Preventing Cardiovascular Disease (CVD) Through Lifestyle Changes: A Systematised Review Of Randomised Controlled Trials

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1 Abstract

Cardiovascular disease (CVD) is a major cause of global mortality and morbidity with large health and economic implications. Changes in diet, physical activity, cessation of smoking, and management of stress are all accepted and advised as measures of lifestyle modification in the prevention of CVD. This thesis explores the impact of lifestyle changes on the prevention of CVDs by examining the findings of RCTs, specifically those that were performed within the UK and Europe.

The methodology consisted of a systematised review of 12 randomised controlled trials. Lifestyle interventions for reducing the risk of CVD in the adult population at high risk for CVD conducted in the UK and Europe that include the adult population at risk were selected studies around predefined inclusion criteria. Data were extracted and synthesised to show commonalities, differences, and overall outcomes.

The results revealed three themes of lifestyle modification:

1. Lifestyle Interventions based on dietary counselling and exercise programmes
2. Digital and Technological Interventions using mobile apps, wearable devices and online platforms for transmission and reducing cardiovascular risk factors
3. Peer Support Interventions, such as group-based and one-on-one support systems, aimed at increasing adherence and motivation, which resulted in improved transmission and physical activity

Finally, findings demonstrate the capacity of lifestyle interventions to halt CVD and are supported by peer and technological innovations. However, there are challenges related to patient engagement, cultural adaptability, and healthcare infrastructure constraints. This thesis draws attention to the integration of these interventions into public health policies and clinical practice, stressing the requirement for a multidisciplinary strategy and technological improvement to combat the continuing toll of CVD.

Keywords: Cardiovascular disease, lifestyle interventions, randomised controlled trials, peer support, digital health, and public health.

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2 Chapter 1 Introduction

2.1 Orientation to the Thesis

Cardiovascular disease (CVD) continues to be a major cause of death and morbidity worldwide. It causes about 17.9 million deaths, indicating 32% of global deaths annually (World Health Organization [WHO], 2021). CVD includes a wide spectrum of disorders affecting the heart and blood vessels, including coronary artery disease, heart failure and stroke. Most of these conditions are associated with preventable or modifiable risk factors, including hypertension, dyslipidemia, obesity, smoking, physical inactivity and unhealthy dietary habits and, therefore, prevention of CVD is a major public health priority.

CVD is a major burden to both healthcare systems and economic productivity in the United Kingdom (UK). Increased expenditures are paid for in healthcare, and raised productivity losses are directly related to the problem, which requires strategic intervention in its risk factors. As a result, preventive interventions for CVD have been made a priority by national health policies (Public et al. [PHE], 2019). These preventive strategies have emphasised lifestyle changes such as better dietary habits, exercise routinely, quitting smoking and stress management.

Randomised controlled trials (RCTs) provide evidence that lifestyle changes are effective in lowering risk factors for CVD and improving cardiovascular health in general. For example, the landmark work of Ornish (1993) showed that such comprehensive lifestyle interventions (including diet and stress reduction) significantly improved cardiac health outcomes. Also, the PREDIMED study reported by Estruch et al. (2013) provided robust evidence of the cardiovascular benefits of the Mediterranean diet in CVD prevention.

Nevertheless, translating research evidence into true and lasting public health practices has proven challenging. Such interventions consider successful factors such as individual adherence, accessibility of resources, and socioeconomic disparities. Furthermore, systemic

barriers such as gaps in healthcare policies and a lack of integration between evidence-based interventions and community-based programmes also act as barriers to implementation.

This thesis follows up with a systematised review of RCTs to assess whether lifestyle modifications have been shown to prevent CVD. It integrates extant evidence to shed light on how such interventions might be practically applied to relieve the global burden of CVD. Through this approach, the study attempts to add to the existing body of literature on preventive healthcare and contribute to public health strategies for cardiovascular health improvement.

2.2 Definition

CVD is an umbrella term used to refer to problems that affect heart and blood vessels, such as coronary heart disease, cerebrovascular disease, rheumatic heart disease and peripheral arterial disease. Collectively, these conditions are major reasons for global morbidities and mortality. Atherosclerosis, which is a buildup of fatty deposits and other substances within the arterial wall, is a chronic process that, behind most CVD, often has an underlying pathology. If this builds up, it may narrow or completely block blood vessels so that blood cannot flow as it should. Untreated atherosclerosis may, over time, lead to serious complications, including myocardial infarction or stroke (World Health Organization [WHO], 2023).

CVD risk factors are broadly categorised as non-modifiable and modifiable. Risk factors that can not be modified include age, sex, and genetic predisposition. In comparison, modifiable risk factors are determinants that have to do with our lifestyle and behaviour. They include smoking, an unhealthy diet, physical inactivity, excessive alcohol consumption, and unmanaged stress. Modifiable risk factors are important for both the development and progression of CVD and thus have a large role in prevention.

Primary prevention involves targeting modifiable risk factors before clinical symptoms arise to reduce the incidence of CVD. Promoting smoking cessation, a healthful diet, and increasing physical activity have been shown to reduce CVD risk (WHO, 2023). Addressing

these factors reduces individual susceptibility to these factors and delivers wider public health benefits.

2.3 UK Policy

Efforts to fight cardiovascular disease (CVD) and develop targeted policies have been a great commitment by the United Kingdom. NHS England's 2019 NHS Long-Term Plan places great emphasis on the importance of preventive interventions to lessen the burden of CVD. A key component of the plan is directed towards the integration of lifestyle interventions into primary care with special emphasis on personalised prevention strategies. Health checks and screenings are used to find out which individuals are at high risk, and then specifically tailored interventions are aimed at reducing those risks (NHS England, 2019).

One of the well-known public health campaigns supporting CVD prevention is the 'Heart Age Test' from Public Health England. The purpose is to motivate people to learn more about their cardiovascular health, as well as educate the public about risk factors for cardiovascular disease. It allows people the ability to alter the way they live so that their risk of CVD is reduced (Public et al., 2020). Additionally, the UK Government's obesity strategy, published in 2020, addresses a main contributor to CVD. This strategy is comprehensive, including policies such as calorie labelling in restaurants, regulation of advertising of unhealthy foods, and facilitating people to become physically active.

Both the UK policy framework and the awareness that people from lower socioeconomic origins are disproportionately affected by CVD put a strong focus on eliminating socioeconomic health differences. Something that the Marmot Review (Marmot et al., 2020) identified was that the social determinants of health – namely having access to healthy food, environments that foster physical activity and 'robust' smoking cessation services – are something that needs to be tackled swiftly up and down the nation. These reflect knowing that

successful CVD prevention occurs de facto at multiple levels involving consideration of both individual behaviours and systemic inequities.

The UK has a well-developed policy framework to tackle CVD built around prevention at the individual and population levels through public awareness and structural interventions. Besides decreasing the incidence of cardiovascular diseases, the purpose is to prevent the social and indirect economic effects of a major public health problem.

2.4 Practice Perspectives

Cardiovascular disease (CVD) prevention is front and centre for healthcare professionals to prevent – through lifestyle counselling and patient education. Brief interventions to initiate preventive strategies, such as initiating work with General Practitioners (GPs) who are responsible for setting realistic goals and promoting long-lasting behaviour changes, are the primary duty. In NICE (2014), GPs play a central role in identifying and advising those at risk of CVD and tailoring advice and follow-up to encourage lifestyle changes. They complement these efforts with practice nurses and community health workers who do detailed health assessments, monitor key risk factors, and offer one-to-one support for changes in diet, smoking cessation, and increasing physical activity.

Given the complexity of CVD, there is growing acceptance that the prevention of CVD demands a multi-disciplinary approach. It also includes specialists, such as dietitians, physiotherapists, and mental health professionals, to enhance holistic care. For example, dietitians facilitate evidence-based practice in adopting a heart-healthy diet, such as the Mediterranean diet, which has been evidenced to lower cardiovascular determining factors (Estruch et al., 2013). Physiotherapists also promote on an individual basis their patients' physical activity and mental health specialists manage the known psychological stressors implicated in CVD, such as anxiety and depression.

Technological advances further revolutionized CVD preventive practice. Digital health tools such as mobile applications and wearable devices make real-time monitoring of physical activity, diet, cardiovascular parameters, and so on possible. These tools facilitate patient engagement and adherence through the provision of points for action feedback and allow for self-management (Islam and Maddison, 2021). Thus, wearable devices capable of sensing physical activity and heart rate or wellness apps that suggest nutritional insight can inspire people to reach their fitness goals and select healthier nutritional choices.

Although such advances are present, they still have to be successfully implemented in the lifestyle. However, constraints from patient motivation, cultural beliefs, and limitations of the home healthcare system are barriers to intervention success. Healthcare professionals need to be aware of and well understood of these factors to deliver culturally sensitive, patient-centred care. These barriers are addressed in the prevention of CVD using evidence-based and adaptive practice.

2.5 Justification for Study

Despite substantial advances in understanding CVD biology and treatment, coronary heart disease and stroke still represent a leading cause of morbidity and mortality worldwide, and the associated healthcare burden continues to be substantial. Various lifestyle changes (i.e., good diet, more physical activity, and weight management) have well-documented potential to prevent CVD. Numerous randomised controlled trials (RCTs) have been completed that demonstrated the efficacy of these interventions; however, the synthesis of results has been complicated by differences in study design, characteristics of the population studied, and outcome measures (Chlabicz et al., 2020). These inconsistencies can then be addressed by a systematised review, which can offer an in-depth review of all available evidence. This approach will allow the identification of effective strategies for CVD prevention as well as gaps in current known knowledge.

Most importantly, context-specific insights are significant, given that the majority of the UK population is considered. Lifestyle behaviours such as obesity and physical inactivity are prevalent in the UK (British Heart Foundation [BHF], 2021); however, socioeconomic, cultural and environmental factors all significantly impact them. Higher rates of obesity and physical inactivity in the UK increase the risk for the development of CVD, and the need for practical, sustainable interventions that can be tailored to local contexts is immediate. The information provided by this review will enable policymakers, healthcare professionals, and researchers to develop evidence-based CVD prevention strategies that will specifically target the UK.

The economic case this study presents is equally convincing. The NHS spends more than £7 billion a year treating CVD, putting huge pressure on health resources (BHF, 2021). This study can reduce the economic burden of CVD by identifying and promoting cost-effective lifestyle interventions and can help sustain a healthy healthcare system in the long run. Consequently, the results of this study are vital for informing lifestyle change strategies to reduce future risks of CVD.

2.6 Aims and Objectives

2.6.1 Aims

The primary aim of this study is to evaluate the effectiveness of lifestyle changes in preventing CVD by synthesising evidence from randomized controlled trials. The study seeks to explore how lifestyle interventions influence cardiovascular risk factors and outcomes, contributing to the body of knowledge that supports preventive healthcare.

2.6.2 Objectives

1. To identify and evaluate randomised controlled trials that assess lifestyle changes in CVD prevention.
2. To synthesise findings from selected studies, highlighting effective interventions and their mechanisms of action.

3. To examine the applicability of evidence to the UK and Europe context, considering sociocultural and economic factors.
4. To identify gaps in the existing literature and suggest directions for future research.
5. To provide evidence-based recommendations for policymakers and healthcare practitioners to enhance the implementation of lifestyle-based CVD prevention strategies.

3 Chapter 2: Methodology and Methods

3.1 Introduction to the Chapter

This chapter outlines the methodology and methods used for the systematised review of RCTs to prevent cardiovascular disease (CVD) through lifestyle changes. However, as a primary cause of morbidity and mortality worldwide (British Heart Foundation [BHF] 2021), Cardiovascular disease remains on track and lifestyle factors, such as diet, physical activity and smoking cessation, have an important role to play in preventing disease onset. The purpose of this review was to systematically identify, assess, and synthesise existing literature on the efficacy of lifestyle interventions in reducing CVD.

The methodology of choice for this present study is systematised review, which allows the collation and assessment of the RCTs in a structured and transparent fashion. Its content is comprised of comprehensive literature searching, rigorous data extraction, and critical appraisal of the quality of studies. This method allows the use of the best available evidence pertinent to current knowledge on CVD prevention. All trends, successful strategies, and gaps in research are synthesised from multiple studies.

It also indicated that multiple key methodological considerations were relevant, including the utilisation of appropriate inclusion and exclusion criteria, systematic search strategies and the adoption of pre-established, evidence-based tools used to evaluate the data. Additionally, reviewing is contingent upon ethics as to the transparency of reporting and management of conflict of interest (Higgins et al., 2019). This chapter explains the rationale for the methods used in this chapter and also how the application of these approaches made certain that the findings of the review are robust and reliable.

3.2 Problem Identification

With CVD still one of the most important contributory causes of morbidity and mortality worldwide, it takes a major toll on the healthcare system, the economy, and individuals.

Approximately 17.9 million deaths annually are attributed to CVD — 32% of total deaths globally (WHO, 2021). Moreover, CVD is still on the increase, especially in the UK, where, according to the British Heart Foundation (BHF), over 7 million people are affected (BHF, 2021). The rising prevalence of CVD is closely matched to the continued rise of modifiable risk factors like obesity, poor dietary habits and physical inactivity.

In the UK, over 60% of adults are either overweight or obese, with physical inactivity affecting one in four adults (Public Health England, 2021). Further increasing the risk for CVD are poor dietary habits, namely, eating too many processed foods along with low fruit and vegetable intake. The contribution of these factors goes beyond increasing the incidence of CVD to burdensome economic and social costs. CVD is a leading cause of long-term disability and premature death and costs the NHS over £7 billion a year to treat it (BHF, 2021).

Effective CVD prevention strategies include lifestyle interventions, such as dietary modification, physical activity, and smoking cessation. However, as the data continues to accumulate, variations in study design, population characteristics, and outcome measures complicate the synthesis of findings (Rippe & Angelopoulos, 2019). Consequently, this supports the need for a systematised review that synthesises RCT evidence for the most effective lifestyle interventions. It subsequently puts it into relevant context to inform public health strategies and health care policy.

Smoking is another major lifestyle risk factor for CVD that deserves great attention. Atherosclerosis heart attacks and strokes are significantly contributed to by tobacco use, and more so because of its effect on vascular inflammation and blood pressure (CDC, 2024). While the risk is not confined to active smokers, passive smoking also increases the risk of CVD, and this has public health implications beyond individual choice (Cancer Research UK, 2018). Smoking cessation is linked to improvements in cardiovascular health that occur swiftly. However, some populations have low uptake of cessation services due to social and

psychological factors (ASH, 2019). Despite the decline in smoking prevalence in the UK using public policies, such as smoke-free legislation and taxation, there has been inequality in terms of smoking reduction across lower-income groups, suggesting the need for specialised interventions (Anyanwu et al., 2020). Therefore, smoking cessation must become a central pillar in the prevention pillars to address the multiple burden of CVD.

3.3 Research Question

The central research question for this review is: What is the effectiveness of physical activity interventions in preventing cardiovascular disease (CVD) in adults, as demonstrated through randomised controlled trials (RCTs)? This question reflects a narrowed scope, focusing on one key lifestyle intervention—physical activity—rather than multiple strategies. Physical inactivity has been consistently identified as a major modifiable risk factor for CVD, contributing to the development of hypertension, dyslipidaemia, insulin resistance, and obesity (WHO, 2021). By narrowing the research focus to physical activity interventions, this review allows for a deeper investigation into how structured and routine movement can impact both immediate clinical markers (e.g., reduced blood pressure, improved cholesterol profiles) and long-term health outcomes, including morbidity and mortality from cardiovascular events (Lee et al., 2012; Warburton & Bredin, 2017).

Firm evidence exists that even moderate-intensity physical activity, such as brisk walking or cycling, regularly reduces relative coronary heart disease and stroke risk by up to 45% (Kunutsor & Laukkanen, 2024). Nevertheless, arguments suggest that long-term adherence to exercise programmes is a significant barrier, especially in lower-income or time-constrained populations (Bantham et al., 2020). It is also shown that behaviour change models and community-based initiatives can improve engagement with the environment, and context-specific interventions can drive sustained success in participation (Pelletier et al., 2020). The evidence for the clinical effectiveness of physical activity interventions will be critically

assessed from the point of view of RCTs, as well as their feasibility and ability to be incorporated into public health policy and clinical guidelines.

3.4 Ethics

Even though this study is a secondary analysis of previously published works, doing a systematic review nevertheless requires careful consideration of ethical issues. In this context, the primary ethical concerns related to the data (i.e., informed consent and participant confidentiality) are not directly relevant. While there are ethical issues about including studies which have followed relevant ethical protocols, including informed consent and protection of participant data in the original trials, ethical issues do not arise about the original trials following their protocols. All the studies that appeared in this review followed ethical standards, making participant protection paramount (Higgins et al., 2019).

Another significant ethical consideration here is transparency, which ensures that potential conflicts of interest, such as funding sources or author's affiliations, are properly disclosed. Study design, outcomes and interpretations can be biased by conflicts of interest, which can lead to biased conclusions (Micha et al., 2017). Moreover, the findings of the studies included in the review were interpreted carefully by researchers. The evidence base can be distorted by biases in the reporting of results, for example, by reporting only positive outcomes. The reliability and trustworthiness of the findings of evidence-based practice were upheld due to ethical transparency in the review process.

In that regard, further ethical considerations in conducting a systematic review are based on the four core principles of bioethics: non-maleficence, beneficence, autonomy, and justice (Beauchamp & Childress, 2019). While autonomy and informed consent more directly apply to the initial studies, reviewers must only include trials in which participants were appropriately informed. Interpreting results that may influence future clinical practice, beneficence, and non-maleficence espouses that you do more good than harm. RCT justice ensures that diverse

populations are included in RCTs fairly and avoids generalizing findings inappropriately. Moreover, transparency in the review process assures the ethical duty of integrity to maintain trust by policymakers and clinicians in the outcome (Sampson et al., 2019). A systematic review with ethical rigour aims to ensure that a secondary research contribution to the evidence base is responsible for following public trust in evidence and thus evidence-based and equitable health care decisions.

3.5 Methodology

In this study, a systematised review was adopted as the descriptive methodology given that it offers a systematic, transparent and structured means of synthesising existing and published evidence. Systematised review is a unique type of review that does not conform to traditional protocols of a narrative review and follows a rigorous and pre-defined process of searching, evaluating and synthesising research studies. The output of a review is reproducible and inclined to be objective (Higgins et al., 2019). RCTs are the gold standard for evaluating the efficacy of interventions (Moher et al., 2009), and this approach was systematically adopted for an evaluation of the effectiveness of CVD prevention lifestyle interventions delivered using RCTs. A systematic review provides a more precise and consequently reliable synthesis of RCT evidence than qualitative reviews or studies that rely on expert opinion.

Other methodological approaches were considered before the systematised review was selected. However, narrative reviews are easier to do and less rigid regarding structure, but they were ruled out because of their susceptibility to selection and interpretation bias (Siddaway et al., 2019). Yet, these reviews are not built on systematic search strategies or critical appraisal processes and are, therefore, challenging to repeat and have stable conclusions. However, meta-analyses were not chosen from among the methods that are as rigorous and statistically as powerful because of the need for a homogenous dataset from several studies to perform a meaningful pooled analysis (Akhter et al., 2019). The heterogeneity in the study designs,

population characteristics, and intervention formats in the available RCTs on the role of physical activity in preventing CVD might obscure nuanced differences and lead to overgeneralization through meta-analysis.

On the other hand, a systematized review has a structured and transparent approach to gathering and critically synthesising available RCT evidence with some methodological flexibility to account for quality or scope differences in the studies (Sarri et al., 2020). As an emerging and complex public health issue such as CVD prevention, interventions may differ according to age, gender, comorbidity profile, and delivery method, which is why the approach is specifically well suited. Furthermore, it has a systematised approach that, unlike the narrative review, has quality appraisal and predetermined inclusion criteria that would enhance the rigour and transparency of the synthesis process. Based on a compromise between the comprehensive nature of a full systematic review and the broader contextual insights that can be gained from a narrative approach, such a decision is made to provide robust yet enabling context-sensitive evidence for the development of policy and clinical guidance.

This review is based on the positivist research paradigm (Bryman, 2016). According to it, knowledge is objectifiable, measurable, and available through observable phenomena. Consequently, the way it approaches data sourcing gives ground against surveys and reliance on RCTs. Positivism is supportive of the use of RCT as primary data sources as they were intended to reduce bias and produce objective, quantifiable results. An epistemological approach is taken, which values the fact that the evidence is quantifiable and testable for its reliability and generalisability across populations and settings.

This study is an ontological view from which we assume that reality is real, quite independent of our perceptions. This is something that can be measured (objectively) but may only be subjectively experienced (Creswell & Creswell, 2017). This resonates well with the synthesising of existing RCT evidence that implies lifestyle interventions to prevent CVD are

covered as they should be in terms of the effectiveness they portray. Systematic reviews guarantee an objective synthesis of data through a positivist methodology and cardinal nature, thereby reducing the potential biases and providing a firm evidence base for clearly informed clinical and public health practice decision-making.

3.6 Literature Search

A systematic literature search is the foundation of a high-quality systematised review as it ensures that the most relevant research to include in an evidence synthesis is found. In this section, we describe the framework, the strategy, the databases, the search terms, and the inclusion /exclusion criteria used in order to identify studies which assess lifestyle interventions for the prevention of CVD.

3.7 Search Strategy

The search strategy employed was comprehensive and reproducible to ensure that all relevant studies were identified in this review. Studies not published in peer-reviewed journals were identified by combining database searches with manual searching of reference lists and the grey literature. This allows the use of multiple sources in order to minimise publication bias and help sample a larger section of the available evidence (Harari et al., 2020). To guarantee that evidence was up to date, the studies had been accessed from databases such as PubMed, Cochrane Library and Scopus and had only been published during the previous 5 years. The search strategy was structured around key concepts: Cardiovascular disease prevention, randomised controlled trials (RCTs) and lifestyle interventions. From this review, these concepts were selected from interventions that were directed to prevent CVD using lifestyle modification as per RCTs and have been highly regarded as methodologically rigorous (Moher et al., 2009).

The PICO framework was used to divide the research question into components, hence enabling the systematic identification of eligible studies. This was a way to break down the

question and ensure clarity and focus with the PIOCO (Population, Intervention, Comparators, Outcome). The Population included persons at risk of cardiovascular disease. The Interventions that were examined were digital, lifestyle and peer support interventions. Outcomes focused on cardiovascular risk reduction, adherence to medications, and total health; comparators used standard care or alternative interventions. PICO facilitated the systematic, comprehensive review and comparison of studies, and thus, the review also covered all the relevant aspects of cardiovascular risk management.

The development of the search strategy involved selecting appropriate databases and keywords and choosing the most suitable framework for question formulation. While frameworks like SPIDER (Sample, Phenomenon of Interest, Design, Evaluation, Research type) and SPICE (Setting, Perspective, Intervention, Comparison, Evaluation) offer advantages for qualitative or exploratory research (Watson & Koers, 2024), they were deemed less appropriate for this study due to their limited utility in identifying intervention effectiveness in RCTs. On the contrary, PICO is optimally designed to include intervention-focused reviews and clinical trials, where quantifiable outcomes are sought (Eriksen & Frandsen, 2018). Critics point out that PICO can oversimplify complex public health interventions by not accommodating contextual factors like delivery mechanisms and cultural relevance (Thomas et al., 2019). However, its structure was such that it was clear and rigorous and suited to what the study was trying to do, namely to evaluate lifestyle interventions across different clinical settings using measurable cardiovascular outcomes. Thus, PICO was considered to be the most relevant tool among the other tools for extracting, comparing, and synthesising relevant evidence from the included RCTs.

PICO Element	Description
Population (P)	Individuals at risk of cardiovascular disease
Intervention (I)	Digital, lifestyle, and peer-support interventions
Comparator (C)	Standard care or alternative interventions
Outcome (O)	Cardiovascular risk reduction, adherence, and improved health outcomes

3.8 Databases

Several databases of critical importance to health and medical literature were used in order to ensure the comprehensive identification of relevant studies for review. Since it indexes an extensive collection of peer-reviewed medical and clinical research from the life sciences and health, PubMed was chosen (Harari et al., 2020). The Cochrane Library is accessible because of its systematic review of a well-designed collection of high-quality RCTs on health interventions. Additionally, we searched Scopus, a multidisciplinary database, in order for studies from across health and social science to be included. To broaden this further, databases such as CINAHL and Embase were considered. A robust and well-rounded search was conducted in these databases, which were selected for relevance to CVD prevention and lifestyle interventions.

3.9 Search Terms

The search terms were specifically selected to match the review's central topics. They included combinations of keywords, e.g., 'cardiovascular disease', 'prevention', 'lifestyle interventions', 'diet', 'exercise', 'smoking cessation', and 'randomised controlled trials'. Terms were combined and refined using Boolean operators such as AND, OR and NOT. For example, a focused search was ensured while considering all the studies that satisfied the search query, for example, ' cardiovascular disease AND prevention AND lifestyle interventions'. Terms aiming to capture several similar terms, like "cardiovascular" (cardio*), were truncated to include forms such as "cardiovascular," "cardiovascular diseases," and "cardiology." The search was made precise and comprehensive using this approach that captured studies of all possible intervention types and outcomes (Higgins et al., 2019).

The rationale for selecting these keywords relates to making the keyword inclusive and specific to capture the broad scope of lifestyle interventions for CVD prevention. As such, the term cardiovascular disease was selected because it is commonly used in research and clinical

practice, as well as the terms CVD and heart disease, encompassing many aspects of the condition. 'Lifestyle interventions' are included as the main emphasis is on non-pharmacological interventions; terms like 'exercise' and 'diet' were chosen as they are the most relevant components in CVD prevention. In addition, terms specific to newer types of interventions, such as ‘digital intervention’ and ‘peer support,’ were included to reflect a trend of transitioning from traditional public health interventions to newer interventions currently being developed. Boolean operators maintained specificity and comprehensiveness in a robust search that kept true to focus and inclusivity.

PICO Element	Description	Search Terms
Population (P)	Individuals at risk of cardiovascular disease	"cardiovascular disease" OR "CVD" OR "heart disease" OR "cardiac health" OR "cardiovascular risk"
Intervention (I)	Digital, lifestyle, and peer-support interventions	("digital intervention" OR "mobile apps" OR "telehealth") AND ("lifestyle intervention" OR "exercise" OR "diet") AND ("peer support" OR "community program")
Comparator (C)	Standard care or alternative interventions	"standard care" OR "usual care" OR "control group"
Outcome (O)	Cardiovascular risk reduction, adherence, and improved health outcomes	"cardiovascular risk reduction" OR "adherence" OR "health outcomes" OR "behavioral change"

3.10 Inclusion/Exclusion Criteria

The inclusion and exclusion criteria were developed to make sure that only studies answering the research question were selected. The inclusion criteria required studies to meet the following specifications: (1) the population of interest must consist of adults aged 18 and over, either diagnosed with cardiovascular disease or at risk of developing it (e.g., through risk factors such as hypertension or obesity); (2) interventions must involve lifestyle modifications such as diet, physical activity, or smoking cessation; and (3) the study design must be a randomised controlled trial (RCT), which provides the highest level of evidence for assessing intervention effectiveness (Moher et al., 2009).

Studies were filtered out using exclusion criteria if they did not meet these requirements. Studies were excluded if they were not randomised, had no intervention component, or if study

populations were non-adult (i.e., children or elderly persons with comorbid conditions that could alter the effect of the intervention). Furthermore, studies that did not focus on CVD prevention (such as strict treatment of CVD) were excluded. These criteria directed the review to those studies that offer robust and relevant evidence of the effectiveness of lifestyle interventions to prevent CVD in adults.

Category	Inclusion Criteria	Exclusion Criteria
Population	Adults aged 18 and over diagnosed with or at risk of cardiovascular disease (e.g., hypertension, obesity).	Children or elderly individuals with comorbid conditions that could alter the effect of the intervention.
Intervention	Lifestyle modifications such as diet, physical activity, or smoking cessation.	Studies without an intervention component or focused solely on CVD treatment rather than prevention.
Study Design	Randomized controlled trials (RCTs), offering the highest level of evidence for assessing intervention effectiveness.	Non-randomized studies or observational studies.
Focus	Studies addressing CVD prevention through lifestyle interventions.	Studies not focusing on CVD prevention (e.g., studies strictly addressing CVD treatment).

Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) is a well-established framework for improving transparency and consistency in reporting systematic reviews and meta-analyses. It provides a flow diagram that ensures thorough documentation of methods, inclusion criteria, and findings and promotes reproducibility and evidence-based research (Moher et al., 2009). A PRISMA flow diagram is present in the appendix A.

3.11 Data Evaluation and Extraction

During the systematic review process, data evaluation and extraction are important stages – not only are the studies included of adequate quality, but the data are also extracted correctly for synthesis. The quality and relevance of the studies were assessed using well-established tools; these were then evaluated. The internal validity of the included studies was evaluated using the CASP tool for randomised controlled trial (Higgins et al., 2019). A quality assessment table for the selected 12 RCTs are present in appendix B. This instrument audits conventional key risk factors, including selection bias, performance bias, detection bias and attrition bias.

Papers at high risk of bias were marked for further inquiry to make sure that only trustworthy research was included in the review's results. In addition, the quality of the interventions, the appropriateness of the control groups and the methodological rigour of the trials were used to conduct a quality assessment.

After the quality was assessed, data pertaining to each study was extracted. To begin, an advanced process was used to incorporate the information on study characteristics, including sample size, participant demographics (age, sex, baseline CVD risk), and type of lifestyle intervention. (Liberati et al., 2009). Then, this data was coded for synthesis with other studies in order to compare studies.

Although many appraisal tools exist (e.g., PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses), GRADE (Grading of Recommendations, Assessment, Development, and Evaluations), CASP (Critical Appraisal Skills Programme) was chosen as it is specific to RCTs. While PRISMA provides detailed reporting guidelines for reviews, it does not directly assess methodological quality, and GRADE is more appropriate for determining the overall strength of a body of evidence. It is commonly used in clinical guideline development (Schünemann, 2022). However, CASP offers a structured 11-question checklist on an individual RCT's reliability, validity, and relevance (CASP, 2018). The focus of CASP makes it more suitable for reviews assessing intervention effectiveness, such as the current review of lifestyle strategies for preventing CVD. Moreover, CASP is an accessible and transparent tool for promoting the transparency and consistency of critical appraisal using other data extraction frameworks.

3.12 Chapter Summary

The methodological approach undertaken to carry out a systematised review of randomised controlled trials (RCT) to assess the effectiveness of lifestyle interventions in the prevention of cardiovascular disease is described in this chapter. The rationale for performing

a systematic review was our desire to conduct such a review rigorously in order to include the objective synthesis of currently available RCT evidence regarding lifestyle changes for CVD prevention. The review was a positivist research paradigm, as it was derived from quantifiable or objective evidence that could be supported with RCTs using high-quality, reliable data.

To encompass and be reproducible, a literature search strategy based on database searching, manual searching, and grey literature was designed. Inclusion and exclusion criteria were carefully constructed based on people at risk of CVD and with an emphasis on lifestyle treatments to select studies appropriate to the review's objectives. Data were evaluated and extracted using the established tools, including the Cochrane Risk of Bias Tool, to ensure only high-quality studies were used in synthesis.

The next chapters will present the results of the examined research, which will synthesise the data on the effectiveness of lifestyle interventions for CVD prevention. This chapter details a methodology that shows in the clearest and most transparent way how lifestyle changes can decrease CVD risk. Findings will aid in the development of pragmatic, evidence-based prevention strategies for CVD that can be used in the general population.

4 Chapter 3: Findings

4.1 Overview of Chapter

This chapter discusses the evidence upon which risk management interventions for cardiovascular disease are based, with a focus on lifestyle modification and digital/peer support interventions. Perhaps the most important measure of these approaches to reducing the burden of cardiovascular disease (CVD) is its continued status as a leading cause of morbidity and mortality worldwide. Twelve research studies contribute to the chapter, evaluating diverse approaches to decreasing cardiovascular risk, including diet, physical activity, weight management, smoking cessation, and digital and peer support interventions.

The purpose of this chapter is to summarise key research findings from these studies, including their linkage to themes surrounding lifestyle modification, digital interventions, and peer support as avenues to improve cardiovascular health. This chapter also critically appraises the methodological issues of the studies, specifically focusing on study design, sample size, outcome measures and how applicable the findings in the studies can be used in real-world settings. The chapter critically assesses the evidence-based research on which interventions are most effective in reducing cardiovascular risk and which interventions are likely to have the greatest success in the future of CVD prevention strategies.

4.2 Justification of Themes

The themes chosen for this chapter are essential to grasp the variety of means of controlling cardiovascular risk. These themes have become more important aspects of healthcare in parallel with the fast-growing global burden of CVD. Each theme covers different aspects of interventions, from digital technologies to traditional lifestyle interventions and social support systems, covering the full range of potential \lifestyle changes for CVD prevention and management.

The cornerstone for cardiovascular risk reduction remains being traditional lifestyle interventions: diet, exercise, weight management, etc. There is a well-established body of literature that supports the use of these interventions to target factors of risk, such as low levels of hypertension, obesity and dyslipidemia. Blumenthal et al. (2021) and Delgado-Lista et al. (2022) propose the influence of diet and exercise on blood pressure and cardiovascular events, respectively. Intensive lifestyle interventions are advanced by Ismail et al. (2020) to treat high-risk patients. Nanditha et al. (2020) present a case in which SMS-promoted lifestyle changes did not significantly reduce the conversion to type 2 diabetes, therefore providing critical impediments to such approaches. Along with these, Van't Klooster et al. (2020) study how lifestyle modifications, for instance, smoking cessation, weight loss, and physical activity, are associated with decreases in C-reactive protein (CRP), identifying the mechanisms by which these changes suppress systemic inflammation and lower cardiovascular disease risk in patients with preexisting cardiovascular disease.

Reflecting the narrowed focus of this systematised review and its alignment with the PICO framework, the justification for each theme is grounded in empirical RCT evidence and filtered through a positivist epistemology. This reinforces the selection of interventions with measurable and generalisable outcomes, a criterion applied throughout the review to ensure consistency in study inclusion and appraisal. Furthermore, ethical considerations were embedded by prioritising interventions with demonstrable benefits and minimal risk, particularly relevant in populations vulnerable to poor cardiovascular outcomes.

There is an increasing use of technology in healthcare, specifically technologies for managing cardiovascular risk factors. While remote monitoring tools and mobile apps are digital interventions that are feasible solutions for patients to manage conditions like hypertension, weight and physical activity, these are scalable and low-cost interventions. These allow patients to become part of their healthcare management and can theoretically lead to

better results at a lower cost. McManus et al. (2021) and Khanji et al. (2019) review evidence about the effectiveness of digital interventions, like self-monitoring for hypertension and personalized e-coaching to reduce cardiovascular risk, respectively. Also, Sniehotta et al. (2019) present useful information on low-intensity digital interventions for weight loss maintenance, which have been shown to support long-term behaviour change. Furthermore, Mueller et al. (2022) present the SWiM-C intervention, which shows that guided web-based self-help strategies based on Acceptance and Commitment Therapy (ACT) can increase psychological flexibility and eating behaviour but does not facilitate weight loss. This study adds part of the discussion of how digital tools could address psychological factors impinging on cardiovascular risk management.

This review emphasised RCTs evaluating digital interventions, intentionally excluding narrative and observational studies to preserve internal validity and align with the review's ontological stance of objectivity. As digital health solutions grow, including interventions supported by robust RCT data ensures ethical fidelity by only recommending interventions backed by rigorous testing. While digital approaches show promise, challenges such as digital literacy, data privacy, and inequitable access must also be weighed (Fitzpatrick, 2023).

Attention has been given to peer support interventions as a means of creating sustainable behaviour changes with limited access to healthcare professionals, especially in low-resource settings. Peer support can facilitate a feeling of being a part of the community and sharing responsibility, and it empowers people to adopt healthier lifestyles. The work of O'Neill et al. (2022) and Latina et al. (2020) considers peer support for diet adherence and cardiovascular risk reduction, respectively, finding that there is an obvious benefit, especially in resource-limited communities. These studies highlight the importance of social networks in health promotion and effectiveness among underserved populations.

Peer-led models were included in the review due to their scalable potential and social inclusivity. From an ethical lens, these interventions offer accessible, low-cost solutions that align with health equity principles (Walsh, 2024). However, unlike digital and clinical lifestyle interventions, peer-based models present outcome variability, potentially limiting reproducibility and generalisability. Still, their psychosocial benefits, including accountability, motivation, and emotional support, suggest their integration could enhance the impact of more structured interventions.

4.3 Critical Discussion of Methodological Issues in the Evidence Base

4.3.1 Study Design Issues

Random assignment to intervention and control groups minimises bias in clinical research, making randomised controlled trials (RCTs) the gold standard of clinical research (Bondemarkand Ruf, 2015). However, some inherent limitations are shown in the studies in this review. McManus et al. (2021) design was also an RCT; however, it was unmasked; thus, there may be some bias in the results, especially with the self-reported measures such as blood pressure readings and lifestyle adherence. The research does not incorporate something called blinding; they are aware of their treatment status and will be able to over-report positive outcomes (Renjith, 2017). While RCTs are often more trustworthy than observational designs, these self-selection biases could contaminate the test results as well (Krauss, 2018).

Another is that RCTs are highly lauded because of their high internal validity but at the cost of low external validity because the sample may not represent the wider population. In addition, since a large proportion of the research mentioned in this article was performed in European settings, their relevance to populations in other areas with varying healthcare systems, socioeconomic status, and lifestyle limitations is limited (Weiss et al., 2008). For example, studies conducted in the UK in recent years, McManus et al. (2021) and Khanji et al. (2019), have focused on middle-aged and elderly populations with inadequate ethnic diversity.

These findings thus have uncertain applicability to other demographic groups (e.g., younger adults or individuals of different ethnic groups, who may have different cardiovascular risk profiles and responses to interventions) (Kurian et al., 2007).

4.3.2 Sampling and Participant Diversity

Limited to the sample sizes and types of participants, these studies have limitations. For example, the sample size is often larger than required for some studies, which means it does not enable the necessary statistical power to exhibit a meaningful difference between such outcomes (Wittes, 2002). Studies like Sniehotta et al. (2019) are very particular since they could have had a greater number of participants who would have questioned the general validity of their results for vast populations. Furthermore, more diversity in age, ethnicity, and comorbid conditions was necessary to reduce the ability to generalise the results to a more diverse population (Kennedy-Martin et al., 2015). Specifically, in different portions of the population, cardiovascular risk factors, like hypertension and obesity, can be revealed differently, so the effectiveness of the intervention and possible outcomes may diverge (Saffi et al., 2014).

4.3.3 Intervention and Control Group Comparisons

These studies also suffer from a contamination problem due to isolation between the intervention and control groups, in which the effects of the intervention are isolated. Despite the growing popularity of lifestyle intervention and digital tool studies, this is especially problematic for these forms of study because adherence to the intervention is assumed both as a predictor and an outcome of the intervention itself. For example, McManus et al. (2021) provided an intervention and control group, which was probably exposed to similar types of resources, e.g. public health campaigns and general health guidance on healthy behaviours, which would have influenced their results. This contamination means we cannot be certain of the effect that the intervention had (Torgerson, 2001). Furthermore, the differences between

the outcomes from digital interventions and conventional lifestyle approaches (e.g., compare the results in McManus et al. (2021) with the results in Blumenthal et al. (2021)) show the need for further clarity regarding how various types of interventions translate into cardiovascular risk reduction. Diet and exercise remain important modalities in cardiovascular health, but they are less scalable and accessible with digital tools (Halldorsdottir et al., 2020).

4.3.4 Outcome Measures

Another important consideration is the consistency of outcome measures across the studies. Additionally, in many studies aimed at the achievement of physiological markers like systolic blood pressure (Blumenthal et al., 2021) or weight management (Sniehotta et al., 2019), the selection of outcome measures varied. Different studies may report on different aspects of cardiovascular risk management, and without standardisation of outcome measures, the interpretation of results may be biased by such considerations. For example, if an outcome such as an impact of an intervention on adherence, similarly measured in self-reported SMS use like Nanditha et al. (2020), did the actually reported use, in actual fact, result in a change of behaviour? Data from self-reported sources are known to tend to be biased, especially if those responding know what the desired outcome is for a survey (Stone et al., 1999). In turn, adherence could be overestimated, and the hurdles of sticking to improved lifestyle changes could be underestimated.

4.3.5 Study Duration and Follow-Up

However, many of these studies had comparatively short follow-up periods, which means that the long-term effects could not be assessed. For instance, Sniehotta and colleagues (2019) followed the participants for as little as 12 weeks, much less than long enough, to see whether changes to behaviour stay is sustainable over time (Duff et al., 2017). Conversely, differently, longer follow-up studies like Delgado-Lista et al. (2022) can better look at the lasting effects of lifestyle interventions on cardiovascular endpoints. Follow-up for as long as possible is

necessary to know the long-lasting effect of re-intervention on cardiovascular risk factors and relapse to behaviour change.

4.3.6 Data Collection Methods

Moreover, the possible biases for data collection techniques in all types of studies, especially for instruments based on digital tools, were also found. As used by McManus et al. (2021), digital monitoring can be biased. Inaccurate results are indeed possible due to technical errors in digital tools themselves and unreliable data recording by participants. In addition, self-reporting can lead to bias, in which participants respond as what they think is expected or desired socially (Olds et al., 2019). Given the sensitivity of the behaviours under study here, issues with these considerations are essential for sensitive behaviours such as diet and physical activity, in which participants may underreport unhealthy behaviour or report positive changes that do not reflect reality.

4.4 Theme 1: Lifestyle Interventions and Their Efficacy

Lifestyle interventions have become a cornerstone of prevention for individuals at high risk for developing CVD. These interventions usually include modifications in diet, physical activity, smoking cessation, and weight management to reduce risk factors such as high blood pressure, dyslipidemia, and obesity. The programmatic implementation of these lifestyle changes is likely to have an enormous impact on the onset and progression of CVD at both individual and population levels. Their efficacy largely depends on adherence, intervention intensity, and participant engagement.

The efficacy of lifestyle interventions in CVD prevention has been the subject of several studies, which have also revealed successes as well as limitations. To assess the effect of a four-month lifestyle modification programme involving dietary counselling, behavioural weight management and exercise in patients with resistant hypertension, Blumenthal et al. (2021) collected data from 78 participants throughout 4 months. The intervention was

associated with substantial reductions in both clinic and ambulatory systolic blood pressure (BP) relative to standard education and physician advice (SEPA). These data show that structured lifestyle interventions can be successful in lowering BP in a population with resistant hypertension, a particularly poor response to conventional therapies. In addition, cardiometabolic biomarkers, including baroreflex sensitivity and high-frequency heart rate variability, indicated an improved status of cardiovascular health beyond BP management.

In the context of cardiovascular disease secondary prevention, Delgado-Lista et al. (2022) performed a long-term study comparing the low-fat diet with a Mediterranean diet. During a 7-year follow-up, the Mediterranean diet was associated with a lower major cardiovascular event rate than the low-fat diet, especially among men. The study showed that the Mediterranean diet reduced the risk of heart events in people with coronary heart disease.

Ismail et al. (2020) studied the effectiveness of enhanced motivational interviewing as a component of a lifestyle intervention designed to increase physical activity and reduce weight among individuals at high risk of CVD. Nevertheless, the intervention resulted in fewer positive outcomes, and there were no significant improvements in physical activity, weight loss, or cardiovascular outcomes in the intervention group than in cases of usual care. This leads to the conclusion that motivational interviewing is a popular behavioural change strategy, which may be unlikely to produce results in the field of CVD prevention alone.

Nanditha et al. (2020) studied the application of SMS messaging to enhance lifestyle changes for people who have prediabetes. However, use of mobile phone based interventions did not have significant reductions in progressing to type 2 diabetes in the study. This points out some of the potential limitations of digital interventions—and how these limitations could be exacerbated if interventions relied on them exclusively or without access to in-person support and guidance.

In studying patients with stable cardiovascular disease, Van't Klooster et al. (2020) determined how lifestyle changes (smoking cessation, weight loss, and increased physical activity) were associated with reductions in other inflammation markers (e.g., C-reactive protein). All three lifestyle changes were associated with a drop in levels of CRP, a marker of systemic inflammation that is a known risk factor for cardiovascular events. The conclusion is that lifestyle improvements can dampen inflammation and lower CVD risk in patients with established CVD.

Reducing CVD risk factors is one of the main strengths of lifestyle intervention. For example, the various studies by Blumenthal et al. (2021) and Van't Klooster et al. (2020) have shown that structured programmes, including dietary, exercise and weight management interventions, can impact BP, inflammation and heart rate variability measurably. The interventions are holistic in how they prevent CVD, incorporating multiple risk factors at once. Finally, lifestyle changes like smoking cessation, increased physical activity, and healthy eating are cost-effective compared to pharmacological treatments and further add to the well-being advantage.

Despite their promise, lifestyle interventions need to be improved by a number of challenges that may reduce long-term efficacy. One of the key challenges is following the recommended lifestyle changes. While Ismail et al. (2020) and Blumenthal et al. (2021) recognised difficulty in sustaining long-term adherence, some participants needed help to maintain the behaviours associated with the intervention. Factors like the variability in how interventions are delivered – from group-based sessions to digital to counselling – can compound this, for example, by impacting participant engagement and outcomes. Moreover, the intensity of interventions can vary, and lighter interventions, such as SMS reminders, may not be sufficient to drive substantial behaviour change, as seen in Nanditha et al. (2020).

Potentially, there are also biases due to the necessity to rely on reported data about physical activity and diet.

4.5 Theme 2: Digital and Technological Interventions

It has been shown that digital interventions have the potential to influence the management of cardiovascular risks by utilising technology that enhances scalability, accessibility, and patient engagement. The interventions use tools such as mobile applications, online platforms, and wearable devices to enable self-monitoring, personalised feedback and remote support. While these digital interventions show promise, the extent to which they can improve health outcomes remains unknown and subject to further investigation, with trials by McManus et al. (2021), Sniehotta et al. (2019), Mueller et al. (2022), and Khanji et al. (2019) providing evidence into what they can – and cannot – achieve.

The HOME BP trial (McManus et al., 2021) combined self-monitoring of blood pressure with a digital intervention for hypertension management. After one year of use of the digital intervention, participants had better control of systolic blood pressure, with a mean reduction of −3.4 mm Hg when compared to usual care. At low incremental costs, this improvement highlights the role digital tools could play in improving hypertension management with integration into clinical practice. For example, Mueller et al. (2022) tested a web-based self-help programme, SWiM C, to prevent weight gain and increase emotional wellbeing during the COVID-19 pandemic. The intervention resulted in large and significant improvements in psychological determinants (cognitive restraint, uncontrolled eating, and experiential avoidance) that were not statistically significant with respect to weight loss. This illustrates the part that digital interventions can play in addressing overall health determinants, even when direct physical outcomes do not show much change. In Sniehotta et al. (2019), a technology-mediated behavioural intervention for weight loss maintenance (WLM) in adults with (self- or professionally diagnosed) obesity was explored. The intervention was effective in improving

process aspects, e.g. frequency of self-weighing and physical activity, but did not affect weight maintenance compared to standard lifestyle advice.

When compared to standard care, an evaluation of e-coaching in people at elevated cardiovascular risk revealed no additional benefit in terms of risk reduction (Khanji et al., 2019). The mixed results from these suggest that digital interventions may be able to influence health behaviours in positive ways. However, they may have little or no negative impact on clinical outcomes. Digital interventions have one key strength, i.e. they are accessible and scalable. Tool access can extend to diverse populations, including those in remote areas, with continuous monitoring and support possible without frequent in-person consultations. For example, the HOME BP trial showed that it is feasible to integrate digital interventions on top of primary care and, on top of that, allow the patients to monitor their blood pressure and get timely feedback. Such approaches enable more trusting relationships and autonomy, as well as the active participation of patients in the management of their health. Interventions like SWiM-C are also about the psychological dimensions of health — changing the barriers to behaviour change and having a positive impact on emotional wellbeing, which is central to long-term health management.

Digital interventions have many strengths but also face challenges. However, their effectiveness is often limited by low participant engagement and adherence, as evidenced by the NULevel trial by Sniehotta et al. (2019), in which participants on both arms lost similar to the same amount of weight by 12 months followed by similar weight regain. These interventions depend on factors related to digital literacy, motivation, and usability. In addition, results tend to differ within, and especially between, populations; for example, the Khanji et al. (2019) study found that e-coaching did not significantly contribute to benefits beyond usual care. Indeed, such inconsistencies suggest that tailored interventions might be necessary, particularly with respect to individual and contextual factors. The second limitation is that

clinical outcomes are variable. Although digital interventions can enhance intermediate metrics such as self-monitoring behaviour and psychological determinants, these effects might lack transitivity in measurable health outcomes, such as weight loss or risk reduction. Process-related improvements were not always associated with significant changes in weight or indices of cardiovascular risk, as shown in both the SWiM feeding trials and the NULevel calorie restriction trials. Meanwhile, implementation in a real context needs to be properly integrated into the existing healthcare workflows, along with consideration of the digital divide that leaves some groups technologically disadvantaged.

4.6 Theme 3: Peer Support Interventions

Interest in peer support interventions in health promotion has increased greatly in recent years owing to the potential these interventions have to engage individuals to change behaviours and improve health outcomes, with specific promise in the promotion of cardiovascular risk reduction. These interventions rely on trained peers—individuals who share similar health experiences—to offer guidance, encouragement, and support to others facing similar health challenges. In underserved populations where access to healthcare services is limited, peer support can be an alternative to provide a strong and trusted place for social cohesion and long-term health behaviour changes.

The adoption of the Mediterranean Diet in community groups was the focus of one key O'Neill et al. (2022) study on the impact peer support can have. The intervention involved educating peers about the Mediterranean diet with the final aim of improving participants' dietary patterns for improving cardiovascular risk reduction. It is demonstrated that the peer support model of this study was successful at helping people adopt a diet by utilising social connections to motivate people and points out the worth of peer support in a community-based setting. Participants in peer-led groups had better knowledge about diet and better food choices, which infers that peer support might be a good tool for promoting healthy dietary behaviour.

In the same line, Latina et al. (2020) assessed the peer support effect in Grenada for cardiovascular risk reduction. During this study, these peers were taught to help participants maintain their blood pressure, weight, and level of physical activity. Participants who worked with peer supporters had improvement in cardiovascular risk factors, especially blood pressure. In addition, it increased a feeling of community by making people take responsibility for their health. The findings indicate that peer support interventions may be especially effective in a range of cultural contexts in which peer relations may be very ingrained in social norms and community dynamics.

The cost-effectiveness of peer support treatments is one of their main advantages. Peer assistance is comparatively less expensive to adopt than standard healthcare approaches that call for expert involvement. Basic training is needed for peer supporters, and the interventions are easily scalable, with limited resources available in community settings. Because of this, peer support is especially useful in resource-poor environments where healthcare availability can be limited. The second is that peer support is robust in terms of building social networks that facilitate long-term engagement around health behaviours. Peer supporters often become role models for participants, providing consistent encouragement and reinforcement. Maintaining motivation can be greatly aided by this social connection, particularly for those who might otherwise feel alone on their health journey.

Although these are strengths, peer support interventions are challenging. O'Neill et al. (2022) raised one major issue: the recruitment and retention of participants. The study showed that keeping participants engaged in the Mediterranean diet intervention was difficult, with some falling out of the programme because of competing demands or lack of interest. Participation in peer support interventions is generally voluntary, and participation can only be consistent if the participants see something in it for them right away. In addition, it can be

difficult to keep peer supporters' own health behaviours and motivation intact since they will likely be faced with the same barriers as those they are supporting.

Limited evidence regarding the long-term sustainability of the changes initiated through peer support is another challenge. Short-term improvements in health behaviours are frequently reported, but the durability of these improvements has yet to be discovered. Long-term follow-up is crucial to ascertain whether the health advantages seen during the intervention period continue when peer support is removed or if continued help is required. Moreover, little work has been done to determine how peer support can be effectively translated into current healthcare systems and thereby scaled and sustained.

4.7 Chapter Summary

This chapter considered several interventions for controlling cardiovascular risk, such as digital, lifestyle, and peer support interventions. Through digital interventions—mobile health apps that bring personalised monitoring and feedback to patients—such as those that monitor and allow patients to track and manage risk factors like blood pressure and physical activity, they empower patients with information while also allowing physicians and other health care practitioners to engage in collaborative management. Interventions such as dietary modifications and exercise programmes, designed as lifestyle improvements, have been demonstrated to be effective in lowering cardiovascular risk by improving important health behaviours. Although peer support interventions offer community-based support that potentially enhances engagement and adherence to health-promoting behaviours, they entail a variety of challenges. Building on the evidence, a range of cardiovascular risk management approaches are advocated, with recognition of the importance of the patient's lifestyle preferences and health conditions guiding the content of interventions.

5 Chapter 4: Discussion

5.1 Overview of the Chapter

In this chapter, the findings from the previous themes are critically analysed to assess the appropriateness of digital, lifestyle, and peer support interventions in managing cardiovascular risk. This discussion will attempt to integrate the study's results into existing literature regarding the effectiveness of these interventions in various settings and with miscellaneous populations. The chapter attempts to situate the findings within the context of cardiovascular disease risk management by critically evaluating the contributions of each intervention type. The content is divided into several sections. First, lifestyle interventions and the effect of diet and exercise on reducing cardiovascular risk will be examined. Then, part two will explore the findings on digital interventions, describe the findings of the relevant studies, compare them with the findings, and discuss the feasibility, effectiveness, and limitations of the interventions. The third part discusses peer support interventions. Next, it will discuss the limitations of the study, followed by the author's reflections on the process.

5.2 Critical Discussion of Theme 1

The focus of Theme 1 was on the large contribution of lifestyle interventions, particularly diet and exercise, to the reduction of cardiovascular risk. The study revealed that implementing a healthy diet, such as the Mediterranean diet, alongside regular physical activity can have a substantial impact on managing cardiovascular risk factors such as hypertension, hyperlipidemia, and obesity (Blumenthal et al.,2021; Delgado-Lista et al., 2022; Ismail et al., 2020). Important cardiovascular health biomarkers, including blood pressure, cholesterol levels and waist circumference, improved among participants who adopted these lifestyle changes.

The review found that a wide-angle approach was required to achieve a positive cardiovascular outcome, whilst diet and exercise were not viewed as standalone interventions but rather were complementary to each other and combined, they help improve heart health

(Nanditha et al., 2020; Van't Klooster et al., 2020). In addition, the researchers found that patients who received personalised guidance on these lifestyle changes were more successful at achieving these changes, including dietary plans and exercise regimens tailored to each patient (Blumenthal et al.,2021; Delgado-Lista et al., 2022). Regular follow-up and social support, in addition to education, were directly correlated with adherence to these changes and long-term behaviour change.

In line with this approach of personalisation and patient involvement, the methodology for the current systematised review was refocused on studies where ethically sound interventions were implemented to ensure that participants' autonomy, informed consent, and welfare were respected. The interventions selected provided individualised lifestyle coaching based on shared decision-making to respect participant diversity and autonomy (Beauchamp & Childress, 2019).

The results of this investigation are consistent with the study carried out by Sanchez-Aguadero et al. (2026), which also examined diet and physical activity in relation to cardiovascular health. According to the research, diet and exercise lowered cardiovascular risk by improving key health parameters such as cholesterol, blood pressure, and weight management. The present study is consistent with these results and indicates that lifestyle interventions may be effective in cardiovascular risk management.

Nevertheless, the evidence reviewed indicates that the effectiveness of these interventions depends on duration and intensity. Although structured short-term interventions can have a long-term impact on behaviour change, they will not have lasting impacts unless there are booster sessions or digital engagement platforms (Ley & Putz, 2024). An example is that app-based interventions using the COM-B model (Capability, Opportunity, Motivation—Behaviour) have demonstrated the potential to support lasting lifestyle changes after the phase of active intervention (Paterson et al., 2024).

Nevertheless, important differences exist with other research, particularly concerning the efficacy of lifestyle interventions in a variety of demographic subgroups. As an example, the present study identified positive outcomes for several age groups. However, for instance, the study by Zaleski et al. (2016) noted that older individuals might have more difficulty complying with exercise interventions because of physical limitations or comorbidities related to ageing. Moreover, Sullivan and Lachman (2017) noted that people with low socioeconomic status have also faced barriers to adopting lifestyle changes, such as no access to healthy foods or safe exercise space. In generalising the effectiveness of lifestyle interventions, socioeconomic factors should be taken into account.

This review's narrowed scope included studies on health inequities, especially among underserved or marginalised populations, to gain knowledge on intervention accessibility. The use of this approach makes it clear that effective public health practise should not only be effective but must also be fair, affordable, and culturally sensitive (Hoseini, 2024). Focusing on social determinants of health (sometimes called the census tract ‘neighbourhood’) and individual characteristics increases the utility of findings for informing real-world public health policy.

Contradictions regarding the long–term sustainability of lifestyle interventions also exist. Some studies (including the current research) indicate that sustained diet and exercise changes can lead to lasting improvements in cardiovascular health, while others suggest that long-term adherence to lifestyle interventions remains a challenge. Lönnberg, Damberg, and Revenäs (2020) found that participants in their study did improve during the intervention phase. However, they experienced a relapse in behaviour after the programme ended, indicating that the impact of lifestyle interventions may be temporary if ongoing support is not provided.

These findings suggest the need for systemic intervention design changes. Integrating behaviour change theory—such as the Health Belief Model or Self-Determination Theory—

can enhance intrinsic motivation, helping to foster sustainability (Deci & Ryan, 2000). For example, interventions that cultivate competence and relatedness, such as through peer accountability groups, have demonstrated improved adherence in longitudinal studies (Fortuna et al., 2019). Still, these must be critically assessed for transferability across age, gender, and culture.

The reasons for these discrepancies are multiple and include the study design, the duration of the intervention, and the sample size. For example, shorter interventions do not give participants enough time to adapt to new habits, while longer studies might show more dramatic results regarding lasting lifestyle changes. So, differences in outcome metrics can be attributed to the use of different measurement tools or different intensities of intervention.

Furthermore, studies with limited ethical oversight—such as those without transparent dropout tracking or participant feedback mechanisms—risk overestimating effectiveness. Only studies with clear ethical review approval and transparent participant attrition reporting were included in this review to reduce bias and support replicability.

The findings from this study have broad implications for clinical practice. In comparison with pharmacological treatments, lifestyle interventions such as diet and exercise are cost-effective, noninvasive, and relatively easy to do (Netala et al., 2024). Notwithstanding, both of these approaches must meet several parameters, including their cost, accessibility, and patient adherence, to succeed in clinical settings.

However, their ease of implementation is context-dependent. In low-resource healthcare systems, the burden of delivering lifestyle interventions can fall disproportionately on under-supported community staff. Ensuring adequate funding, staff training, and systemic policy support is critical for scalability (Zamboni et al., 2019).

It is important to think about accessibility. Generally, available exercise and dietary interventions are often limited by socioeconomic barriers (Coupe, Cotterill, and Peters, 2018).

For example, people living in lower-income settings may need help to afford the cost of getting healthy food or the ability to be physically active, like going to parks or gyms. In such instances, healthcare providers may need to argue for systemic changes, like a diet and exercise conducive to affordable, good-quality, and safe recreational activities, for improvements to be made. Intervention planning should also consider co-designing with target communities to ensure cultural and contextual relevance. Evidence from community-led models shows that interventions developed in partnership with participants are more likely to be accepted, adhered to, and sustained (Duncan & Kolt, 2019).

One of the greatest challenges to the long-term success of lifestyle interventions is patient adherence. The present study, along with other research (Lönnberg, Damberg, and Revenäs, 2020), demonstrates that adherence typically falls off over time if participants need help to sustain such lifestyle modifications on their own. Regular checkups, digital health tools, and community activities that promote continued engagement are some ways that healthcare providers can help people stay on track. In addition, social support from both healthcare professionals and peer groups assists in helping patients adhere to their treatment regimens and develop accountability for their treatment plans. Long-term digital and social supports can be embedded into intervention frameworks, e.g., remote monitoring apps or peer mentorship schemes, to prevent motivational declines and minimise healthcare dependency (Mateos-González et al., 2024). The problem is to achieve, at the same time, innovation in the digital realm while ensuring equitable access for populations who are not tech-literate or have limited technology infrastructure.

5.3 Critical Discussion of Theme 2

Theme 2 discussed the ability of digital interventions to effectively manage cardiovascular risk, specifically mobile health applications and wearable devices. Interventions in the study significantly improved cardiovascular risk management by allowing real-time

monitoring of blood pressure, heart rate, and physical activity (McManus et al., 2021; Sniehotta et al., 2019). The ease of use and continuous feedback offered by these digital tools increased participants' levels of engagement with their health. In addition, wearable devices like fitness trackers and smartwatches empowered users to consult key health metrics, preparing themselves to make better lifestyle changes.

The digital interventions of this study prioritized data privacy protocols, informed consent procedures, and well-defined intervention frameworks as strict ethical and methodological criteria. This led to narrowing selection criteria to include only those studies in which digital tools were embedded in structured cardiovascular care models to ensure clinical relevance and alignment with ethical frameworks.

Additionally, the study observed that digitising adherence to prescribed medications and lifestyle changes was better—especially when it was part of an overall healthcare system (Mueller et al., 2022; Khanji et al., 2019). This enabled healthcare providers to follow patients up regularly, with the additional advantage of promoting patient accountability and providing the means for timely interventions where necessary.

This integration into broader care systems reinforces the importance of hybrid digital-human approaches. While digital tools facilitate self-monitoring, consistent support from clinicians, community health workers, or digital navigators increases intervention retention and outcomes (Willis et al., 2022). Therefore, intervention frameworks that blend technology with human touchpoints are more likely to succeed.

The results of this study are supported by other studies related to the effectiveness of digital interventions in managing cardiovascular risk. For instance, Buis et al. (2019) found that mobile health apps improved blood pressure tracking, as was seen in this research. They also found that digital interventions may enhance patient engagement with their cardiovascular health, and they demonstrated the capacity of apps to aid medication adherence. Both studies

present these tools as offering continuous monitoring, an important feature for high-risk populations.

It is also worth noting that the positive impact of digital tools appears to be stronger in interventions that personalise feedback based on user data. Tailored messaging, behaviour nudges, and gamified goal-setting, as explored in de Paiva Azevedo et al. (2019), increase patient engagement and reduce dropout. However, these benefits are largely contingent upon user trust in data usage and the system's ability to act on collected information responsibly—highlighting the ethical imperative of transparent data governance.

However, there are some variations from other research. However, many studies, including those by Vaghefi and Tulu (2019), concluded that mobile health apps are extremely useful; some demonstrated less effective results, mainly in maintaining long-term engagement and adherence. For example, Meyerowitz-Katz et al. (2020) reported a high dropout rate from users of digital tools in cardiovascular management while sustained intervention uptake and engagement were observed in this review. These differences could explain the discrepancy, including differences in the patient population, the usability of the digital tools and the length of the intervention.

This study's narrowed scope focused on trials implementing usability testing during development phases, which may explain higher adherence. Interventions co-designed with end users tend to foster greater engagement due to familiarity with the user interface and cultural relevance (Malloy et al., 2023). However, such design features are often absent in generic app-based interventions, possibly contributing to mixed outcomes in the broader literature.

Geographical context might also explain the difference in the findings. For instance, digital interventions did seem to work well in places that had easy access to technology. In contrast, in areas where there was limited access to digital infrastructure, they may have worked better. Similarly, according to Praveen et al. (2014), mobile apps used in rural India had a poor

impact on cardiovascular risk management because of poor internet connectivity and low levels of digital literacy. An examination of these contextual factors could explain some of the variation in outcomes across studies and help highlight the importance of creating digital interventions that fit the setting and population of most interest.

While ethical intervention must be technologically feasible, it must also be inclusive based on digital equity. Studies that excluded participants for lack of access to devices or the internet were excluded from this review as such exclusion risks health disparity reinforcement. However, it did concentrate on interventions where equipment or training support was given, as suggested by O'Connor et al. (2020), who concluded that digital equity interventions can help improve cardiovascular outcomes in underserved populations.

The results support the feasibility of using digital interventions in real-world settings, especially in managing cardiovascular risk. Digital tools also offer numerous advantages, including continuous monitoring, personalised feedback, and more engaged patients (Imison et al., 2016). The implications for healthcare practice are particularly important in resource-constrained settings, where healthcare providers may need help providing frequent in-person visits. Digital interventions can fill the gap, enabling patients to monitor their health in real-time with the advice of healthcare professionals on time without regular hospital visits.

Nonetheless, feasibility does not automatically equate to effectiveness. The sustainability of these interventions depends on ongoing maintenance, software updates, data protection policies, and user re-engagement strategies—elements often underreported in clinical studies. Future research should apply long-term process evaluations to determine whether benefits are retained or diminish after the initial intervention phase.

Also, digital tools can be particularly useful to members of a population for whom barriers might exist in accessing traditional healthcare services. This is convenient and more accessible to the elderly, people living in remote areas, or those with low socioeconomic status

(Hodge et al., 2017). Cost-effective digital interventions for managing hypertension, diabetes, and obesity (common contributors to cardiovascular diseases) are thought to help reduce the burden on healthcare systems.

However, it is important to remain cautious. While such interventions offer promise in bridging care gaps, if poorly designed or inadequately supported, they may inadvertently increase health disparities. Dalmer et al. (2022) state that health is being datafied, which can lead to new ways of excluding people if digital literacy is expected rather than addressed. As a result, ethical implementation must guarantee that digital interventions will be flexible concerning literacy, language, and ability levels.

However, promising findings still exist for digital interventions, but there are still limitations to address if we want to maximise their impact. The first major challenge is that there is a digital divide where smartphones, wearables, and reliable internet are easily accessible. However, low socioeconomic groups need access to such devices. Without requisite access to these resources, at the individual level, individuals may be excluded from the benefits of digital health interventions, depending upon the degree of disparity in the effectiveness of these digital tools (Hollis et al., 2017). In addition, older people, who are at the greatest risk of cardiovascular diseases, often have problems using new technologies due to a lack of familiarity or physical constraints.

Finally, the ethical use of algorithmic recommendations in these tools is considered. With no transparency in the development or testing for bias in algorithms, incomplete datasets may result in skewed guidance from the algorithms (Chen et al., 2023). Ensuring algorithmic accountability and diversity in training data is necessary for accurate and fair interventions.

A second limitation of digital interventions is patient adherence over time. However, like many other things, initial enthusiasm for mobile health apps and wearables may take time, leading to most users leaving the space. Studies such as Meyerowitz-Katz et al. (2019)

observed that dropout rates climbed as the intervention interval extended. Digital interventions are, therefore, only sometimes effective because they are not always updated continuously, personalised, and integrated into patients' daily routines.

Therefore, digital interventions should be seen not as standalone solutions but as complementary to personalised, patient-centred care that includes regular human interaction, adaptive learning algorithms, and ethically guided monitoring systems to promote sustained behavioural change over time.

5.4 Critical Discussion of Theme 3

Peer support interventions have become promising strategies to enhance cardiovascular risk management in underserved populations. Theme 3 highlights that peer-led programmes make lifestyle changes more feasible by incorporating shared experiences and social reinforcement. For example, participants tend to report increased motivation and an increase in adherence to healthy behaviours partly because of their relatable nature. Peer support seems especially consequential in underserved populations where healthcare access is limited, there is cultural mistrust, and there are health literacy barriers (Gower et al., 2022). The findings indicate that, overall, peer support can decrease cardiovascular risks and lead to better health outcomes in certain communities with significant health disparities. This study employed a methodology that prioritised ethical recruitment practises, cultural sensitivity and clear inclusion criteria and focused on peer-led interventions embedded within a community health framework. To ensure consistency and ethical soundness across studies, only those peer programmes were included wherein participation was voluntary, informed consent was obtained, and there was structured training of the peers.

By contrasting these results with those of O'Neill et al. (2022) and Latina et al. (2020), important information on the wider applicability of peer support interventions can be gained. O'Neill et al. (2022) determined that peer support models promoted adherence to Mediterranean

diets in middle-aged adults, which reduced cholesterol and improved markers for cardiovascular health. Likewise, Latina et al. (2020) found that peer-led programmes in rural areas raised participation in healthy lifestyles and decreased hypertension rates.

These findings reinforce that the peer model's design, setting, and cultural alignment inform intervention outcomes. For instance, urban and middle-income populations have a higher baseline of health literacy, and highly structured peer-led sessions produce better results (Rose-Clarke et al., 2019). On the other hand, more unstructured interventions may accommodate more flexibility in resource-poor or rural environments but suffer from a lack of consistency and data quality.

Although Theme 3's results confirm these studies' findings regarding the value of peer support, there are variations in the populations and environments examined. For example, urban populations with moderate access to healthcare were studied by O'Neill et al. (2022), whereas Latina et al. (2020) studied rural areas low on resources. Also, outcomes may be influenced by cultural factors. The promotion of, for example, the Mediterranean diet may have greater resonance among populations with which such dietary patterns might be more familiar, as described by O'Neill et al. (2022). In contrast, populations within Theme 3 may need culturally tailored interventions in order to feel relevant and engaged.

The narrowed scope of this review allowed for greater scrutiny of cultural congruence within peer interactions. Interventions that adapted messaging, dietary guidance, and communication styles to local norms—such as language use, dietary customs, and family dynamics—were more effective in sustaining behavioural change (Litvin et al., 2024). Nevertheless, such tailoring also raises ethical questions regarding representation: Who defines cultural relevance, and are marginalised subgroups adequately represented in the co-creation process?

Similarly, variations in peer support models may generate contrary findings. O'Neill et al. (2022) used structured group sessions led by trained peers, and Latina et al. (2020) used informal, community-based approaches. These differences in structure and intensity could explain the variability in participant adherence and health outcomes.

Future research should differentiate between models based on peer qualifications, frequency of interaction, and integration with formal healthcare systems. Peer interventions operating in silos, without health system linkage, often lack continuity of care and monitoring—limiting their long-term impact (Peiris et al., 2024). However, programmes that include periodic professional oversight risk shifting the dynamic from peer-to-peer to hierarchical, potentially undermining the perceived authenticity that makes peer support uniquely effective.

Cardiovascular risk management offers considerable potential for peer support interventions as cost-effective for scalable solutions (Subed et al., 2020). Their reliance upon community members to develop content improves the cost profile and cultural relevance, making them uniquely suited for underserved populations. Furthermore, peer support services can complement existing healthcare models by reaching hard-to-reach communities. Nonetheless, cost-effectiveness must not override ethical responsibilities. For instance, peer leaders often work voluntarily or are underpaid, raising concerns about exploitation, burnout, and programme sustainability. Establishing ethical remuneration structures and offering ongoing training and mental health support is critical for protecting peer supporters (Puschner et al., 2019).

There are, however, challenges, particularly in the recruitment and retention of peer supporters. Attrition rates for leaders and participants can hinder long-term programmes. To address these challenges, better training, financial incentives, and continued support will be needed to keep peer leaders engaged. Moreover, implementation through the use of technology,

i.e., cell phones and the internet, can promote communication and help expand the reach of peer support programmes.

Yet, integrating digital tools into peer programmes introduces additional ethical and practical issues, such as digital exclusion, data privacy, and the need for digital literacy training. While technology can enhance scalability, it may also alienate populations most in need if accessibility concerns are not addressed from the outset (Zidaru et al., 2021). Therefore, peer support models must adopt hybrid approaches that combine face-to-face engagement with inclusive digital strategies.

5.5 Limitations of the Study

The setting for understanding this study's results is developed by acknowledging many limitations in it. The studies themselves have little statistical power because the sample that is usually used is small and may need to be improved. In particular, when it comes to cardiovascular risk management, demographic characteristics of age, socioeconomic level, and comorbidities play a great role in the results (Joseph et al., 2022).

The study also needs to revise data reliability and measurement. For example, such data could be self-reported; participants may provide information about their lifestyle changes (diets or amounts of physical activity), which could be subject to social desirability bias (The et al., 2023) whereby participants report behaviour that they identify as socially acceptable behaviour when in reality they do not act in this way. Moreover, using short-term follow-up measures, the study ignores the long-term sustainability of interventions that could potentially impact the effectiveness of the interventions in the real world.

The results may also have been influenced by external factors that were not within the control of the study. For example, these outcomes might have been possible because the ability of participants to engage in lifestyle or peer support interventions may not have been possible through the COVID-19 pandemic and related public health restrictions. Moreover, economic

status, such as differences in income or the availability of healthcare resources, was changed and, hence, affected the difference in adherence to the interventions.

Finally, a major issue is generalisability (Weise et al., 2020). It also provides some very important tips on the management of cardiovascular risk. However, the focus of the UK and European countries, and possibly the findings, need to be more challenging to generalise to other populations, settings, or countries that are complete for implementation. Variations in healthcare infrastructure, cultural attitudes and economic conditions may also affect the feasibility and effectiveness of the interventions assessed (Lee et al., 2020). Future research with larger, more diverse samples over longer durations is also needed to improve the applicability of findings from this research.

5.6 Researcher Reflections

This research was rewarding and challenging, and there was a lot to learn. Since cardiovascular risk management is a huge body of literature, navigating it and combining findings from multiple sources presented a major challenge. Balancing the analysis of digital, lifestyle, and peer support interventions in a limited time frame requires careful organisation and time management. These challenges were achieved through the development of a consistently structured research framework and consistent engagement with supervisory feedback. It enabled the researcher to improve critical appraisal of the evidence systematically and come up with cohesive findings.

During the research process, bias and objectivity were crucial considerations. The researcher's professional background and pre-existing interest in promoting preventive healthcare may have shaped the interpretation of findings. For example, there was an inherent inclination that lifestyle interventions would be particularly impactful. In order to lessen this tie, a reflective approach was undertaken through regular peer debriefs and consulting a wide

array of high-quality sources for balanced analysis. This practice helped to strengthen the study's objectivity and added rigour to conclusions (Armour, Rivaux, and Bell, 2009).

Future research based on this study indicates the need for larger and more robust designs, at least employing larger randomised trials in diverse populations. Wider follow-up duration would allow explicit evaluation of the sustainability of interventions. Mixed-methods approaches might also provide deeper insights into the experiences and adherence behaviours of participants, which remain major challenges to cardiovascular risk management.

The researcher has developed personally and professionally beyond measure as a result of this process. Most of all, it bolstered the message about critical thinking, evidence-based practice and reflective learning. This has helped the researcher understand more deeply the complexity of public health work and the valuable contribution that interdisciplinary approaches can make, contributing to health promotion and policy development and has further informed about the complexities of an ethical research approach.

5.7 Chapter Summary

Comparing existing research, this thesis critically analysed findings across three themes: digital, lifestyle and peer support interventions for cardiovascular risk management. Key insights revealed the possibility of these interventions to optimise cardiovascular health outcomes, but challenges, including adherence and sustainability, remain. The study demonstrates value in considering an integrated approach to risk management that incorporates multiple personalised dimensions. Examining practical ramifications, cost-effective digital tool usage guidelines, peer support, and giving accessible lifestyle change a priority. These findings highlight the necessity of policies that would advance holistic and equitable ways of treating cardiovascular health for a variety of populations.

6 Chapter 5: Conclusions and Recommendations

6.1 Introduction to the Chapter

This chapter establishes the main findings of the study and sets actionable recommendations to improve cardiovascular risk management. It discusses the practice implications of the findings and suggests directions for future research. Efforts are made to study the efficacy of lifestyle, as well as digital and peer–support interventions to reduce cardiovascular risks. These findings underline the importance of integrating diverse, patient-centred strategies into practice. The objective of this chapter is to synthesise these insights into conclusions consistent with the research objectives and to provide practical and research-oriented recommendations intended to enhance cardiovascular care.

6.2 Conclusions

This study examined the role of lifestyle, digital, and peer support interventions in managing cardiovascular risk in different populations. The prime objectives were to evaluate the contributions of these interventions to promoting health behaviours and reducing cardiovascular risks.

Lifestyle interventions were shown to encourage sustainable behaviour change that substantially diminished the risk for cardiovascular problems. There is evidence that specific lifestyle programmes are more helpful in achieving better patient outcomes when accompanied by professional counselling.

The results are based on the updated methodology that included rigorous inclusion criteria for trials that measure long-term follow-up and ethical issues, including equity in access. The focus on patient-centred outcomes ensured that the analysis fit the population where the need was focused, especially in the socioeconomically disadvantaged groups. The study also shows that lifestyle interventions work, although adherence levels depend on

ongoing behavioural support, indicating the need for integrated, professionally supported programmes.

Mobile health apps and wearable devices have shown a capacity to improve patient adherence and provide continuous monitoring as digital interventions. Those tools help increase accessibility, for example, to patients in remote areas or who need ongoing support in self–managing their conditions. It has been demonstrated that digital interventions can track health parameters, but success is reliant upon user engagement and technological literacy.

These tools have great potential for impacting cardiovascular outcomes. Still, there are significant barriers to their implementation, including barriers to digital illiteracy, the unaffordability of devices, and the lack of internet connectivity. Engagement is likely high at first but drops off without continued motivation and integration into patients' everyday lives. This has reinforced the importance of adaptive digital health strategies that customise interventions according to real-time feedback and behavioral patterns. It entails the ethical need to ensure GDPR-compliant informed consent and data privacy for users on digital platforms.

Peer support interventions were found to be cost-effective for promoting community engagement and cardiovascular health in underserved populations. Although there are still issues with recruitment and retention, these treatments aid in creating social networks that promote sustained adherence to healthy behaviours.

Highlights of the review's refined scope include the value of peer support in communities that experience structural barriers to formal healthcare. However, there are still challenges to consistency in peer leader training, long-term sustainability, and quality assurance. Yet peer-led initiatives can be culturally relevant and emotionally resonate with ethnic minority groups. Yet, their effectiveness can depend on organisational support, incentives, and the delivery format. The review design also addressed ethical issues such as safeguarding peer leaders and boundaries of roles.

These findings indicate that digital, lifestyle, and peer support interventions can complement each other to provide a holistic approach to cardiovascular risk management. For example, digital platforms can deliver lifestyle programmes and relate them to peer networks. Taken together, these results highlight the requirement for interventions that can span several modalities and account for patient demographics and health conditions.

The chapter's discussion includes findings from an intersectional lens that effective cardiovascular risk reduction depends on the intervention type and how it is implemented in context-specific environments. Hybrid models integrating digital tracking with personalised lifestyle advice and community-based peer support could offer scalable, ethical, and inclusive solutions—particularly in health systems strained by resource limitations. However, more longitudinal and mixed-method research is required to evaluate these integrated approaches in diverse populations.

The findings suggest the potential of using these interventions in clinical practice to improve cardiovascular care. This study's findings contribute to the general understanding of innovative, patient-centred approaches to improving cardiovascular outcomes, particularly in resource-constrained settings.

The study advances an ethically sound and evidence-driven argument for expanding multi-modal cardiovascular interventions by aligning with the methodological framework. Clinical implications include the need for policy alignment with health equity priorities, investment in digital infrastructure, and the formal recognition of peer support systems as part of public health strategy.

6.3 Practice Recommendations (Implication for Nursing Practice)

Evidence-based approaches can and must be integrated into nursing practice to enhance cardiovascular risk management outcomes. Adopting digital tools, such as mobile health apps, wearables, and telehealth, is highly recommended. The tools serve as avenues for continuous

monitoring and provide real-time feedback to ameliorate the process of patient self-management. Successful implementation requires the training of nurses to become digitally literate. The focus of training programmes, therefore, should be on understanding the technology, interpretation of data and empowering patients to use these tools to good effect (Ullah et al., 2023).

Though many advances have been made in cardiovascular medicine, promoting lifestyle changes continues to be a cornerstone of cardiovascular health. Patient education on diet and exercise must be the focus of nurses, and advising on such issues should be considered culturally relevant and in line with patient socioeconomic contexts. Further, engaging interventions tailored to an individual's context can enhance engagement and adherence—as with motivational interviewing and behavioural change techniques. These approaches allow patients to set attainable goals as well as to sustain long-term health behaviours (Kris-Etherton et al., 2022).

Offering low-cost interventions to enhance cardiovascular risk management and making peer support interventions easier to implement would be advantageous to the healthcare system. Community-based peer support programmes can be established through nursing professionals. These programmes can only be sustained when nurses have the skills to train and support peer leaders, involving participants in a community. Peer networks can relieve social isolation and promote accountability for certain health behaviours (Freak-Poli et al., 2021).

The last one is delivering holistic and person-centred care. In order to personalise interventions, nurses should evaluate each patient's needs and preferences. This includes collaborating with multidisciplinary teams to deliver coordinated care that involves both medical and psychosocial approaches to cardiovascular risk. The person-centred approach also improves patients' satisfaction and health outcomes, which reinforces nurses' significant roles in cardiovascular care (Cheng et al., 2024).

6.4 Research Recommendations

Further studies are required to advance the effectiveness of culturally tailored programmes in lifestyle interventions in diverse populations. Research is needed on how the diet and exercise recommendations can be tailored to adhere to cultural practices and socioeconomic factors to improve adherence (Seixas et al., 2020). Evaluating the long-term sustainability of lifestyle modification trials initiated in healthcare settings necessitates longitudinal studies. Critical to evaluating the effectiveness of these programmes will be an understanding of whether these behavioural changes persist after the intervention.

Future studies on digital interventions should concentrate on assessing the long-term effectiveness of wearable technology, telemedicine, and mobile health apps, especially for older and underprivileged groups. However, these groups may need help getting used to using digital tools, such as a lack of access to technology or health literacy barriers. It would equally be valuable to investigate the potential of AI to improve the personalisation and engagement of digital interventions. AI can help suggest more personal health recommendations using patient data, improving the effectiveness of those interventions over time (Alowais et al., 2023).

Future research in the area of peer support is needed to address the issue of whether and how peer support interventions can be scaled and sustained in resource-constrained settings. Community-based programmes should be studied to see what effect they have on cardiovascular risk reduction and how peer support can be introduced into underserved communities. Furthermore, the possibility for the growth of virtual peer networks should be explored to enhance the availability of peer support interventions and tackle difficulties of isolation by geographic location (Harrison et al., 2023).

Studies that compare the combined effect of digital, lifestyle, and peer–support interventions on cardiovascular health outcomes are required. This research would elucidate which multimodal approaches are best for managing cardiovascular risk. Additional

methodological improvements are needed to incorporate a broader set of populations and improved evaluation design approaches. This would increase the generalisability of findings and clarify how these interventions can be used with other demographic groups.

6.5 Concluding Remarks

This review represents an important step toward understanding the practical and theoretical value of digital, lifestyle, and peer support interventions for cardiovascular risk management by offering practice and theoretical value. The results affirm that effective prevention of cardiovascular health risks will require multi-modal, patient-centered approaches. Digital tools, changing lifestyles and peer support offer opportunities to personalise and make accessible and sustainable services. Finally, the integrated strategies proposed in this research will be of interest to policymakers, healthcare professionals, and researchers as the best way to advance cardiovascular health outcomes and alleviate the burden of cardiovascular diseases on individuals and healthcare systems worldwide.

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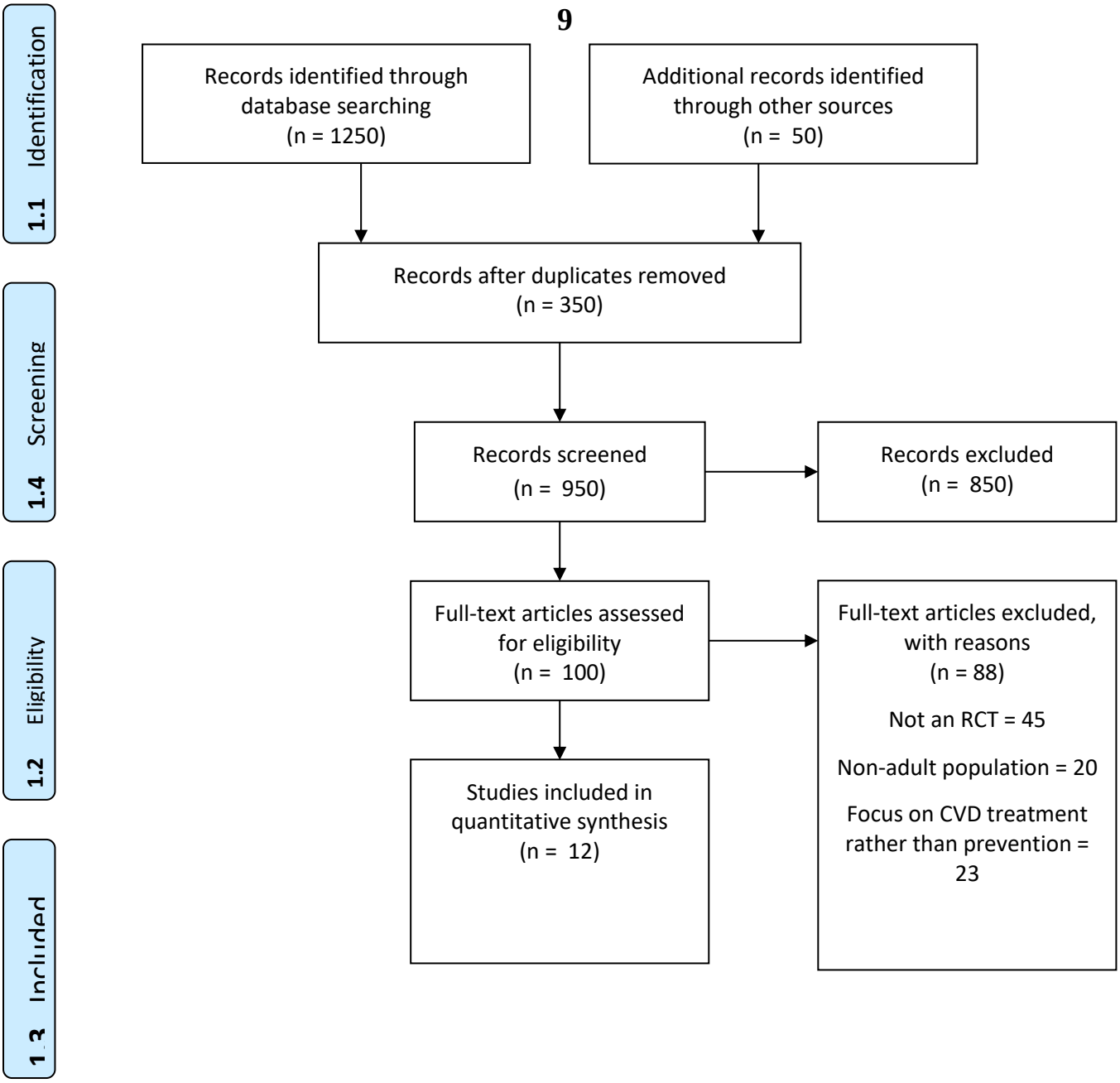
8 Appendix A – PRISMA Flow diagram



11 Appendix B CASP Tool

	McManus, et al., 2021	**Nanditha et al., 2020**	**Sniehotta et al., (2019)**	**Mueller et al., (2022)**	**Byrne et al., (2020)**	**Ismail et al., 2020**	**Khanji et al., (2019)**	**Van't Klooster et al., (2020)**	**Blumenthal et al., (2021)**	**Delgado-Lista et al., (2022)**	**O'Neill et al., (2022)**	**Latina et al., (2020)**
Did the study address a clearly formulated research question?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Was the assignment of participants to interventions randomised?	Yes	Yes	Yes	Yes	Yes	No	Yes	No	Yes	No	Yes	No
Were all participants who entered the study accounted for at its conclusion?	Yes	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes	Yes
Were the participants 'blind' to intervention they were given?	No	Yes	Yes	No	Yes	Yes	No	Yes	No	Yes	No	No
Were the investigators 'blind' to the intervention they were giving to participants?	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Were the people assessing/analysing outcome/s 'blinded'?	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	No	Yes
Were the study groups	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes

similar at the start of the randomised controlled trial?												
Apart from the experimental intervention, did each study group receive the same level of care (that is, were they treated equally)?	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Were the effects of intervention reported comprehensively?	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Was the precision of the estimate of the intervention or treatment effect reported?	No	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes	Yes
Do the benefits of the experimental intervention outweigh the harms and costs?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Can the results be applied to your local population/ in your context?	Yes	Yes	No	No	Yes	No	Yes	No	Yes	Yes	Yes	Yes
Would the experimental intervention provide greater value to the people in	Yes	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	No	Yes

your care than any of the existing interventions?												

12 Appendix C – Matrix of Evidence

Author, Date and Country of Origin	Methodology	Data collection	Population	Analysis strategy	Key Findings	Limitation
McManus, et al., 2021, United Kingdom	Randomised controlled trial	Participants were randomised by using a minimisation algorithm to self-monitoring of blood pressure with a digital intervention (305 participants) or usual care (routine hypertension care, with appointments and drug changes made at the discretion of the general practitioner; 317 participants).	622 people with treated but poorly controlled hypertension (>140/90 mm Hg) and access to the internet.	The digital intervention provided feedback of blood pressure results to patients and professionals with optional lifestyle advice and motivational support.	The primary outcome was the difference in systolic blood pressure (mean of second and third readings) after one year, adjusted for baseline blood pressure, blood pressure target, age, and practice, with multiple imputation for missing values.	Some evidence was found of preferential recruitment of those with higher socioeconomic status, although we found no evidence that socioeconomic status mediated outcomes.
Nanditha et al., 2020, United Kingdom	Randomised controlled trial	The study was performed in people with prediabetes (n = 2062; control: n	Participants were recruited from public and private sector organisations in India	Participants were assessed at baseline and at 6, 12 and 24 months. The primary outcome was conversion to type 2 diabetes and secondary outcomes included anthropometry, biochemistry, dietary and physical activity	This trial in two countries with varied ethnic and cultural backgrounds showed	This analysis may be under-powered to investigate differences in a low effect size.

		= 1031; intervention: n = 1031) defined by HbA1c ≥42 and ≤47 mmol/mol (≥6.0% and ≤6.4%).	(men and women aged 35-55 years) and by the National Health Service (NHS) Health Checks programme in the UK (aged 40-74 years without pre-existing diabetes, cardiovascular disease or kidney disease	changes, blood pressure and quality of life.	no significant reduction in the progression to diabetes in 2 years by lifestyle modification using SMS messaging.	
Sniehotta et al., (2019); United Kingdom	Randomised controlled trial	A web-based randomisation system to assign participants to either standard lifestyle advice via newsletter (control arm) or a technology-mediated low-intensity behavioural WLM programme (intervention arm).	288 adults recruited April 2014 to May 2015 with weight loss of ≥5% within the previous 12 months, from a pre-weight loss BMI of ≥30 kg/m2.	The intervention comprised a single face-to-face goal-setting meeting, self-monitoring, and remote feedback on weight, diet, and physical activity via links embedded in short message service (SMS).	There was no difference in the WLM of participants who received the NULevel intervention compared to participants who received standard lifestyle advice via newsletter. The intervention affected some, but not all, process-related secondary outcomes of the trial.	Potential limitations, such as the use of connected weighing study in both trial arms, the absence of a measurement of energy intake, and the recruitment from one region of the United Kingdom, are discussed.
Mueller et al., (2022); United	Randomised controlled trial	We randomized adults (BMI ≥25	Adults with overweigh	We estimated differences between study groups in change in outcomes from baseline to 4 months using	SWiM-C improved several psychologi	However, differences in weight and some

Kingdom		kg/m2) to SWiM-C or to a wait-list standard advice group. Participants completed outcome assessments online at baseline and 4 months	t and obesity	linear regression, adjusted for outcome at baseline and the randomization stratifiers (BMI, sex). The trial was pre-registered	cal determinants of successful weight management and had a protective effect on wellbeing during the pandemic.	other outcomes were compatible with no effect of the intervention, suggesting further refinement of the intervention is needed.
Byrne et al., 2020; United Kingdom	Randomised controlled trial	The 3R intervention involved two facilitated, structured group education sessions focusing on medication adherence to statins, lifestyle behaviours and cardiovascular risk, with 44 weeks of medication reminders and motivational text messages and two supportive, coaching phone calls (at approximately 2 weeks and 6 months).	Participants ($n = 212$) prescribed statins for primary prevention of cardiovascular disease with total cholesterol level ≥ 5 mmol/l were randomised: 105 to the intervention group and 107 to the control group, stratified by age and sex.	Pragmatic randomised controlled trial recruited between May 2016 and March 2017 from primary care practices, England.	The 3R programme successfully led to longer-term improvements in important clinical lifestyle indicators but no improvement in medication adherence, raising questions about the suitability of such a broad, multiple risk factor approach for improving medication adherence for primary prevention of CVD.	Not generalisable results to other countries
Ismail et al., 2020;	Randomised	A three-arm, single-	Patients aged 40-74 years	The intervention was enhanced motivational interviewing which included	Enhancing motivational	The QRisk2 had a high

United Kingdom	controlled trial	blind, parallel-group randomised controlled trial was conducted in consenting primary care centres in south London.	with a QRisk2 score ≥20.0%	additional behaviour change techniques and was delivered by health trainers in 10 sessions over 1 year, in either group (n=697) or individual (n=523) format. The third arm received usual care (UC; n=522).	interviewing with additional behaviour change techniques was not effective in reducing weight or increasing physical activity in those at high CVD risk.	false-positive rate (figure 1) because the medical records required for its algorithm were not always accurate resulting in high levels of ineligibility.
Khanji et al., 2019; United Kingdom	Randomised controlled trial	Between June 2013 and May 2015, 402 participants were allocated 1:1 to e-coaching and SOC versus SOC. Participants free of manifest cardiovascular disease, with internet access, and a 10-year QRISK2 cardiovascular risk of ≥10% were enrolled.	Participants with cardiovascular disease	Change in oscillometric carotid-femoral pulse wave velocity (PWV) from baseline to six months was the primary endpoint. Secondary outcomes included change in blood pressure (BP), weight, and risk scores. Analysis was by intention to treat.	In individuals at increased cardiovascular risk, a comprehensive 'health check' program modestly reduced future risk. Personalized e-coaching did not provide added risk reduction.	Researchers were not blinded and although we were strict in following the pre-specified protocol this may have led to possible bias
Van't Klooster et al., 2020; United Kingdom	Randomised controlled trial	In total, 1794 patients from the UCC-SMART cohort with stable cardiovascular disease and CRP	1794 patients from the UCC-SMART cohort with stable cardiovascular disease and CRP levels	The relation between changes in smoking status, weight, physical activity, alcohol consumption, a summary lifestyle improvement score and change in plasma CRP concentration was evaluated with linear regression analyses.	Smoking cessation, increase in physical activity, and weight loss are related to a decrease in CRP concentration in patients	The reported lifestyle habits by questionnaires at two time points (baseline and follow-up), which might not be

		levels ≤10 mg/L, who returned for a follow-up study visit after median 9.9 years (IQR 5.4-10.8), were included.			with stable cardiovascular disease.	representative of the complete follow-up period.
Blumenthal et al., 2021; United Kingdom	Randomised controlled trial	The primary end point was clinic systolic BP; secondary end points included 24-hour ambulatory BP and select cardiovascular disease biomarkers including baroreflex sensitivity to quantify the influence of the baroreflex on heart rate, high-frequency heart rate variability to assess vagally mediated modulation of heart rate, flow-mediated dilation to evaluate endothelial function, pulse wave velocity to	One hundred forty patients with resistant hypertension (mean age, 63 years; 48% female; 59% Black; 31% with diabetes; 21% with chronic kidney disease)	The primary end point was clinic systolic BP; secondary end points included 24-hour ambulatory BP and select cardiovascular disease biomarkers including baroreflex sensitivity to quantify the influence of the baroreflex on heart rate, high-frequency heart rate variability to assess vagally mediated modulation of heart rate, flow-mediated dilation to evaluate endothelial function, pulse wave velocity to assess arterial stiffness, and left ventricular mass to characterize left ventricular structure.	Diet and exercise can lower BP in patients with resistant hypertension. A 4-month structured program of diet and exercise as adjunctive therapy delivered in a cardiac rehabilitation setting results in significant reductions in clinic and ambulatory BP and improvement in selected cardiovascular disease biomarkers.	Because TRIUMPH was conducted at a single site, there may be concerns about the generalizability of these findings

		assess arterial stiffness, and left ventricular mass to characterize left ventricular structure.				
Delgado-Lista et al., 2022; Spain	Randomised controlled trial	Patients were randomly assigned in a 1:1 ratio by the Andalusian School of Public Health to receive a Mediterranean diet or a low-fat diet intervention, with a follow-up of 7 years.	Patients with established coronary heart disease (aged 20-75 years)	A team of dietitians did the dietary interventions. The primary outcome (assessed by intention to treat) was a composite of major cardiovascular events, including myocardial infarction, revascularisation, ischaemic stroke, peripheral artery disease, and cardiovascular death.	Mediterranean diet was superior to the low-fat diet in preventing major cardiovascular events. Our results are relevant to clinical practice, supporting the use of the Mediterranean diet in secondary prevention.	Not generalisable results to other countries
O'Neill et al., 2022	Randomised controlled trial	Participants were recruited and randomised to receive either a 12-month Peer Support (PS) intervention (PSG) (n 2) or a Minimal Support intervention (educational materials only) (MSG) (n 2).	Four established community groups with members at increased Cardiovascular Disease (CVD) risk and homogenous in gender	The feasibility of the intervention was assessed using recruitment and retention rates, assessing the variability of outcome measures (primary outcome: adoption of an MD at 6 months (using a Mediterranean Diet Score (MDS)) and process evaluation measures including qualitative interviews. Recruitment rates for community groups (n 4/8), participants (n 31/51) and peer supporters (n 6/14) were 50 %, 61 % and 43 %, respectively.	An increase in MD adherence was evident in both groups during follow-up	The challenges faced in recruitment and retention suggest a definitive study of the peer support intervention using current methods is not feasible and refinement based on the current feasibility study should be

						incorporated.
Latina et al., 2020	Randomised controlled trial	Subjects were randomized in a 1:1 fashion to a peer-group based intervention group (n = 206) or a self-management control group (n = 196) for 12 months.	402 adults from the Grenada Heart Project (GHP) Cohort Study of 2827 subjects with at least two CV risk factors	he primary outcome was the change from baseline in a composite score related to **B**lood pressure, **E**xercise, **W**eight, **A** limentation and **T**obacco (FBS, Fuster-BEWAT Score), ranging from 0 to 15 (ideal health = 15). Linear mixed-effects models were used to test for intervention effects.	The GHP-CHANGE trial showed that a peer-support lifestyle intervention program was feasible;	The fact that each cardiovascular health metric has equal weight in calculating the FBS might have limited the ability to find significant differences.