speak with us, each participant will receive a £20 voucher.

Appendix F: Patient Recruitment Poster

University of Essex

YOUR VOICE MATTERS

We are looking at peoples diagnostic experiences of cardiovascular diseases following a diagnosis of a mental health condition.

WHAT IS INVOLVED?

1. GET IN CONTACT
If you have been diagnosed with a mental health condition and have since been diagnosed with a cardiovascular disease, and are interested in participating, get in touch! We can then arrange a suitable time to complete an interview.

2. INTERVIEW
The interview will last approximately 60 minutes and will involve having a chat about your experiences as well as completing a couple of additional tasks.

3. DEBRIEF
Following the interview, you will have the opportunity to as any outstanding questions that you might have. I will also provide details of how to get in contact should you have any questions at a later time.

4. TOKEN OF THANKS
As a little token of our appreciation for giving up your time to participate in this study, we will be offering a £20 gift card to reimburse you for your time.

HOW TO GET IN TOUCH

- You can get in contact using the details below, or by informing a member of staff at the Cardiology Clinic.
- If you have any questions before signing up for the study, please do not hesitate to get in touch.

Appendix G: Clinician Information Sheet

University of Essex

Clinician Information Sheet

Title of Study:
The Role of Intersectionality and Interoception on the Diagnostic Delay of Coronary Heart Disease in Patients with a Pre-Existing Mental Health Condition

Researcher: Katie Baker (kb23658@essex.ac.uk)

Institution: University of Essex

Ethics Approval Code: 343468

Invitation
My name is Katie Baker and I am a Trainee Clinical Psychologist at the University of Essex. I would like to invite you to take part in a study. This study is examining the diagnostic experiences and challenges associated with coronary heart disease (CHD) in patients who also have mental health conditions. For this research, 'mental health condition' refers to anyone with a diagnosis of anxiety or depression, or has been treated for a mental health condition.

This study seeks to understand how certain demographic and experiential factors, including interoceptive awareness, may affect the timeliness and accuracy of CHD diagnosis. This information sheet outlines the purpose of the study, what your participation involves, and how your insights will contribute to understanding and improving diagnostic practices.

Purpose of the Study
This study aims to explore the role of intersectional factors—such as age, gender, ethnicity—and interoceptive awareness in the delayed diagnosis of CHD among patients with mental health conditions. As a clinician, your insights into diagnostic challenges, protocols, and biases are crucial in identifying areas for improvement in patient care.

What is the meaning of "interoception"?

Interoception refers to our ability to identify and interpret our bodily signals.

Why Have I Been Invited to Participate?
You have been invited to participate because of your experience in diagnosing and treating CHD and/or mental health conditions in patients. Your professional insights will help us understand the clinical factors affecting CHD diagnosis and management in diverse patient populations.

Do I Have to Take Part?
Participation is entirely voluntary. You may choose not to take part or, if you decide to participate, you are free to withdraw at any time without providing a reason. Your decision to participate or withdraw will not impact your professional role or relationships. You can withdraw from the study at any time by contacting the chief investigator or a member of the research team using the contact details at the bottom of this sheet.

What Will Happen if I Take Part?

University of Essex

You will be asked to participate in a 30-minute interview to discuss your experiences and perspectives on diagnosing CHD in patients with mental health conditions. This can be completed online or face-to-face depending on your preference.

Topics may include:

- Challenges or biases in CHD diagnosis
- Specific intersectional factors (e.g., age, gender, ethnicity) that you feel may impact the diagnostic process
- Personal observations on the effectiveness of current diagnostic protocols and recommendations for improvements

For accuracy of data collection, interviews will be audio recorded. All data will be transcribed by the Chief Investigator (internal researcher) and data will be stored on an encrypted computer system, not personal devices. Audio recordings will be deleted once the transcription process has been completed.

Where and When Will the Study Take Place?

The interview will be completed at the cardiology clinic you work at, or at the University of Essex, Colchester campus. Should neither of these locations be convenient for you, we could consider completing this interview remotely via Microsoft Teams. We aim to complete the study as soon as possible, at a time that is convenient to you. If you contact us using the details below to register your interest in participating in the study, you can arrange a time to complete the interview with the Chief Investigator (Katie Baker).

Are There Any Risks in Taking Part?

There are no anticipated risks in participating in this study. All data will be anonymised to protect your identity, ensuring that specific responses cannot be traced back to you or your workplace. You are welcome to skip any questions that make you uncomfortable.

Are There Any Benefits in Taking Part?

Your participation will contribute valuable insights that may help improve diagnostic protocols and reduce diagnostic delays for CHD in patients with mental health conditions. While there may be no direct benefits for you, your input could shape future practices in cardiology and mental health services.

How Will We Use Information About you?

We will need to use information from you for this research project. This information will include your:

- Initials
- Contact Details
- Age
- Sex
- Ethnicity
- Employment History

People who do not need to know who you are will not be able to see your name or contact details. Your data will have a code number instead.

The University of Essex is the sponsor of this research, and is responsible for looking after your information. We will keep all information about you safe and secure by:

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- Encrypted and password protected stored on the University of Essex Network.
- Paper copies of information will be stored in a secure box and destroyed in 3 years.

International transfers
Your data will not be shared outside the UK.

Once we have finished the study, we will keep some of the data so we can check the results. We will write our reports in a way that no-one can work out that you took part in the study.

We will keep your study data for a maximum of 3 years. The study data will then be fully anonymized and securely archived or destroyed.

What are your choices about how your information is used?
You can stop being part of the study at any time, without giving a reason, but we will keep information about you that we already have. You have the right to ask us to remove, change or delete data we hold about you for the purposes of the study. We might not always be able to do this if it means we cannot use your data to do the research. If so, we will tell you why we cannot do this. If you agree to take part in this study, you will have the option to take part in future research using your data saved from this study. Your data will be made publicly available in anonymised form through the data repository, UK data Archive Service.

What Will Happen to the Results of the Study?
Your data will be analysed as part of the study. It may then be published in my thesis. Data used in publications will be in fully anonymised form, this may include anonymised quotes. The findings will be disseminated to healthcare providers, policymakers, and potentially published in medical journals to improve diagnostic practices for CHD in patients with pre-existing mental health conditions. You may request a summary of the findings upon study completion. With your consent, your data will be made publicly available anonymised form by sharing with in a data repository (UK data Archive Service) for the purpose of further research.

Where Can You Find Out More About How Your Information is Used?
You can find out more about how we use your information.

- Our leaflet
- By asking one of the research team
- By sending an email to kb23658@essex.ac.uk
- by ringing us on 07498055217.

If you have any questions or would like further information about the study, or how your information will be used please contact the Chief Investigator, Katie Baker by emailing kb23658@essex.ac.uk.

Concerns and Complaints

University of Essex

If you have any concerns about any aspect of the study or you have a complaint, in the first instance please contact the Chief Investigator of this study, Katie Baker, using the contact details below. If you are still concerned m if you think your complaint has not been addressed to your satisfaction or you feel that you cannot approach the principle investigator, please contact the departmental Director of Research in the department responsible for this project, Mariachiara Di Cesare (m.dicesare@essex.ac.uk). If you are still not satisfied, please contact the University of Essex REO Research Integrity Manager (reo-integrity@essex.ac.uk). Please include the ERAMS reference which can be found at the footer of this page so that the study can be identified, details of the name or description of the study, the researcher(s) involved, and the details of the complaint you wish to make.

What is the Legal Basis for Using Personal Data and Who is the Data Controller?
The University processes personal data for the primary purpose of research under the lawful basis of processing set out in Article 6 (1)(e) of the UK GDPR, 'processing is necessary for the performance of a task carried out in the public interest or in the exercise of official authority vested in the controller'. The University's lawful basis for processing Special Category data is Article 9 (2), (j) 'processing is necessary for archiving purposes in the public interest, scientific or historical research purposes or statistical purposes in accordance with Article 89(1)'. Using this lawful basis requires the University to also meet a substantial public interest condition as set out in Schedule 1, Part 1 of the Data Protection Act 2018. The condition that the University will use is 4. Research, etc. Under UK data protection legislation, the University acts as the Data Controller for personal data collected as part of the University's research. For more information on data protection legislation and your rights visit the University's Data protection and research activity webpage. For any queries, email dpo@essex.ac.uk.

Looking after yourself
Whilst the intention of this study is not to bring any psychological harm to participants. We understand that talking about your experiences might bring up negative emotions. Should you feel like you require further support with your mental wellbeing following completing the study, please let us know and we can support you in accessing the correct support i.e. through your GP surgery. However, should you feel like you are in crisis and require immediate support you can call NHS 111 option 2, to speak with a mental health trained professional or, you can call The Samarian's by calling 116 123.

Who Has Reviewed the Study?
This study has ethical approval from the Ethical Review Board of the NHS (IRAS Project ID: **343468)** and has been granted a favourable ethical opinion by the University of Essex Ethics Committee.

Contact Details:
Chief Investigator: Katie Baker (kb23658@essex.ac.uk)
Research Supervisor: Mariachiara Di Cesare (m.dicesare@essex.ac.uk)

As a thank you for taking the time to speak with us, each participant will be entered into a prize draw to win a £30 voucher.

Appendix H: Clinician Consent Form

University of Essex

Consent Form – Clinicians

Title of the Project: Exploring Patient's Experiences of being Diagnosed with a Cardiovascular Disease, Following a Mental Health Diagnosis.

Research Team: Katie Baker, Dr Mariachiara Di Cesare and Ruoyu Wang

Please initial box

1. I confirm that I have read and understand the Information Sheet dated 26/10/2024 for the above study. I have had an opportunity to consider the information, ask questions and have had these questions answered satisfactorily. ☐

2. I understand that my participation is voluntary and that I am free to withdraw from the project at any time without giving any reason and without penalty. I understand that I can request to withdraw any data collected up to the point of my withdrawal. ☐

3. I understand that the study will involve an interview. All tasks can be completed sitting down. ☐

4. I agree to my interview being audio recorded. ☐

5. I agree to the use of anonymised quotes in the research reports and publications. ☐

6. I understand that the identifiable data provided will be securely stored and accessible only to the members of the research team directly involved in the project, and that confidentiality will be maintained. ☐

7. I understand that my fully anonymised data will be used for data analysis which could be published in relevant research articles and feedback to cardiology teams. Open Access of anonymous data will be stored on the UK Data Archive Service. ☐

University of Essex

8. I understand that the data collected about me will be used to support other research in the future and may be shared anonymously with other researchers.

9. I agree to take part in the above study.

Participant Name	Date	Participant Signature
_____	_____	_____

Researcher Name	Date	Researcher Signature
_____	_____	_____

Appendix I: Patient Consent Form

Consent Form – Patients

Title of the Project: Exploring Patient's Experiences of Being Diagnosed with a Cardiovascular Disease, Following a Mental Health Diagnosis.

Research Team: Katie Baker, Dr Mariachiara Di Cesare and Ruoyu Wang

Please initial box

1. I confirm that I have read and understand the Information Sheet dated 26/10/2024 for the above study. I have had an opportunity to consider the information, ask questions and have had these questions answered satisfactorily.

2. I understand that my participation is voluntary and that I am free to withdraw from the project at any time without giving any reason and without penalty. I understand that any data collected up to the point of my withdrawal will be destroyed.

3. I understand that the study will involve an interview,

4. I agree to my interview being audio recorded.

5. I agree to the use of anonymised quotes in the research reports and publications.

6. I understand that the identifiable data provided will be securely stored and accessible only to the members of the research team directly involved in the project, and that confidentiality will be maintained.

7. I understand that my fully anonymised data will be used for data analysis which could be published in relevant research articles and feedback to cardiology teams. Open Access of anonymous data will be stored on the UK Data Archive Service.

University of Essex

8. I understand that the data collected about me will be used to support other research in the future and may be shared anonymously with other researchers.

9. I agree to take part in the above study.

Participant Name	Date	Participant Signature
_____	_____	_____

Researcher Name	Date	Researcher Signature
_____	_____	_____

Appendix J: Patient Interview Schedule

University of Essex

Clinical Interview for Patients:

Confidentiality: Your responses will be kept confidential, and your identity will not be revealed in any report. You may stop the interview at any time or skip any questions is you prefer.

1) Could you briefly describe your background? (age, gender, general living situation eg occupation, family status etc)

2) Could you describe your mental health condition? (When were you diagnosed? What was the diagnosis? What were the symptoms? What kind of treatment or support did you receive?

3) When were you diagnosed with a cardiovascular disease? (what type of cardiovascular condition do you have?

University of Essex

4) Could you share your experience of being diagnosed with a mental health condition?

5) Do you feel that having a mental health diagnosis changed the way doctors treated you for other medical issues afterwards? If yes, how?

6) Can you walk me through the time when you first noticed symptoms of cardiovascular disease? (What symptoms did you experience, and how did you seek medical help?)

University of Essex

7) What was the diagnostic process like for your cardiovascular disease? (What tests or consultations did you undergo? How long did it take to receive a diagnosis? Did you get a check of heart health on your first visit?)

8) Did you feel like your mental health history influenced how healthcare providers handled your cardiovascular diagnosis? (did they seem to focus more or less on your mental health instead of your physical symptoms?)

9) In your opinion, did your mental health diagnosis affect how seriously your cardiovascular symptoms were taken? (do you think your concerns were dismissed because of your mental health condition?)

University of Essex

10) Do you think the doctors attributed your cardiovascular symptoms to stress or anxiety instead of considering a heart-related condition at first? (how did it make your feel? What impact did it have on your care)

11) Did you notice any difference in how you were treated based on other aspects of your identity, such as your gender, age, race/ethnicity, or socioeconomic status? (what do you think the impact of this was?)

12) Do you think the healthcare system provides enough support for people with both mental health and cardiovascular issues? What could be improved?

University of Essex

13) Looking back, is there anything you would have wanted doctors to do differently when diagnosing your cardiovascular disease, especially given your mental health history?

14) Do you have any advice for healthcare providers when diagnosing patients who have both mental health conditions and physical health concerns like cardiovascular disease?

15) Is there anything else that we haven't spoken about that you think is important to add?

Appendix K: Clinician Interview Schedule

University of Essex

Clinical Interview for Clinicians:

Confidentiality: All information will remain confidential, and no personal identifiers will be used in the final report. You can stop the interview at any time or decline to answer any question.

1) Could you tell me about your current role and how long you have been practising?

2) Have you had previous experience of working with patients with mental health conditions?

3) Have you noticed any trends in the characteristics (i.e. sex, ethnicity, age etc) of people seen in clinic who are diagnosed with a cardiovascular disease? Has this changed over time?

University of Essex

4) When diagnosing a new patient with possible cardiovascular disease, what is your typical approach? What factors do you consider most important?

5) In your experience, what are some of the key challenges in diagnosing a cardiovascular disease in patients with a mental health conditions?

6) In your experience, do you believe that gender affects the diagnosis of cardiovascular disease? For instance, are men and women equally likely to be diagnosed with conditions such as heart disease, when presenting with similar symptoms?

University of Essex

a. Race and ethnicity.

b. Level of education

c. Type of occupation

7) To what extend do you think personal biases influence the diagnostic process?

University of Essex

8) Do you think institutional factors i.e. hospital policies/ systems contribute to diagnostic biases within the cardiology service? Is this more or less prominent when a patient has a mental health diagnosis? How so?

9) Are there any strategies you would recommend in order to mitigate biases in diagnosis, either at individual or institutional level?

10) Is there anything else that we haven't spoken about that you think is important to add?

Appendix L: Letter Confirming NHS Ethical Approval

Ymchwil Iechyd a Gofal Cymru
Health and Care Research Wales

NHS
Health Research Authority

Mrs Katie Baker
Holly House, Little Laver Road,
Matching Green
Harlow
CM17 0QB

Email: approvals@hra.nhs.uk
HCRW.approvals@wales.nhs.uk

21 January 2025

Dear Mrs Baker

Initial Assessment Letter

Study title:	**The Role of Intersectionality on the Diagnostic Delay of Coronary Heart Disease in Patients with a Pre-Existing Mental Health Condition.**
IRAS project ID:	**343468**
Protocol number:	**N/A**
REC reference:	**25/YH/0023**
Sponsor	**University of Essex**

Thank you for your application for HRA and Health and Care Research Wales (HCRW) Approval. I am writing to confirm that you are now able to share the Local Information Pack with participating NHS organisations in England and Wales in order to invite them to arrange of capacity and capability to deliver your study. Please note that **the research should not begin** at any participating NHS organisations in England or Wales until HRA and HCRW Approval is issued.

To share the Local Information Pack with participating NHS organisations in England and Wales please use the template email available on the IRAS website.

Once the Local Information Pack has been shared, please work with participating NHS organisations to arrange capacity and capability, in line with the instructions provided in the "Information to support study set up" section towards the end of this letter.

What happens next with my application for HRA and HCRW Approval?

Your application is progressing. Please find below an indication of where you are in the process (indicated by the red box).

Combinations	Variables	30day			90day			180day			365day		
		OR	**CI**	***p***	**OR**	**CI**	***p***	**OR**	**CI**	***p***	**OR**	**CI**	***p***
Anxiety + all CVDs	Age	0.96	0.94- 0.97	<.001*	0.96	0.94 - 0.97	< .001	0.96	0.94 - 0.97	< .001 *	0.96	0.95 - 0.98	< .001 *
	Male (ref=female)	0.42	0.34 - 0.52	< .001*	0.41	0.34 - 0.5	< .001 *	0.43	0.34 - 0.50	< .001 *	0.43	0.36 - 0.52	< .001 *
	Annual income >=31,000 (ref=Annual income < 31,000)	0.92	0.71 - 1.20	.552	0.90	0.70 - 1.15	.038	0.80	0.68 - 1.09	.022	0.80	0.64 – 1.00	.046 *
	White (ref= other ethnicities)	1.95	1.00 - 3.82	.051	2.27	1.16 - 4.44	.016*	2.11	1.17 - 4.19	.014 *	2.11	1.18 - 3.78	.011*
	Employed (ref=others)	1.10	0.85 - 1.44	.459	1.07	0.83 - 1.37	.0598	1.00	0.83 - 1.34	.067	1.00	0.80.- 1.25	.0992
	High level of education (ref=low level of education)	1.03	0.766 -1.39	.0847	1.06	0.79 - 1.42	.0683	1.07	0.85 - 1.49	.04132	1.07	0.82 - 1.38	.0618
	Intermediate level of education (ref=low level of education)	0.95	0.67 - 1.36	.0791	1.06	0.76- 1.48	.0721	1.00	0.76 - 1.46	.0749	0.97	0.72 - 1.30	.0824
	Other education (ref=low level of education)	0.72	0.50 - 1.04	.079	0.76	0.54- 1.08	.0130	0.71	0.55 - 1.08	.01314	0.71	0.52 - 0.97	.031 *
	TDI (Townsend Deprivation Index)	0.99	0.95 - 1.02	.438	1.00	0.97 - 1.04	.867	1.00	0.97 - 1.04	.838	1.00	0.97 - 1.03	.807
	Age	0.92	0.90 - 0.94	< .001*	0.92	0.90- 0.94	< .001 *	0.92	0.90 - 0.94	< .001 *	0.93	0.91 - 0.95	< .001 *
	Male (ref=female)	0.31	0.23 - 0.42	< .001*	0.30	0.23- 0.40	< .001 *	0.33	0.25 - 0.43	< .001 *	0.37	0.28 - 0.47	< .001 *

Combinations	Variables	30day			90day			180day			365day		
		OR	**CI**	***p***	**OR**	**CI**	***p***	**OR**	**CI**	***p***	**OR**	**CI**	***p***
Anxiety + Ischemic Heart Disease	Annual income >=31,000 (ref=Annual income < 31,000)	1.02	0.72 - 1.46	.894	0.93	0.66- 1.31	.694	0.92	0.66- 1.28	.620	0.88	0.65 - 1.19	.404
	White (ref= other ethnicities)	2.83	1.04 - 7.72	.042 *	3.32	1.22 - 9.03	.019 *	2.84	1.16 - 6.98	.023 *	2.31	1.07- 4.95	.032 *
	Employed (ref=others)	1.08	0.75- 1.55	.677	0.96	0.68- 1.35	.8003	0.96	0.69 - 1.34	.820	0.90	0.66 - 1.23	.509
	High level of education (ref=low level of education)	0.88	0.59- 1.33	.552	0.90	0.61- 1.32	.589	0.96	0.66 - 1.39	.814	0.95	0.67- 1.34	.760
	Intermediate level of education (ref=low level of education)	0.91	0.57 - 1.46	.699	0.93	0.60 - 1.45	.756	0.96	0.62- 1.47	.841	0.91	0.61 - 1.36	.662
	Other education (ref=low level of education)	0.81	0.50- 1.32	.392	0.78	0.49- 1.24	.290	0.78	0.50 - 1.22	.272	0.70	0.46- 1.06	.089
	TDI (Townsend Deprivation Index)	0.98	0.93 - 1.03	.395	0.99	0.95- 1.04	.811	1.00	0.95 - 1.04	.909	1.01	0.97 - 1.05	.806
Anxiety + Cerebrovascular Disease	Age	1.00	0.97 - 1.02	.736	0.99	0.97 - 1.02	.622	1.00	0.98- 1.02	.949	1.00	0.98- 1.02	.684
	Male (ref=female)	0.56	0.42 - 0.75	< .001 *	0.55	0.42 - 0.73	< .001 *	0.52	0.40 - 0.67	< .001 *	0.51	0.40 - 0.66	< .001 *
	Annual income >=31,000 (ref=Annual income < 31,000)	0.89	0.63 - 1.27	.526	0.90	0.65 - 1.26	.551	0.83	0.61 - 1.15	.265	0.74	0.55 - 0.99	.044 *
	White (ref= other ethnicities)	1.53	0.62 - 3.78	.357	1.85	0.75 - 4.55	.181	1.70	0.74 - 3.87	.209	2.04	0.90 - 4.64	.089
	Employed (ref=others)	1.18	0.82 - 1.70	.360	1.23	0.87 - 1.72	.237	1.25	0.90 - 1.72	.182	1.14	0.85 - 1.54	.375

Combinations	Variables	30day			90day			180day			365day		
		OR	**CI**	***p***	**OR**	**CI**	***p***	**OR**	**CI**	***p***	**OR**	**CI**	***p***
	High level of education (ref=low level of education)	1.07	0.70 - 1.63	.763	1.10	0.73- 1.66	.637	1.15	0.78 - 1.70	.473	1.03	0.73 - 1.46	.863
	Intermediate level of education (ref=low level of education)	0.89	0.54 - 1.47	.657	1.11	0.70 - 1.75	.667	1.06	0.68- 1.65	.804	0.91	0.61 - 1.35	.630
	Other education (ref=low level of education)	0.68	0.41- 1.13	.136	0.77	0.48 - 1.25	.290	0.76	0.48 - 1.20	.24	0.71	0.47 - 1.06	.091
	TDI (Townsend Deprivation Index)	0.98	0.93 - 1.03	.446	1.00	0.96 - 1.05	.981	1.00	0.96 - 1.04	.965	1.00	0.96 - 1.04	.893
Depression + All CVDs	Age	0.95	0.93 - 0.96	< .001 *	0.95	0.94 - 0.96	< .001 *	0.95	0.94 - 0.96	< .001 *	0.95	0.94 - 0.96	< .001 *
	Male (ref=female)	0.59	0.48- 0.72	< .001 *	0.58	0.48- 0.71	< .001 *	0.59	0.49 - 0.71	< .001 *	0.64	0.54 - 0.75	< .001 *
	Annual income >=31,000 (ref=Annual income < 31,000)	0.88	0.68 - 1.14	.332	0.88	1.15 - 1.13	.313	0.85	0.68 - 1.07	.171	0.83	0.67- 1.02	.081
	White (ref= other ethnicities)	2.33	1.19 - 4.56	.013 *	1.95	1.09 - 3.49	.025 *	1.47	0.91 - 2.37	.119	1.17	0.78 - 1.74	.445
	Employed (ref=others)	0.81	0.63 - 1.05	.115	0.75	0.59- 0.96	.023*	0.71	0.57 - 0.90	.004 *	0.65	0.53 - 0.80	< .001 *
	High level of education (ref=low level of education)	1.05	0.76 - 1.44	.7661	1.19	0.88 - 1.61	.254	1.13	0.86- 1.49	.383	1.03	0.80 - 1.33	.799
	Intermediate level of education (ref=low level of education)	1.22	0.86- 1.72	.2727	1.25	0.89- 1.75	.201	1.13	0.83 - 1.55	.443	1.06	0.80- 1.41	.676

Combinations	Variables	30day			90day			180day			365day		
		OR	**CI**	***p***	**OR**	**CI**	***p***	**OR**	**CI**	***p***	**OR**	**CI**	***p***
	Other education (ref=low level of education)	1.24	0.89 - 1.74	.208	1.34	0.97 - 1.86	.072	1.28	0.95 - 1.72	.103	1.24	0.95 - 1.62	.110
	TDI (Townsend Deprivation Index)	1.03	1.00 - 1.06	.074	1.03	1.00 - 1.06	.089	1.03	1.00 - 1.06	.042 *	1.03	1.01 - 1.06	.011 *
Depression + Ischemic Heart Disease	Age	0.91	0.89 - 0.93	< .001 *	0.92	0.90- 0.94	< .001 *	0.93	0.91 - 0.95	< .001 *	0.93	0.92 - 0.95	< .001 *
	Male (ref=female)	0.66	0.48- 0.92	.013 *	0.64	0.48 - 0.87	.004 *	0.64	0.49 - 0.85	.002 *	0.70	0.55 - 0.91	.007*
	Annual income >=31,000 (ref=Annual income < 31,000)	0.74	0.50- 1.10	.139	0.74	0.52- 1.07	.111	0.79	0.56 - 1.11	.169	0.78	0.57 - 1.07	.120
	White (ref= other ethnicities)	1.72	0.79 - 3.71	.170	1.22	0.65- 2.27	.538	1.17	0.66 - 2.08	.589	0.99	0.61 - 1.63	.976
	Employed (ref=others)	0.67	0.46 - 0.98	.038 *	0.65	0.46- 0.92	.015 *	0.61	0.44 - 0.84	.003 *	0.57	0.42- 0.78	.0003*
	High level of education (ref=low level of education)	0.92	0.59 - 1.42	.703	1.06	0.70 - 1.60	.781	1.06	0.72 - 1.56	.762	0.96	0.67 - 1.35	.798
	Intermediate level of education (ref=low level of education)	1.02	0.63 - 1.67	.927	1.06	0.66- 1.69	.807	1.07	0.69 - 1.65	.776	0.97	0.65- 1.43	.864
	Other education (ref=low level of education)	1.00	0.62 - 1.60	.998	1.09	0.70 - 1.70	.705	1.11	0.74 - 1.67	.614	1.01	0.70 - 1.45	.976
	TDI (Townsend Deprivation Index)	1.04	0.99 - 1.09	.093	1.05	1.00- 1.09	.044 *	1.06	1.01 -1.10	.007 *	1.07	1.03 - 1.11	.0005 *
Depression + Cerebrovascular Disease	Age	0.97	0.95 - 0.99	.003*	0.97	0.95 - 0.99	.003*	0.97	0.95 - 0.99	< .001 *	0.96	0.95 - 0.98	< .001 *
	Male (ref=female)	0.62	0.47 - 0.81	< .001 *	0.62	0.48 - 0.80	< .001 *	0.64	0.50 - 0.80	< .001 *	0.66	0.53- 0.82	< .001 *

Combinations	Variables	30day			90day			180day			365day		
		OR	**CI**	***p***	**OR**	**CI**	***p***	**OR**	**CI**	***p***	**OR**	**CI**	***p***
	Annual income >=31,000 (ref=Annual income < 31,000)	1.02	0.73 - 1.42	.904	1.02	0.75 - 1.39	.885	0.94	0.71 - 1.27	.704	0.92	0.70 - 0.20	.532
	White (ref= other ethnicities)	2.11	0.86 - 5.19	.103	2.35	0.96 - 5.76	.062	1.48	0.75 - 2.93	.253	1.18	0.68- .05	.550
	Employed (ref=others)	0.97	0.70 - 1.35	.862	0.88	0.64 - 1.20	.407	0.83	0.62- 1.12	.226	0.77	0.59- .01	.058
	High level of education (ref=low level of education)	1.04	0.68 - 1.59	.860	1.20	0.79 - 1.80	.391	1.10	0.76 - 1.60	.607	1.07	0.76- 0.49	.698
	Intermediate level of education (ref=low level of education)	1.29	0.81 - 2.06	.276	1.35	0.86 - 2.11	.197	1.18	0.78- 1.79	.433	1.11	0.76- 0.61	.603
	Other education (ref=low level of education)	1.51	0.97 - 2.36	.071	1.69	1.10 - 2.59	.017 *	1.48	1.00 - 2.19	.050	1.53	1.08- 0.17	.01*
	TDI (Townsend Deprivation Index)	1.02	0.98 - 1.06276	.383	1.01	0.97 - 1.05	.660	1.01	0.97 - 1.05	.610	1.01	0.98 - .05	.426
Anxiety Depression + All CVDs	Age	0.95	0.94 - 0.97	< .001 *	0.95	0.94 - 0.97	< .001 *	0.96	0.95 - 0.97	< .001 *	0.96	0.94- 0.97	< .001 *
	Male (ref=female)	0.50	0.42- 0.60	< .001 *	0.50	0.42 - 0.59	< .001 *	0.51	0.44 - 0.60	< .001 *	0.57	0.49- 0.66	< .001 *
	Annual income >=31,000 (ref=Annual income < 31,000)	1.00	0.81 - 1.25	.972	0.99	0.81 - 1.22	.947	0.93	0.77 - 1.13	.479	0.87	0.73 - .04	.134
	White (ref= other ethnicities)	1.93	1.13 - 3.32	.017*	1.92	1.16 - 3.19	.011*	1.57	1.02 - 2.42	.042 *	1.29	0.89- 0.85	.173
	Employed (ref=others)	0.94	0.75 - 1.17	.571	0.89	0.73 - 1.10	.287	0.87	0.71 - 1.05	.147	0.78	0.65- 0.94	.007 *

Combinations	Variables	30day			90day			180day			365day		
		OR	**CI**	***p***	**OR**	**CI**	***p***	**OR**	**CI**	***p***	**OR**	**CI**	***p***
	High level of education (ref=low level of education)	0.93	0.72 - 1.21	.599	1.05	0.82- 1.35	.699	1.07	0.85 - 1.35	.572	0.99	0.80 - 0.22	.912
	Intermediate level of education (ref=low level of education)	1.00	0.74 - 1.33	.939	1.02	0.76- 1.35	.908	1.01	0.77 - 1.32	.966	0.94	0.74 - 0.20	.625
	Other education (ref=low level of education)	1.05	0.79- 1.40	.738	1.12	0.86- 1.47	.405	1.13	0.87 - 1.45	.358	1.05	0.83- 0.32	.684
	TDI (Townsend Deprivation Index)	1.02	0.99 - 1.05	.193	1.02	0.99 - 1.05	.112	1.02	1.00 - 1.05	.052	1.03	1.01 - 0.05	.014 *
Anxiety Depression + Ischemic Heart Disease	Age	0.92	0.90- 0.94	< .001 *	0.92	0.91- 0.94	< .001 *	0.93	0.92 - 0.95	< .001 *	0.94	0.92 - 0.95	< .001 *
	Male (ref=female)	0.45	0.35- 0.59	< .001 *	0.45	0.36 - 0.58	< .001 *	0.49	0.39 - 0.62	< .001 *	0.56	0.46 - 0.70	< .001 *
	Annual income >=31,000 (ref=Annual income < 31,000)	0.99	0.73 - 1.35	.960	0.97	0.72- 1.29	.816	0.98	0.74 - 1.28	.866	0.93	0.72- 1.20	.599
	White (ref= other ethnicities)	2.07	1.01- 4.24	.046*	1.71	0.92 - 3.16	.088	1.61	0.91- 2.83	.102	1.29	0.80 - 2.08	.292
	Employed (ref=others)	0.91	0.67 - 1.24	.558	0.84	0.63 - 1.12	.240	0.81	0.62 - 1.06	.124	0.74	0.57- 0.95	.017*
	High level of education (ref=low level of education)	0.89	0.63 - 1.28	.538	1.00	0.71 - 1.4	.994	1.03	0.75 - 1.42	.857	0.94	0.71 - 1.26	.691
	Intermediate level of education (ref=low level of education)	0.91	0.60 - 1.37	.657	0.94	0.63- 1.39	.760	0.99	0.69 - 1.44	.971	0.91	0.65 - 1.27	.564

Combinations	Variables	30day			90day			180day			365day		
		OR	**CI**	***p***	**OR**	**CI**	***p***	**OR**	**CI**	***p***	**OR**	**CI**	***p***
	Other education (ref=low level of education)	1.02	0.69 - 1.52	.912	1.10	0.76 - 1.59	.629	1.13	0.79 - 1.60	.502	0.98	0.72 - 1.34	.902
	TDI (Townsend Deprivation Index)	1.02	0.98- 1.06	.323	1.03	0.99 - 1.07	.126	1.04	1.00- 1.07	.049*	1.05	1.01- 1.08	.004 *
Anxiety Depression + Cerebrovascular Disease	Age	0.98	0.96- 1.00	.091	0.98	0.97 - 1.00	.086	0.98	0.97 - 1.00	.0751	0.98	0.96- 0.99	.002*
	Male (ref=female)	0.59	0.46 - 0.74	< .001 *	0.60	0.48- 0.75	< .001 *	0.59	0.48 - 0.73	< .001 *	0.64	0.53 - 0.77	< .001 *
	Annual income >=31,000 (ref=Annual income < 31,000)	1.03	0.77 - 1.39	.821	1.05	0.80 - 1.37	.750	0.92	0.71- 1.19	.527	0.83	0.66 - 1.05	.128
	White (ref= other ethnicities)	1.40	0.71- 2.76	.331	1.62	0.82 - 3.18	.16	1.18	0.68 - 2.04	.55	1.08	0.67 - 1.74	.753
	Employed (ref=others)	0.99	0.74- 1.33	.943	0.97	0.73 - 1.27	.803	0.96	0.74- 1.25	.776	0.86	0.68 - 1.09	.219
	High level of education (ref=low level of education)	0.89	0.62 - 1.27	.519	1.01	0.72- 1.42	.948	1.01	0.74 - 1.38	.951	1.02	0.77 - 1.36	.885
	Intermediate level of education (ref=low level of education)	1.01	0.68 - 1.50	.966	1.05	0.72 - 1.55	.791	1.01	0.71 - 1.45	.945	0.99	0.71 - 1.37	.939
	Other education (ref=low level of education)	1.08	0.74 - 1.59	.678	1.19	0.83 - 1.71	.353	1.11	0.79- 1.56	.548	1.18	0.84 - 1.55	.418
	TDI (Townsend Deprivation Index)	1.02	0.98- 1.06	.327	1.02	0.98 - 1.05	.388	1.07	0.98 - 1.05	.329	1.01	0.98 - 1.05	.345

Note: * = significant result, CI = 95% Confidence Interval, OR= Odds Ratio, *p* = P- Value.

Appendix N: Results from the Other Logistic Regression Models

Table 1

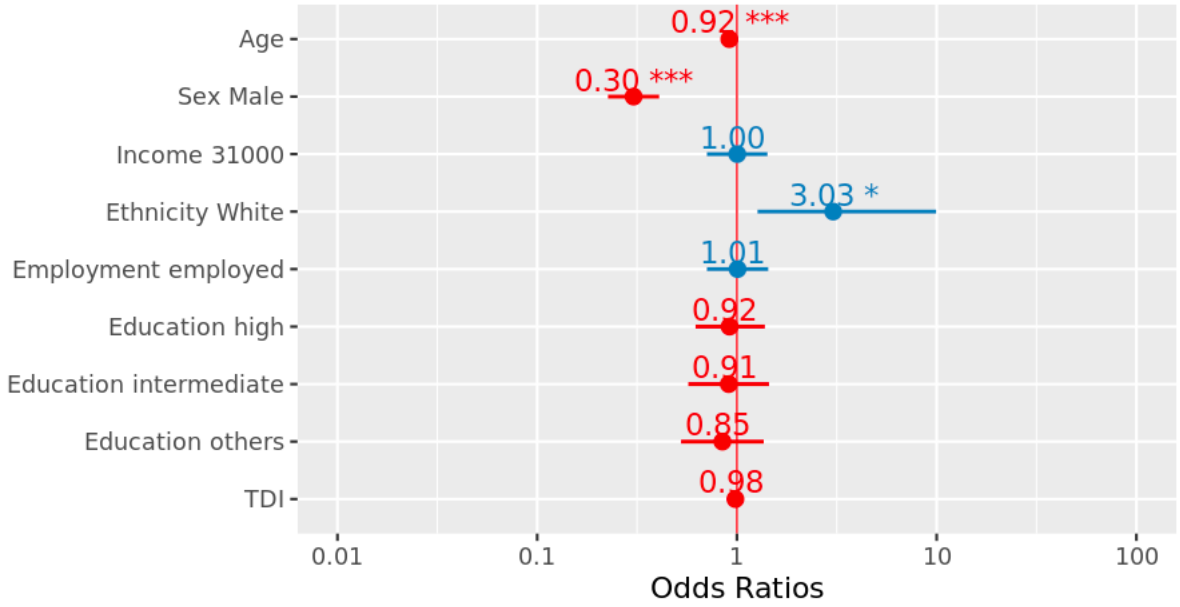
Logistic Regression - Anxiety and Ischemic Heart Disease at 60-days.

Combinations	Variables	Odds Ratio	95% CI	P Value
Anxiety + Ischemic Heart Disease	Age	0.92	0.90 - 0.94	***p* < .001**
	Male (ref=female)	0.30	0.23 - 0.41	***p* < .001**
	Annual income >=£31,000 (ref=Annual income < £31,000)	1.00	0.71 - 1.42	*p* = .980
	White (ref= other ethnicities)	3.03	1.11 - 8.27	***p* = .030**
	Em*p*loyed (ref=others)	1.01	0.71 - 1.43	*p* = .970
	High level of education (ref=low level of education)	0.92	0.62 - 1.37	*p* = .680
	Intermediate level of education (ref=low level of education)	0.91	0.57 - 1.45	*p* = .690
	Other education (ref=low level of education)	0.85	0.53 - 1.36	*p* = .490
	TDI (Townsend De*p*rivation Index)	0.98	0.94 - 1.03	*p* = .470

Note: Each additional year of age is associated with approximately 8% (*OR*= 0.92, 95% CI= 0.90-0.94) lower odds of a diagnosis of ischemic heart disease following a diagnosis of Anxiety. Being a man is associated with lower odds (*OR* = 0.30, 95% CI= 0.23 - 0.41) indicating that men had about 70% lower odds compared to women. Being of white ethnicity is associated with higher odds (*OR*=3.03, 95% CI= 1.11 - 8.27), compared to non-white individuals. Annual income (*OR*= 1.00, 95% CI= 0.71-1.42), being employed (*OR*=1.01, 95% CI= 0.71-1.43), high levels of education (*OR*= 0.92, 95% CI= 0.62-1.37), intermediate levels of education (*OR*= 0.91, 95% CI= 0.57-1.45), other forms of education (*OR*= 0.85, 95% CI= 0.53-1.36) as well as TDI (*OR*= 0.98, 95% CI= 0.94-1.03) did not have a significant effect on the odds of being diagnosed with ischemic heart disease following a diagnosis of anxiety.

Figure 1

Adjusted Odds Ratios for Ischemic Heart Disease at 60 days: Anxiety as the Primary Predictor



*Note: * $p < .05$, ** $p < .01$, *** $p < .00$,* model is adjusted for all covariates

Table 2

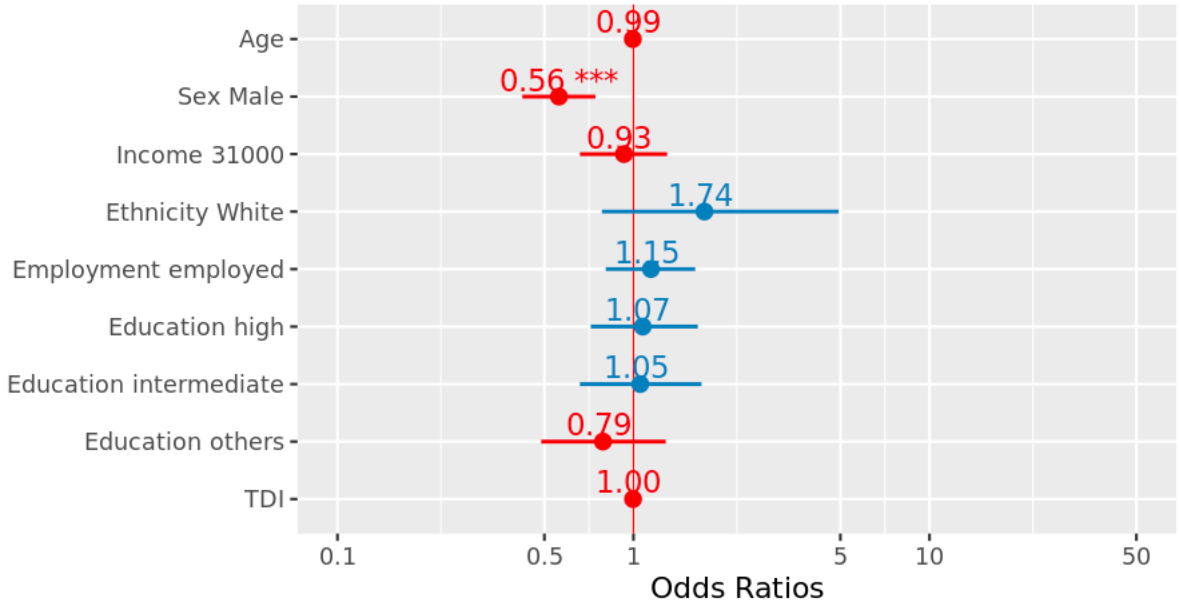
Logistic Regression - Anxiety and Cerebrovascular Disease at 60-days.

Combinations	Variables	Odds Ratio	95% CI	P Value
Anxiety + Cerebrovascular Disease	Age	0.99	0.97 - 1.02	$p = .670$
	Male (ref=female)	0.56	0.42 - 0.74	$\mathbf{p < .001}$
	Annual income >=£31,000 (ref=Annual income < £31,000)	0.93	0.66 - 1.30	$p = .670$
	White (ref= other ethnicities)	1.74	0.70 - 4.28	$p = .230$
	Em*p*loyed (ref=others)	1.15	0.81- 1.62	$p = .450$
	High level of education (ref=low level of education)	1.07	0.71 - 1.63	$p = .730$
	Intermediate level of education (ref=low level of education)	1.05	0.66- 1.69	$p = .830$
	Other education (ref=low level of education)	0.79	0.49 - 1.28	$p = .340$
	TDI (Townsend De*p*rivation Index)	1.00	0.95- 1.04	$p = .890$

Note: Being a man is associated with 44% (*OR*= 0.56, 95% CI= 0.42-0.74) lower odds of a diagnosis of cerebrovascular after being diagnosed with anxiety, compared to women. Age (*OR*= 0.99, 95% CI= 0.97-1.02), ethnicity (*OR*-1.74, 95% CI= 0.74-4.28), employment (*OR*= 1.15, 95% CI= 0.81- 1.62), level of education, and TDI (*OR*= 1.00 95% CI 0.95-1.04) were not significant predictors.

Figure 2

Forest Plot of Adjusted Odds Ratios for Cerebrovascular Disease at 60 Days: Anxiety as the Primary Predictor



Note: * $p < .05$, ** $p < .01$, *** $p < .00$, model is adjusted for all covariates

Table 3

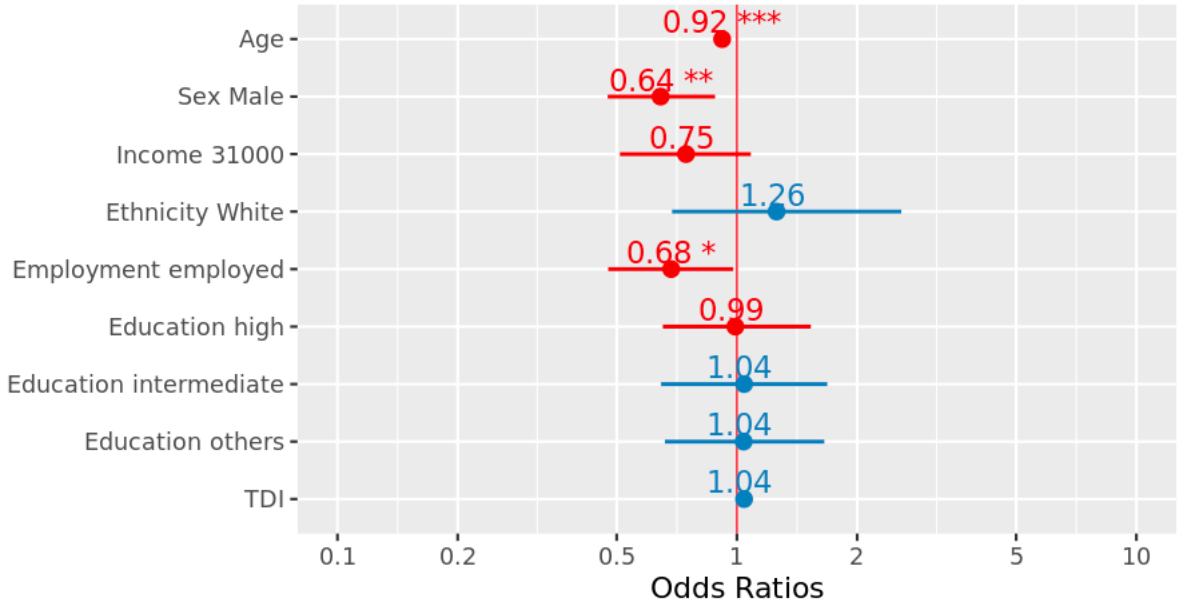
Summary of Adjusted Odds Ratios from Logistic Regression Models Examining Repression and Ischemic Heart Disease at 60-Days.

Combinations	Variables	Odds Ratio	95% CI	P Value
Depression + Ischemic Heart Disease	Age	0.92	0.90 - 0.94	***p* < .001**
	Male (ref=female)	0.64	0.47- 0.88	***p* = .005**
	Annual income >=£31,000 (ref=Annual income < £31,000)	0.75	0.51- 1.09	*p* = .130
	White (ref= other ethnicities)	1.26	0.65 - 2.42	*p* = .490
	Em*p*loyed (ref=others)	0.68	0.48 - 0.98	***p* = .039**
	High level of education (ref=low level of education)	0.99	0.65- 1.52	*p* = .970
	Intermediate level of education (ref=low level of education)	1.04	0.65 - 1.68	*p* = .870
	Other education (ref=low level of education)	1.04	0.66 - 1.64	*p* = .870
	TDI (Townsend De*p*rivation Index)	1.04	1.00- 1.09	*p* = .072

Note: Each additional year of age is associated with approximately 8% (*OR*= 0.92, 95% CI= 0.90 - 0.94) lower odds of a diagnosis ischemic heart disease following a diagnosis of depression. Being a man is associated with 36% (*OR*= 0.64, 95% CI= 0.47 - 0.88) lower odds of being diagnosed with ischemic heart disease following a diagnosis of depression, compared to women. Being in paid employment is associated with 32% lower odds (*OR*= 0.68, 95% CI= 0.48 - 0.98), compared to being in unpaid work. Household income (*OR*= 0.75, 95% CI= 0.51-1.09), ethnicity (*OR*= 1.26, 95% CI= 0.65-2.42) , TDI (*OR*=1.04, 95% CI= 1.00-1.09), high levels of education (*OR*= 0.99, 95% CI= 0.65-1.52), intermediate levels of education (*OR*= 1.04, 95% CI= 0.65-1.68), and other forms of education (*OR*= 1.04, 95% CI= 0.66-1.64), did not have a significant effect on the odds of being diagnosed with ischemic heart disease following a diagnosis of depression.

Figure 3

Forest Plot of Adjusted Odds Ratios for Ischemic Heart Disease at 60 Days: Depression as the Primary Predictor



Note: * $p < .05$, ** $p < .01$, *** $p < .00$, model is adjusted for all covariates

Table 4

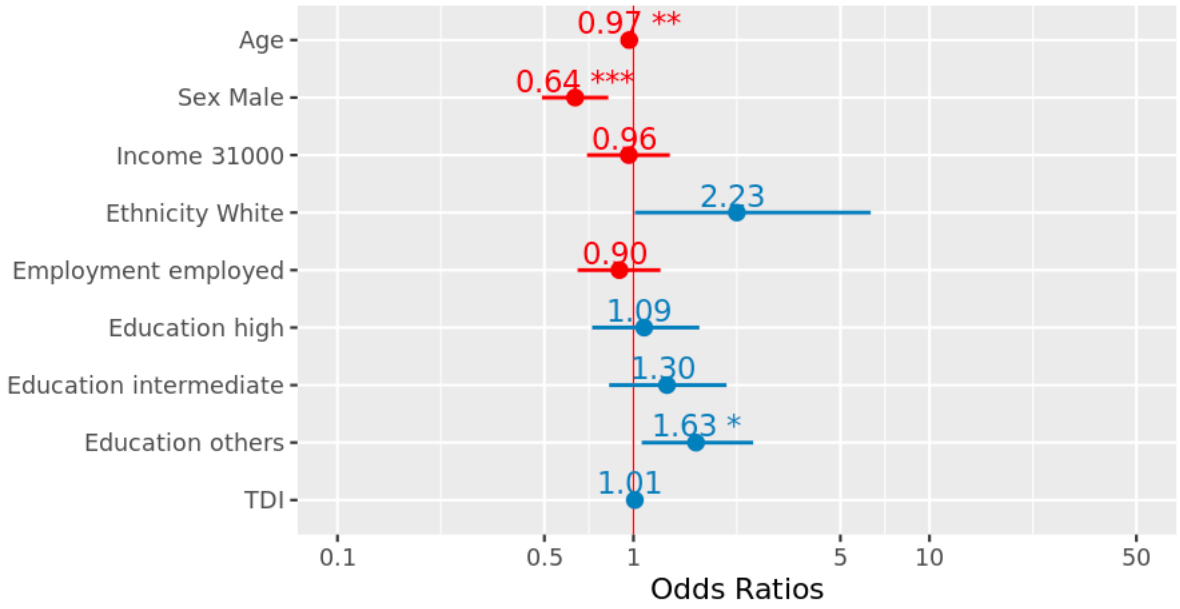
Summary of Adjusted Odds Ratios from Logistic Regression Models Examining Depression and Cerebrovascular Disease at 60-Days.

Combinations	Variables	Odds Ratio	95% CI	P Value
Depression + Cerebrovascular Disease	Age	0.97	0.95- 0.99	***p* = .002**
	Male (ref=female)	0.64	0.49 - 0.82	***p* < .001**
	Annual income >=£31,000 (ref=Annual income < £31,000)	0.96	0.70- 1.33	*p* = .830
	White (ref= other ethnicities)	2.23	0.91- 5.49	*p* = .079
	Em*p*loyed (ref=others)	0.90	0.65 - 1.24	*p* = .510
	High level of education (ref=low level of education)	1.09	0.72- 1.65	*p* = .690
	Intermediate level of education (ref=low level of education)	1.30	0.82 - 2.05	*p* = .260
	Other education (ref=low level of education)	1.63	1.06- 2.51	***p* = .027**
	TDI (Townsend De*p*rivation Index)	1.01	0.97 - 1.05	*p* = .610

Note: Each additional year of age is associated with approximately 3% (*OR*= 0.97, 95% CI= 0.95 - 0.99) lower odds of a diagnosis of cerebrovascular disease following a diagnosis of depression. Being a man is associated with 36% (*OR*= 0.64, 95% CI= 0.49 - 0.82) lower odds of a diagnosis of cerebrovascular disease following a diagnosis of depression, compared to women. Being in other forms of education (such as apprenticeships) is associated with approximately 63% (*OR*=1.63, 95% CI= 1.06 - 2.51) higher odds compared to those who obtained below GCSE level. Annual income (*OR*=0.96, 95% CI= 0.70-1.33), being of white ethnicity (*OR*= 2.23, 95% CI= 0.91-5.49), TDI (*OR*=1.01, 95% CI= 0.97-1.05), being employed (*OR*= 0.90, 95% CI= 0.65-1.24), high level of education (*OR*= 1.09, 95% CI= 0.72-1.65), and intermediate level of education (*OR*= 1.30, 95% CI= 0.82-2.05) did not have a significant effect on the odds of being diagnosed with cerebrovascular disease following a diagnosis of depression.

Figure 4

Forest Plot of Adjusted Odds Ratios for Cerebrovascular Disease at 60 Days: Depression as the Primary Predictor



Note: * $p < .05$, ** $p < .01$, *** $p < .00$, model is adjusted for all covariates

Table 5

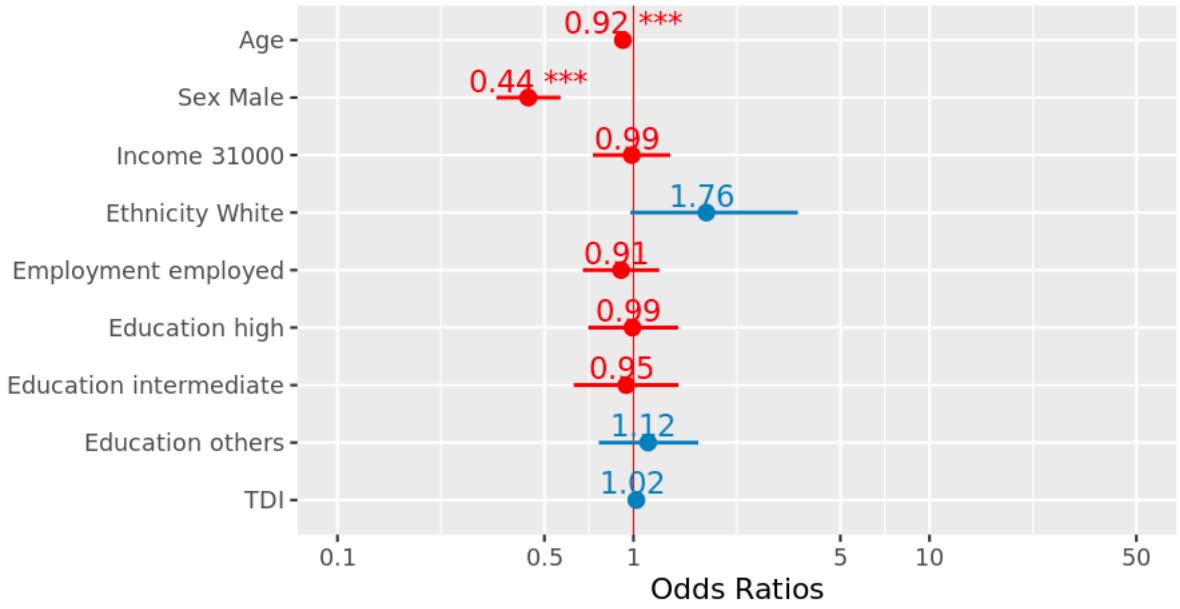
Summary of Adjusted Odds Ratios from Logistic Regression Models Examining Comorbid Depression and Anxiety, and Ischemic Heart Disease at 60-Days.

Combinations	Variables	Odds Ratio	95% CI	P Value
Anxiety + Depression + Ischemic Heart Disease	Age	0.92	0.90- 0.94	***p* < .001**
	Male (ref=female)	0.44	0.34- 0.57	***p* < .001**
	Annual income >=£31,000 (ref=Annual income < £31,000)	0.99	0.73- 1.33	*p* = .930
	White (ref= other ethnicities)	1.76	0.92 - 3.36	*p* = .085
	Em*p*loyed (ref=others)	0.91	0.67 - 1.22	*p* = .530
	High level of education (ref=low level of education)	0.99	0.70 - 1.41	*p* = .960
	Intermediate level of education (ref=low level of education)	0.95	0.63 - 1.42	*p* = .790
	Other education (ref=low level of education)	1.12	0.76- 1.65	*p* = .560
	TDI (Townsend De*p*rivation Index)	1.02	0.98 - 1.06	*p* = .250

Note: Each additional year of age is associated with approximately 8% (*OR*= 0.92, 95% CI= 0.90 - 0.94) lower odds of being diagnosed with ischemic heart disease following a diagnosis of both anxiety and depression. Being a man was associated with 56% (*OR*= 0.44, 95% CI= 0.34 - 0.57) lower odds of a diagnosis of ischemic heart disease after being diagnosed with both anxiety and depression, compared to women. Annual income (*OR*= 0.99, 95% CI= 0.73-1.33), being of white ethnicity (*OR*= 1.76, 95% CI= 0.92-3.36), TDI (*OR*= 1.02, 95% CI= 0.98-1.06), being employed (*OR*= 0.91, 95% CI= 0.67-1.22), high level of education (*OR*= 0.99, 95% CI= 0.70-1.41), intermediate level of education (*OR*= 0.95, 95% CI= 0.63-1.42), and other forms of education (*OR*= 1.12, 95% CI= 0.76-165), did not have a significant effect on the odds of being diagnosed with ischemic heart disease following a diagnosis of both anxiety and depression.

Figure 5

Forest Plot of Adjusted Odds Ratios for Ischemic Heart Disease at 60 Days: Depression and Anxiety as the Primary Predictor



Note: * $p < .05$, ** $p < .01$, *** $p < .00$, model is adjusted for all covariates

Table 6

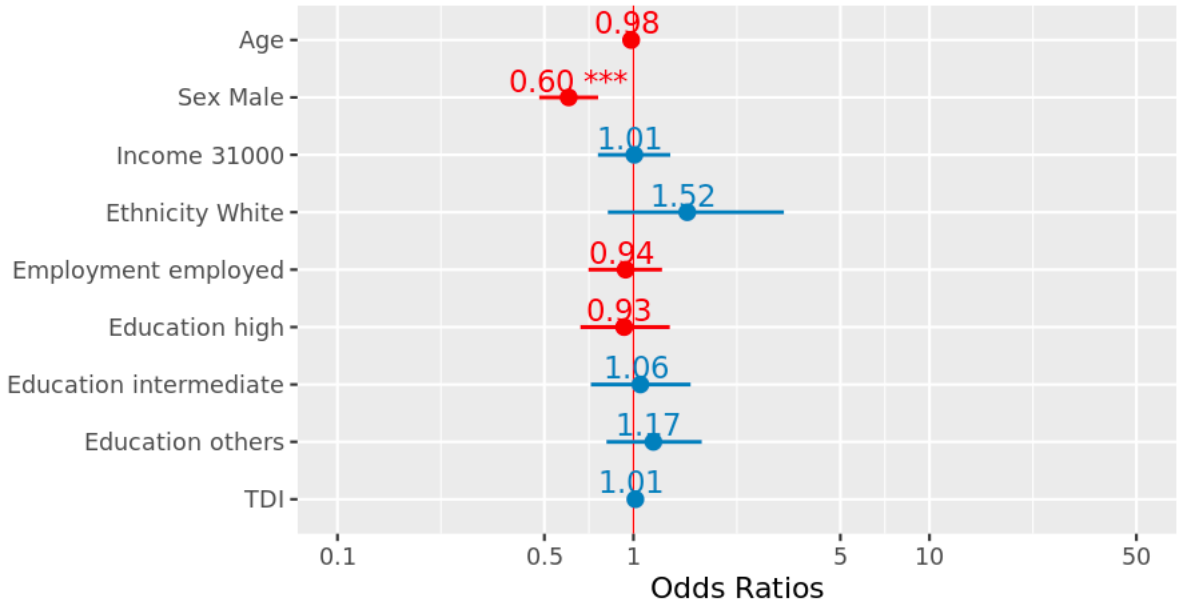
Summary of Adjusted Odds Ratios from Logistic Regression Models Examining Comorbid Depression and Anxiety, and Cerebrovascular Disease at 60-Days.

Combinations	Variables	Odds Ratio	95% CI	P Value
Anxiety + Depression + Cerebrovascular Disease	Age	0.98	0.96 - 1.00	$p = .060$
	Male (ref=female)	0.60	0.48 - 0.76	$\mathbf{p < .001}$
	Annual income >=£31,000 (ref=Annual income < £31,000)	1.01	0.76 - 1.33	$p = .960$
	White (ref= other ethnicities)	1.52	0.77- 2.99	$p = .230$
	Employed (ref=others)	0.94	0.70- 1.25	$p = .670$
	High level of education (ref=low level of education)	0.93	0.66- 1.32	$p = .680$
	Intermediate level of education (ref=low level of education)	1.06	0.72- 1.55	$p = .790$
	Other education (ref=low level of education)	1.17	0.81- 1.69	$p = .410$
	TDI (Townsend Deprivation Index)	1.01	0.98 - 1.05	$p = .420$

Note: Being a man was associated with 40% (*OR*= 0.60, 95% CI= 0.48 - 0.76) lower odds of a diagnosis of cerebrovascular disease following a diagnosis of anxiety and depression, compared to women. Age (*OR*= 0.98, 95% CI= 0.96-1.00), annual income (*OR*= 1.01, 95% CI= 0.76-1.33), being of white ethnicity (*OR*= 1.52, 95% CI= 0.77-2.99), TDI (*OR*= 1.01, 95% CI= 0.98-1.05), being employed (*OR*= 0.94, 95% CI= 0.70-1.25), high level of education (*OR*= 0.93, 95% CI= 0.66-1.32), intermediate level of education (*OR*= 1.06, 95% CI= 0.72-1.55), and other forms of education (*OR*= 1.17, 95% CI= 0.98-1.05), did not have a significant effect on the odds of being diagnosed with cerebrovascular disease following a diagnosis of both anxiety and depression.

Figure 6

Forest Plot of Adjusted Odds Ratios for Cerebrovascular Disease at 60 Days: Depression and Anxiety as the Primary Predictor.



Note: * $p < .05$, ** $p < .01$, *** $p < .00$, model is adjusted for all covariate

Appendix O: Output for Analysis Using a Model Adjusted for All Key Predictors

Table 1

Output for Analysis Using a Model Adjusted for All Key Predictors – Excluding Same-Day Diagnosis

	Potential for Delayed Diagnosis (60 day) mean/numbers	SD/%	No Potential for Delayed Diagnosis (60 day) mean/numbers	SD/%	p-value
Age	58.24	8	60.53	6.82	<.001
Male	269	50.85	25675	67.95	<.001
Female	260	49.15	12110	32.05	
Income >=31000£	191	36.11	13440	35.57	.798
Income <31000£	338	63.89	24345	64.43	
White Ethnicity	514	97.16	36140	95.65	.089
Other Ethnicity	15	2.84	1645	4.35	
Employed	214	40.45	13783	36.48	.059
Other Employment	315	59.55	24002	63.52	

Table 2

Output for Analysis Using a Model Adjusted for All Key Predictors – Including Same-Day Diagnosis

	Potential for Diagnostic Challenges (60 day) mean/numbers	SD/%	No Potential for Diagnostic Challenges (60 day) mean/numbers	SD/%	p-value
Age	59.41	8.06	60.5	6.85	.18
Male	46	46	25898	67.771	<.001
Female	54	54	12316	32.229	
Income >=31000£	29	29	13602	35.5943	.17
Income <31000£	71	71	24612	64.4057	
White Ethnicity	98	98	36556	95.6613	NA
Other Ethnicity	2	2	1658	4.33872	
Employed	30	30	13967	36.5494	.17
Other Employment	70	70	24247	63.4506	
High Education	38	38	15227	39.8467	.79
Intermediate Education	15	15	6641	17.3784	
Low Education	17	17	6378	16.6902	
Other Education	30	30	9918	25.9538	
TDI	-0.76	3.11	-0.97	3.25	.5

Appendix P: Example Excerpt from an Interview Transcript

I: And thinking more specifically about cardiovascular disease and that diagnostic process, have you seen different trends in the people who are presenting more in your clinics in terms of characteristics of age, gender, ethnicity?

P2: We don't have a huge ethnic blend of patients here so it's a little hard to comment on changes and that's what we do have is largely governed by the people that have come to this area in the last few years. So, it's a very white population, Caucasian population, the only non-white group really have been Eastern Europeans that have come in the last five to ten years and built up some of the population locally, and so we're starting to see some of them come to our clinic, obviously as they get older. Generally, when people come here, they're usually young people in their 20s and 30s, and they don't tend to have health problems and the only time they ever use the hospital is probably for babies and kids. So, the adults that are coming here are now getting of an age when they may start to have health problems. In cardiology, the bulk of my patients are 40-plus. I have a smaller number of patients that are, you know, teenagers and young adults, but it's not a big population and thankfully, most of them have relatively trivial problems wrong with them. Those are not usually life-threatening. So that's the general trend. I think that there's been a huge splurge in a diagnosis called POTS syndrome in the last 10 years, which seems to affect young women. And so, we've been inundated with referrals for that to the extent that we have now actually said to GPS, we're not seeing them anymore because it can actually be diagnosed by a GP practice nurse. I think spending a year waiting to see a cardiologist in a cardiology clinic is not the best way to make that diagnosis. But that's been a recent trend that we've seen, and I don't know where, I think there's a lot on social media about it. I know it's the young people who follow social media and then you know if you pick up on that as a potential cause of your symptoms, then that's identified. So I think young people are probably to find out about this on social media and then say, " This might be me” I think there's an element of that in a lot of conditions, but also in your own field as well, where people are making a self-diagnosis not necessarily because you Googled your symptoms, but because the endless stream of TikTok eventually does trip something on you that says, oh, I wonder if I've got that and then presumably once you've clicked the follow this or I like that a few times the algorithm then displays far more pictures

of people telling you do you think you've got X? Which is probably why everyone and their sister thinks they've got ADHD nowadays. I suspect that's probably going to be over-diagnosed in the future. Well, I think it is being over-diagnosed because there are definitely some clinics that have 100% guarantee we will diagnose you with ADHD or you get your money back. You know, that doesn't sound like a diagnostic clinic. That sounds like a clinic just willing to extract money from your wallet.

I: And in terms of the gender of the people you're seeing is there is a bit of an equal split, or does they tend to be more males than females?

P2: I think it's fairly split. I wouldn't have said it's changed over the years too much. Cardiac disease tends to affect women here, as I see later on in life. So, there's probably a little bit more of an older woman and getting cardiac disease than men. But as the incidence of smoking is going down, that's probably balancing out as well. Fewer people are smoking, so I may change that.

I: And when diagnosing a new patient with a possible cardiovascular disease, what's your typical approach, and what factors do you consider most important?

P2: So, when trying to make a diagnosis, the vast majority of the diagnosis can be made from talking to the patient, which is one reason why I actually do a telephone clinic on a Thursday and don't see any of the patients in person. And yet I'm still able to make a diagnosis much of the time now.
They may end up having to have some physical tests, and someone may have already listened to their heart and looked at them. But you know, the heart is inside your body, so there's nothing to see really. There are a few clinical signs listening to our heart that can tell you something, but nowadays most people have had an ECG and almost everyone can do their blood pressure at home. And in fact, some people are even doing their ECGS at home or an Apple Watch and presenting that to you. So, there's less of a physical need to actually bring people up to the clinic to see them.
And a lot of the nuance of what's wrong with someone is from just helping them describe the symptoms and in a detailed way so that you can understand and try and exclude other problems. So, the diagnosis is about trying to push yourself down a path to getting the name for something. And the other thing is also trying to take off things that it isn't so that you end

up with a certain level of confidence. And sometimes you never get a name for what's wrong with them and sometimes all you can do is exclude the nasty stuff and say ‘I don't know, but it doesn't sound as though it's going to kill you’. We don't always get a diagnosis, and then there are a variety of tests that we do, you know, ultrasound, CT scans, heart monitors and things that may then give the diagnosis. But the bulk of the diagnosis is already made when you just talk to someone for 10-15 minutes, and I think the skill of a good doctor is to be able to do that.

I: So, you'd say it's kind of where you get most of your information, and that's kind of the most important part of the process, almost.

P2: Yes, I mean, there's a famous American physician, I don't know whether he actually said it, but everyone attributes it. He basically said, “Listen to the patient, he's telling you the diagnosis”. So, it's basically, it's the young doctors that just want to do lots and lots of tests and get numbers back and think that the numbers are going to tell them the diagnosis, but the numbers really don’t. The numbers probably lie a lot. Blood test results often have abnormalities in them. They don't actually mean anything, particularly in elderly people. Your bloods are often abnormal just because of lots of organs not doing their best of their best job and it gets very confusing. And so if you just get presented with a big bunch of numbers, you know with you know five of them or big asterisks next to them, you try and work backwards and think what could have caused those problems, which then gives you the original diagnosis and you kind of forget what the original reason why the patient came to see you in the 1st place. Doctors seem to rely on those numbers or the report of a test as being more definitive than listening to someone. And you know, and maybe fear of being sued, and you know the patient saying hello, you know the doctor listened to me but didn't do any tests and didn't examine me, and you kind of think I didn't need to do any tests or examine you because I already did the best test, which was listen to the patient. It's a test at the end of the day. It's just a test, you know, its spending time talking to someone, hearing what they have to say and gently get encouraging them to go down it, you know, tell them more about something, or move on to another option or whatever. And we'll get the back story and past history.