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Cardiac Telehealth Rehabilitation: Empowering the Patient

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Cardiac Telehealth Rehabilitation: Empowering the Patient

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Abstract

Coronary artery disease or coronary heart disease is one of the leading causes of death in the world. Center-based cardiac rehab has long been a sustainable answer for recovery from an acute coronary event. However, the COVID-19 pandemic halted in-person appointments for cardiac rehab patients. Therefore, patients and their healthcare team met virtually. The objective of this literature review is to discover the efficacy and cost-effectiveness of cardiac telerehabilitation, as it will likely have a more prominent role in patient recovery from acute myocardial infarctions. To determine this, a literature review was conducted based on recent studies involving coronary artery disease patients in a center-based cardiac rehab and telehealth-style cardiac rehab. Twenty-one articles were reviewed, and five themes were revealed. These include lifestyle modifications, secondary prevention, patient-led care and adherence, technology during COVID-19, and cost-effectiveness. From these themes, a concept map was constructed. The literature revealed no statistically significant difference in patient outcomes between telehealth-based and center-based cardiac rehab. Telehealth rehab also demonstrated cost-effectiveness in various delivery methods including telephone, short messaging services, mobile applications, and video calls. Therefore, it can be concluded that cardiac telehealth rehab can be offered as a primary option for cardiac rehab. With the common barriers to attending in person cardiac rehab including schedule, geographical barriers, and the COVID-19 pandemic, telehealth rehab offers the patient relief of some of these barriers.

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Cardiac Telehealth Rehabilitation: Empowering the Patient

Introduction

Cardiovascular disease (CVD) remains the number one cause of mortality, which is responsible for 31% of deaths in the world (Han et al., 2019). Although there have been significant advancements in the medical management of the disease, it still remains the leading cause of death. Factors that remain an issue are sedentary lifestyle, unhealthy diet, and cigarette smoking (Richardson et al., 2019). The treatments for CVD include revascularization by way of coronary angiogram, coronary artery bypass graft, or medical management. For patients who receive any of the three interventions, the risk of hospital readmission in the first year after diagnosis of CVD is high. In the United States approximately 720,000 people receive a new diagnosis of acute myocardial infarction and half suffer from recurrent episodes. The Agency for Healthcare Research and Quality released national data, revealing that 20% of Medicare patients hospitalized for acute myocardial infarction are readmitted within 30 days of hospital discharge. Hospital readmissions are not only a burden on the patient physically but are also a financial liability for both the patient and the healthcare system. This results in a total cost of \$693 million from the delivery of hospital expenses (Spaulding et al., 2019).

A secondary coronary event prevention method that has been in effect for decades is cardiac rehabilitation (CR). Comprehensive CR is one of the most successful and cost-effective interventions in CVD. Patient benefits from CR include improvements in morbidity, reduced hospital admissions, increased physical activity, exercise capacity, psychological wellbeing, and increased health related quality of life (Dalal et al., 2021). CVD patients are encouraged to be active members in their disease management. CR educates the patient on their disease; therefore,

empowers them to take control of their disease and make conscious efforts to participate in their care and self-management role (Dinesen et al., 2021).

One barrier to attending CR over the last two years has been the Coronavirus Disease 2019 pandemic (COVID-19). Patients with chronic conditions, not specifically CVD, have seen a large decline in in-person appointments in an effort to reduce exposure to COVID-19. This led to lower rates of CR attendance along with some healthcare systems halting in-person programs during the wake of the pandemic. Therefore, CVD patients had few resources to guide them through secondary prevention (Kendzerska, 2021). The issue has highlighted the need for the healthcare system to create alternative delivery methods for CR. The advancement of technology has increased the cultivated application of digital health interventions. The increasing number of digital health tools, which include wearable and smart devices, have made early or real-time detection, monitoring, and intervention possible for CVD patients to prevent events that are consistent with high morbidity and mortality (Jiang et al., 2019).

Background and Rationale

Over three quarters of those deaths occur in low to middle income countries (Han et al., 2019). CR dates as far back as 1772 when Heberden noted a patient with angina pectoris improved after working in the woods for one half hour per day. This however made no effect on the recommendations for CVD patients until the mid-1900s. In the 1930s and 1940s, patients were instructed to six weeks of bed rest and chair rest. Morris conducted a study in 1953 that demonstrated London bus drivers had a higher rate of coronary events compared to the ticket sellers, who were more physically active in their role. Finally in 1968, Saltin et al. demonstrated convincing evidence to exercise and improve outcomes with coronary patients, leading to modern CR that is used today (Mampuya, 2012).

The standard form of CR consists of three phases throughout the recovery phase. The first phase occurs while the patient is still in the inpatient setting. The patients' health care providers ensure that the patient is physically capable of completing simple household tasks, which may include walking upstairs and throughout the house. The patient also receives education on the physiology of CVD, associated risks, and treatment strategies. The second phase entails more intense exercise takes three to six months following hospitalization and is held in a CR center. The patients' education is reinforced on the importance of risk factor prevention and reduction. Once patients have graduated from CR, they move into phase three, which is also known as the lifetime maintenance phase. The goal is for patients to develop a healthier lifestyle including exercise, tobacco cessation, improved nutritional intake, and weight management (Mampuya, 2012). Positive results from CR include smoking cessation, improved blood pressure, improved LDL and HDL cholesterol levels, and loss of weight or maintenance of a healthy weight. CR focuses on patient empowerment to self-manage their CAD through their daily life, improve quality of life, and to adjust their behavior to achieve optimal well-being (Gonzalez-Gonzalez et al., 2020).

One evolution that has begun to take effect in cardiovascular medicine is the use of telehealth. Telehealth utilizes modern technologies to communicate between provider and patient in order to deliver patients the care that they require. Technologies that can be utilized in telehealth include mobile devices, wearable devices such as smart watches, short message services, mobile applications, telephone and video calls, and Bluetooth devices for monitoring vital signs (Jiang, 2019).

Purpose of Inquiry

The rationale for this inquiry is to explore the data behind the use of technologies and their effectiveness. These technologies include short-message systems, telephone support, mobile applications, video conferencing systems, digital transmission of physiologic data, and wearable medical devices (Jiang et al., 2019). One barrier that kept patients from attending CR over the last year was COVID-19. In the early phases of the pandemic, governments around the world imposed restrictions on hospital and ambulatory services. This led to canceling all elective, routine, and non-urgent patient procedures, enforcing stricter physical distancing measures, and transitioning into remote care to redistribute resources to the urgent care of COVID-19 patients (Kendzerska et al., 2021). During the COVID-19 pandemic, telehealth use increased by nearly 90% in the United States. Heart failure clinics reported that heart rhythm, blood pressure, and oxygen saturation monitoring were also effective. Telemedicine care for heart failure patients also demonstrated a compliance rate of 51% compared to in-person compliance, which was 35% during the COVID-19 pandemic (Kendzerska et al., 2021).

Clinical Question

To guide the focus of this paper and literature review, a clinical question was formed using the PICO format. The PICO format consists of population, intervention, comparison, and outcome. The clinical question is, “For patients diagnosed with CVD who attend CR telehealth rehabilitation compared to standard, center-based cardiac rehab demonstrates similar or improved outcomes in CR?”

Method of Inquiry

To discover the answer to the clinical question, a literature review was conducted. The purpose of this review was to identify recent articles that focus on patients with CVD and utilize

some form of telehealth in their recovery and rehabilitation. There were many recent articles due in part to the high utilization of telehealth in the wake of the COVID-19 pandemic.

Literature Review

Introduction

To develop a deeper understanding of the relationship between CVD and telehealth rehabilitation outcomes, a literature review was conducted. The emergence of COVID-19 has accelerated efforts as health care professionals to reach patients from a distance using digital and telecommunications. The paper will reveal the findings of the most recent literature regarding CVD and telehealth rehabilitation efforts. Appendix A provides a literature table with the appraisal of each article used for this paper.

Search Strategy

To discover the literature necessary for this paper, multiple databases were utilized. These databases included CINAHL Complete, WSU Krueger Library OneSearch, and Nursing and Allied Health Premium. Table 1 provides the details of the literature search.

When searching on CINAHL Complete, WSU Krueger Library OneSearch, and Nursing and Allied Health Premium, the keywords that were used included ‘cardiovascular disease,’ ‘cost-effectiveness,’ ‘patient education,’ ‘digital health,’ ‘outpatient,’ ‘nursing intervention, coronary artery disease,’ ‘eHealth,’ ‘heart failure,’ ‘management’, ‘COVID-19’, and ‘telehealth.’ The search was limited to articles ten years or newer from the time of the search. Articles that focused on secondary prevention of CVD using telehealth rehabilitation were prioritized. Articles that discussed the effects COVID-19 has had on the health system’s care delivery were also taken into consideration. Articles that focused more so on heart failure and cardiac arrhythmias were also taken into consideration and the telehealth rehabilitation approach is

similar to that of CR for CVD patients. The levels of evidence for each article were identified and were scored based on the rating tool created by Ackley, Swan, Ladwig, and Tucker (2008). These scores can be found in Table 2.

Themes

When reviewing the literature, multiple themes were identified. These themes included lifestyle modifications, secondary event prevention, patient-led care and adherence, technology with the emergence of COVID-19, and cost-effectiveness. Each of these themes will be discussed in detail on how they connect with CVD and telehealth rehabilitation.

Lifestyle Modifications

One of the major themes noted in the literature was the importance and effectiveness of lifestyle modifications in CVD patients. The three main treatments for a patient with a coronary event include pharmacological intervention, percutaneous coronary intervention, and lifestyle modifications.

Lifestyle modifications have been an effective measure to reduce primary and secondary coronary events. These lifestyle modifications include but are not limited to a healthy, Mediterranean diet, regular exercise and smoking cessation, and weight loss. Aggarwal et al. (2021) discuss these lifestyle modifications and their effectiveness. They note that in the last two decades, lifestyle modifications demonstrate effect sizes similar to those of pharmacotherapies and even outperform those of elective PCIs in stable CVD. Stuart (2012) considered the major risk factors that contributed to CVD in the Australian population. These factors included high blood pressure, high cholesterol, physical inactivity, and being overweight and obese. Stuart considered these to be modifiable risk factors. Lifestyle modifications paired with health policy changes, hold tremendous potential to reduce economic burdens from CVD (Aggarwal, 2021).

Secondary Event Prevention

Another major theme from the literature review was the importance of secondary event prevention. Once a patient has an initial diagnosis of CVD, their odds of having another coronary event are much higher. According to Spaulding (2019), approximately 720,000 people have a primary acute myocardial infarction (AMI), and approximately half of those patients will have recurrent AMIs. This can lead to further cardiac tissue damage, which could lead to further cardiac complications including heart failure.

CR is an effective secondary prevention measure for CVD patients to decrease the risk of total mortality, cardiac mortality, and cardiac morbidity (Varnfield & Karunanithi, 2015). CR has evolved with its research findings to become more effective for patients. One new approach to CR is the use of telehealth rehabilitation. This approach allows the patient to participate in CR from home. Dalal et al. (2021) found both center and home-based CR approach provided a statistically significant reduction in hospital admissions compared to standard care. A meta-analysis that reviewed telehealth interventions found that these telehealth interventions were at least as effective as center-based programs in improving modifiable cardiovascular risk factors and exercise capacity (fixed effect standardized mean difference 0.75 (95% CI 0.52 to 0.98)). Dalal et al., 2021 also reported a systematic review and meta-analysis that included 30 telehealth trials of secondary coronary prevention in patients with CVD. The re-hospitalization rate and cardiac event rate were significantly lower in the intervention groups (RR 0.56, (95% CI 0.39 to 0.81(P<0.0001)).

Patient-Led Care and Adherence

Patient adherence is one of the most critical factors in the risk reduction of CVD. If a patient with CVD does not participate and champion their treatment plan, the risk of secondary

events is significant. Nonadherence to post AMI medications can have a significant effect on cardiovascular morbidity and mortality (Kouta et al., 2012). To guide patients to the decision that best supports their CR enrollment, clinicians also need to be educated on the indications and benefits of CR. Aggarwal et al. (2021) state that there are large gaps in patient adherence to healthy diets, maintaining a regular exercise routine, cessation of smoking, and being enrolled in CR.

One reason for nonadherence is patients' gaps in knowledge of their condition and the rationale for their treatments. Early patient education is essential to promote patient adherence and empower the patient to take lead on their health. Give the patient a firm date for their initial rehabilitation assessment as they are four times more likely to engage in their rehabilitation programs (Dalal et al., 2021). For each day that CR referral is delayed, CR participation rates are decreased by one percent (Aggarwal et al., 2021). Early education and referrals are one of the most important keys to maintaining patient adherence to the CR regimen.

Technology during COVID-19

Healthcare providers and patients have been utilizing mobile technologies as the technology has become more reliable. "Mobile technologies such as phones and wireless monitoring devices are increasingly being used in health care" (Hamine et al., 2015). These technologies allow for communication between patient and provider, collection of patient data in patient monitoring, and patient education. The potential of these technologies is extremely high; however, they are often underutilized. The utilization of these technologies is reliant upon the healthcare provider and patient. These technologies of course became more relevant in the spring of 2020, in the wake of the COVID-19 pandemic.

Telehealth had already been used for chronic diseases besides CVD including patients with heart failure and chronic obstructive pulmonary disease (COPD). However, when COVID-19 struck the United States, it was determined that telehealth utilization had increased by almost 90 percent (Kendzerska, 2021). Heart failure patients were found to be more compliant using virtual care with follow-up appointments and routine monitoring, compared to in-person care in the wake of COVID-19.

Telehealth options have also offered patients with lifestyle flexibility thanks to the capabilities of their smartphones and other at-home devices (Varnfield & Karunanithi, 2015). More patients have access to smartphones, which possess' health tracking capabilities including exercise and other key cardiovascular risk factors. Patients can share this information with their healthcare team and guidance and adjustments can be made accordingly. This form of communication also offers faster response times for patient treatments, which could lead to higher patient compliance and fewer patient events. These technologies also offer patients the opportunity to overcome some barriers to CR participation. Some of these barriers include scheduling, physical distance to the CR facility, and social distance measures due to COVID-19. Thanks to telehealth, patients would have the capabilities to maintain consistency with their CR should any barriers present themselves.

Cost-Effectiveness

The cost-effectiveness of any healthcare intervention is of course a concern before it can be considered. Globalizing CR rather than maintaining a centralized and center-based CR system can threaten higher costs. The higher costs could include a higher volume of equipment used as it is distributed to the patients' homes versus equipment that can be used by all patients at a center. Another concern would be the cost of introducing technology-based CR and the staff and patient

education that would go along with that technology. Jiang & Joyce conducted a cost-effectiveness systematic review in 2019 regarding digital health interventions (DHI). DHIs that were cost-effective included short-messaging services for CVD patients, telephone support for HF patients, wearable medical devices for patients at risk of sudden cardiac arrest, and video conferencing systems for prenatal and stroke patients. It was determined that the type of DHI that is being utilized can influence the cost associated with the care. Jiang & Joyce found that there is an increasing demand for cost-effective applications of DHIs for CVD patients.

Heart failure clinics have been one of the pioneers of telehealth rehabilitation, thus offering more data on this subject. Dalal et al. (2021) conducted an economic evaluation for heart failure patients in the United Kingdom (UK). They found that remote CR was an effective and cost-efficient model that can improve satisfaction and the overall utilization of participants. While these studies were conducted in the UK, it would be reasonable to predict similar findings in the US. For example, Kouta et al. (2012) determined that improvement in acute coronary events in the 600,000 Medicare beneficiaries who have an AMI each year would create \$200,000,000 in lifetime savings. This theme demonstrates that cardiac telehealth rehabilitation can be a cost-effective intervention. With increasing evidence of the cost-effectiveness in cardiac telehealth rehabilitation, many healthcare systems will likely roll out with this approach.

SYNTHESIS OF THE LITERATURE

Overall Synthesis

For this paper, 21 relevant articles were reviewed, and the evidence identified within the articles provided various levels of evidence. The majority of the evidence provided was quantitative data relating to patient events and outcomes. Qualitative data was also identified in most part from patient experiences during CR. Brouwers et al., 2017, Gonzalez-Gonzalez et al.,

2020, Engen-Verheul et al., 2014, and Varnfield & Karunanith, 2015 provided level VII evidence, coming from expert opinion. Level I evidence had the highest number of articles selected compared to all other levels of evidence. Between Levels II-Level V, there was a consistent distribution of articles being represented. These results can be seen in Table 2. The level of evidence and their descriptions are listed in the first two columns followed by the count of articles per level of evidence in the third column. The levels of evidence were provided by Ackley et al. (2008). A majority of the articles were literature reviews, systematic reviews, and meta-analyses.

Gaps in Literature

After analyzing the evidence provided by the articles, gaps in the literature were noted. One of these gaps was a lack of Level I evidence, investigating modern technology for the use of secondary prevention in CVD patients. Brors et al. (2019) and Turan Kavradim et al. (2020) both offer evidence from their systematic reviews, noting the effectiveness of eHealth interventions for secondary prevention in CVD patients. The other Level I article, however, provide evidence for secondary prevention by way of older methods i.e., telephone-based intervention or mailed education. Other Level I and Level II articles offer excellent evidence for CR, although the CR is not specifically for CVD, rather heart failure or heart arrhythmias.

Conceptual Framework

Concept map

To provide a visualization of the concepts identified for this literature review, a concept map was made. The main focus of this literature review was secondary prevention of CVD via cardiac telehealth rehabilitation. This can be seen at the top and center of Figure 1. The main themes identified in this literature review included lifestyle modifications, secondary prevention,

patient-led care and adherence, technology during COVID-19, and cost-effectiveness. These themes are depicted in the five blue boxes of the concept map. The main points from each theme are listed in the text boxes, which demonstrate their relation to each theme based on the blue arrows. The concept map can be seen in Figure 1.

Conclusion, Implications, and Recommendations

Introduction

Cardiovascular disease continues to be the number one cause of mortality in the world (Han et al., 2019). In our 21st century lifestyle, the risk factors for CVD have increased dramatically. These risk factors are highlighted by sedentary lifestyles and unhealthy diets, which leads to potential development of CVD. A large part of our society's recent increase in sedentary lifestyle is the rapid expansion of technology use in our daily lives. However, technology can also be a valuable asset to the prevention and recovery from a coronary ischemic event. CR has consistently demonstrated its effectiveness in the prevention of secondary coronary events. Due to the COVID-19 pandemic, alternative delivery models of care for CR became necessary. While telehealth had already been an established resource for providers and patients, its utilization was expedited due to the pandemic, to maintain social distance efforts to protect the most medically vulnerable.

The medical field has learned an immense amount about CVD; the treatments for the disease, and the mechanisms of preventing secondary events. Some of these secondary prevention methods remain simple and timeless, which includes the lifestyle modifications recommended for CVD patients. Five implications for cardiac telehealth rehabilitation were identified. The implications are based on the five themes previously identified including lifestyle

modifications, secondary prevention, patient-led care and adherence, technology during COVID-19, and cost-effectiveness.

Implications for Cardiac Telehealth Rehabilitation

Lifestyle Modifications

Lifestyle modifications remain one of the more efficacious and certainly the most cost-effective to reduce an individual's probability of developing CVD. The lifestyle modifications that are recommended include smoking cessation, decreasing blood pressure, limiting dietary lipids, controlling diabetes, adhering to a Mediterranean diet, maintaining an active lifestyle, and preventing obesity (Gonzalez-Gonzalez, 2020). Enrolling in a CR program post coronary event is critical to assist patients in attaining adherence to the recommended lifestyle modifications. Specialists in these programs have developed methods to assist patients to adhere to these recommended lifestyle changes (Aggarwal et al., 2021).

There is data that clearly states that lifestyle changes lead to an effective reduction of fatal cardiovascular risk factors, which can improve long-term outcomes. Telephone-assisted cardiovascular lifestyle programs effectively provided a significant reduction in LDL cholesterol and modest weight reduction without in-person contact (Stuart et al., 2012). Han et al., 2019 also determined this in a systematic review of seven randomized control trials. The objective of lifestyle modifications is to prevent primary and secondary coronary events and improve overall health outcomes. CVD can lead to heart failure and heart arrhythmias, which can lead to other comorbidities. Therefore, these lifestyle changes can ultimately lead to a lower rate of medical comorbidities along with a higher quality of life (Aggarwal et al., 2021).

Secondary Prevention

The second implication from the literature was secondary prevention of coronary events. Spaulding, 2019 states that unplanned readmissions following hospitalization for acute myocardial infarction are one of the leading causes of preventable morbidity, mortality, and healthcare costs. Of those patients who are hospitalized for an acute myocardial infarction, half will be readmitted for a secondary event. That is why CR has been one of the most highly recommended approaches to secondary prevention for patients who are recovering from a heart attack or heart surgery (Varnfield, Karunanithi, 2015). In a study conducted by Nakayama, 2020, the rate of emergency readmissions within 30 days of discharge was lower in the CR groups, including the outpatient CR and remote CR groups, compared to patients who did not attend CR. Both at home and center-based CR are effective measures in preventing secondary events. It was determined that there were statistically significant reductions in hospital admissions with center and home-based CR compared to standard care (Dalal et al., 2021). Researchers also found that there was no statistically significant difference in 12-month mortality between home and center-based CR. This leads one to believe that should the medical field transition to primarily home-based CR, there would not be a drop-off in the quality of CR as well as patient outcomes. After the onset of the COVID-19 pandemic, the rates of remote CR were increased dramatically. The rates before the pandemic were 19% versus the 69% that used the remote CR option after March of 2020 (Nakayama et al., 2020).

Patient-Led Care and Adherence

Many factors lead to nonadherence to lifestyle modification after an AMI. Along with nonadherence to the recommended lifestyle changes, there is also nonadherence to CR attendance, and post-myocardial infarction medications, which has a substantial effect on cardiovascular morbidity and mortality (Kouta et al., 2012). Patients need to feel empowered to

take control of their health. Without the patient's full commitment to adherence, successful recovery from AMI is unlikely. The introduction of telehealth to patients in CR has helped with symptom management and the promotion of patient self-management. CR via telehealth allows healthcare team members to be more accessible to patients. For example, telephone interviews allow for verbal persuasion and emotional arousal greatly empowers blood pressure control to reduce cardiovascular risk (Hong et al., 2021).

Technology During COVID-19

The COVID-19 pandemic forced the healthcare system to digitize healthcare much sooner than anticipated. Fortunately, our society was well-equipped to take on this challenge. Mobile technologies including phones and wireless monitoring devices have been used in healthcare and public health care for communication, data collection, patient monitoring, and education to guide patients through their chronic disease management (Hamine et al., 2015). This was necessary as the COVID-19 pandemic led to a significant reduction in hospitalizations, emergency department visits, and inpatient visits for non-COVID-19 patients with chronic conditions, specifically during March and April of 2020 (Kendzerska, 2021). This was due to the caution exercised by patients with chronic diseases in an attempt to prevent infection with COVID-19. As technology continues to advance and become more of common possession for all patients, digitized healthcare will become an even more practical approach. However, early in the COVID-19 pandemic, socioeconomically disadvantaged patients with chronic diseases were dealt a greater disadvantage, leading to worsening health outcomes (Kendzerska, 2021).

Patients will be able to keep in closer communication with their healthcare providers following an AMI due to telehealth options. The capabilities of modern smartphones offer patients flexibility to monitor their exercise, communicate via short message service messaging,

journal, simultaneous transmission of electrocardiogram (ECG), and remote coaching (Varnfield & Karunanithi, 2015).

Cost-Effectiveness

One factor that is often considered before implementing a healthcare measure is the cost-effectiveness of that measure. Dalal et al. (2021) determined remote cardiac rehabilitation was an effective, cost-efficient alternative to a center-based program that could even improve the overall utilization by meeting the preferences of the patients. Some of the factors that would drive up the cost of a digital health intervention include telephone support, wearable medical devices, and video conferencing systems for patients to communicate with their healthcare team (Jiang, 2019). However, these measures continue to demonstrate effectiveness, driving up the demand for cost-effective applications. The implication is, so long as the measures lead to lower rates of admission for primary and secondary coronary events, the measure will likely be cost-effective. This will lead to more cost-effective measures being developed for patient use.

Recommendations

The following are recommendations for healthcare team members from the literature review:

Lifestyle Modifications

- Patients are recommended to manage their risk factors which include high blood pressure, high cholesterol, physical inactivity, and obesity (Aggarwal et al., 2021; Gonzalez-Gonzalez, 2020; Stuart, 2012).
- Patients are recommended to maintain lifestyle changes to reduce the risk of AMI including a Mediterranean diet, regular exercise, smoking cessation, and weight loss (Aggarwal et al., 2021; Gonzalez-Gonzalez, 2020; Stuart, 2012).

Secondary Prevention

- Cardiac Rehabilitation is recommended for the prevention of secondary coronary events (Varnfield & Karunanithi, 2015; Nakayama, 2020; Dalal et al., 2021).
- Lifestyle modifications are recommended to prevent secondary coronary events (Aggarwal et al., 2021; Gonzalez-Gonzalez, 2020; Stuart, 2012).

Patient-Led Care and Adherence

- Tailored patient education is recommended to emphasize enabling patients to become more active participants in the management of their disease (Dinesen, 2021; Gonzalez-Gonzalez, 2020).
- Patients should be given a firm date to attend the initial rehabilitation assessment before dismissal from the inpatient setting (Aggarwal et al., 2021; Dalal et al., 2021).
- Narrow gaps in knowledge about patients' conditions and their treatment to improve adherence (Dinesen et al., 2021; Hong et al., 2021; Kouta et al., 2012).

Technology During COVID-19

- Mobile technologies should be optimized and utilized for the use of remote monitoring of patients (Hamine et al., 2015; Hong et al., 2021; Varnfield & Karunanithi, 2015).
- Telehealth operations can be used for patient-provider contact via telephone, short messaging, patient monitoring, and online coaching (Dalal, et al., 2021; Varnfield, Karunanithi, 2015).

Cost-Effectiveness

- Health care facilities should conduct a cost-effect analysis of their available technologies to determine the sustainability of telehealth measures (Dalal et al., 2021; Jiang et al., 2019; Kouta et al., 2012)

Conclusion

Cardiovascular disease remains the medical condition with the highest rate of mortality in the world (Han et al., 2019). The practice of cardiovascular medicine has made significant advancements over the past 75 years. These advancements include primary prevention, disease treatment, recovery, and secondary prevention. CR remains an effective measure to prevent secondary coronary events. However, as society and its technologies advance, so too must the platform for CR. The COVID-19 pandemic demonstrated the potential for telehealth measures. As the healthcare industry anticipates an aging patient population, leading to high demand for patient capacity and staff members, the healthcare approach must be altered. In the field of cardiology, cardiac telehealth rehabilitation has been effective as center-based CR, cost-effective, and exhibited improved quality of life patients. Moving forward, cardiovascular telehealth rehabilitation should be considered as a primary or hybrid delivery method for patients with CAD to decrease secondary coronary events.

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Appendix A

Literature Table

Citation	Purpose	Sample/ Setting	Design/ Framework	Variables/ Instruments	Results	Implications	Level of Evidence
Aggarwal, M., Ornish, D., Josephson, R., Brown, T., Ostfeld, R., Gordon, C., Madan, Shivank, M, Allen, K., Khetan, A., Mahmud, A., Freeman, A., Aspry, K. (2021). Closing gaps in lifestyle adherence for secondary prevention for coronary heart disease. <i>The American Journal Of Cardiology</i> . https://doi.org/10.1016/j.amjcard.2021.01.005	This article reviews the evidence base for lifestyle interventions for the secondary prevention of coronary heart disease and discusses the current gaps in adherence. It also presents strategies for closing the gaps via evidence-based and emerging interventions that are conceptually aligned with the elements of the chronic care model.	Coronary heart disease patients	Systematic review	The chronic care model (CCM) was the evidence-based, patient-centered framework for organizing and delivering chronic illness care. Six interrelated elements of the CCM included clinical decision support, self-management support, delivery system design, clinical information systems, health system organization, and community resources and linkages.	Coronary heart disease outcomes are improved significantly by adherence to healthy lifestyle behaviors.	More organized lifestyle management efforts by practices and health systems, coupled with related health policy changes, will hold immense potential for reducing the growing health and economic burdens for coronary heart disease in the coming decades.	Level I

Citation	Purpose	Sample/ Setting	Design/ Framework	Variables/ Instruments	Results	Implications	Level of Evidence
Brors, G., Pettersen, T., Hansen, T., Fridlund, B., Holvold, L., Lund, H., Norekval, T. (2019). Modes of e- Health delivery in secondary prevention programmes for patients with coronary artery disease. <i>BMC Health Services Research</i> , 19(364) https://doi.org/ / 10.1186/s 12913-019- 4106-1	To Describe the effectiveness of different modes of delivery and components in e- Health secondary prevention programs on adherence to treatment, modifiable coronary artery disease (CAD) risk factors and psychosocial outcomes for patients with CAD.	24 randomized controlled trials including 3654 participants with CAD were included.	Systematic Review	Medication adherence, secondary prevention of CAD, CAD risk factors.	Evidence exists that supports the use of e-Health interventions for improving secondary prevention of CAD.	High quality trials are needed to define the most efficient mode of delivery and components capable of addressing a favorable outcome for patients.	Level I

Citation	Purpose	Sample/ Setting	Design/ Framework	Variables/ Instruments	Results	Implications	Level of Evidence
<p>Brouwers, R., Kraal, F., Traa, S., Spee, R., Oostven, L., Kemps, H. (2017). Effects of cardiac telerehabilitation inpatients with coronary artery disease using a personalized patient-centered web application. <i>BMC Cardiovascular Disorders</i>, 17(46). https://doi.org/10.1186/s12872-017-0477-6</p>	<p>The hypothesis of this study is that cardiac telerehabilitation, using evidence-based behavioral change strategies, modern communication methods and on-demand coaching will result in improved self-management skills and sustainable behavioral change, which would translate to higher physical activity levels in a cost-effective manner.</p>	<p>300 patients entering cardiac rehabilitation randomized to center-based cardiac rehabilitation (control group) or cardiac telerehabilitation (intervention group)</p>	<p>Protocol for the SmartCare-CAD randomized controlled trial</p>	<p>The primary outcome measure is physical activity level, assessed at baseline, three months, and twelve months, and is calculated from accelerometer and heart rate data. Secondary outcome measures include physical fitness, quality of life, anxiety and depression, patient empowerment, patient satisfaction and cost-effectiveness.</p>	<p>The results for this study were not yet released.</p>	<p>The SmartCare-CAD trial is one of the first studies evaluating the effects and costs of a cardiac telerehabilitation intervention that combines modern technology with evidence-based behavioral change strategies, including relapse prevention by on-demand coaching.</p>	<p>Level VII</p>

Citation	Purpose	Sample/ Setting	Design/ Framework	Variables/ Instruments	Results	Implications	Level of Evidence
<p>Dalal, H., Doherty, P., McDonagh, S., Paul, K., Taylor, R. (2021). Virtual and in-person cardiac rehabilitation. <i>The BMJ</i>. https://dx.doi.org/10.1136/bmj.n1270</p>	<p>Identify new delivery methods of cardiac rehab in the wake of the COVID-19 pandemic.</p>	<p>Patients who qualify for cardiac rehab, which includes patients with ACS and all patients undergoing reperfusion (coronary artery bypass graft, primary percutaneous coronary intervention, and percutaneous coronary intervention).</p>	<p>Literature review</p>	<p>Minnesota Living with Heart Failure questionnaire</p> <p>Incremental cost effectiveness ratios, patient assessment, physical activity counselling, exercise training, diet, weight control, lipid management, blood pressure management, smoking status, psychosocial management.</p>	<p>There are low rates of attendance in center-based cardiac rehabilitation. Studies have found similar patient outcomes from both center-based and at home programs with significantly higher attendance rates for at home programs.</p>	<p>There is new evidence that supports home based and digitally delivered cardiac rehabilitation interventions.</p>	<p>Level V</p>

Citation	Purpose	Sample/ Setting	Design/ Framework	Variables/ Instruments	Results	Implications	Level of Evidence
<p>Dinesen, B., Dam Gade, J., Skov Schacksen, C., Spindler, H., Eie Albertsen, A., Dittmann, L., Jochumsen, M., Svenstrup Moller, D. (2021). The Danish future patient telerehabilitation program for patients with atrial fibrillation. <i>FMIR Cardio</i> 2021 5(2), 1-16. https://cardio.jmir.org/2021/2/e27321</p>	<p>The aim of this pilot study is to evaluate and compare feasibility of the two programs of Telerehabilitation (TR) programs for patients with atrial fibrillation (AFib).</p>	<p>N=20 Group A: n=10 Group B: n=10 Patients diagnosed with AFib, above 18 years of age, living in Viborg or Skive, were living at home and capable of caring for themselves, had basic computer skills or a spouse with basic computer skills.</p>	<p>Pilot study using qualitative and self-recorded data.</p>	<p>Sociodemographic and clinical data were acquired from the patients' medical journal or through self-reporting. Semi structured qualitative interviews. Self-monitored data from devices used at home i.e. Fitbit, iHealth, and Emfit as well as self-monitored ECG data from KardiaPro.</p>	<p>Patients with AFib and their spouses were positive about participating in a TR program consisting of remote monitoring, an interactive web-based HeartPortal, and education at a local care center.</p>	<p>Patients with AFib and their spouses found the TR program useful and it enhanced their knowledge about mastering their symptoms, and a feeling of belonging to a community of practice linking patients with AFib and their spouses and a health care personnel.</p>	<p>Level VI</p>

Citation	Purpose	Sample/ Setting	Design/ Framework	Variables/ Instruments	Results	Implications	Level of Evidence
<p>Gonzalez-Gonzalez, A., Perestelo-Perez, L., Koatz, D., Ballester, M, Pacheco-Huergo, V., Ramos-Garica, V., Torres-Castano, A., Rivero-Santana, A., Toledo-Chavarri, A., Valcarcel-Nazco, C., Mateos-Rodilla, J., Obaya-Rebollar, J., Garcia-Garcia, J., Diaz-Sanchez, S., Marles-Cabos, L., Bosch-Fontcuberta, J., Vallego-Camazon, N., Rodriguez-Almodovar, A., Castillo, J.,...Orrego, C. (2020). Effectiveness and cost-effectiveness of a virtual community of practice to improve the empowerment of patient with ischaemic heart disease. <i>BMJ Open</i> 2020;10:e037374. doi:10.1136/bmjopen-2020-037374</p>	<p>To experimentally test an innovative learning intervention based on a Virtual Community of Practice (VCoP) for patient empowerment, for which the literature lacks experimental evaluations.</p>	<p>250 patients with a recent diagnosis of Ischemic Heart Disease attending the participating centers.</p>	<p>Randomized Controlled Trial protocol</p>	<p>The primary outcome will be measured with the Patient Activation Measure questionnaire at baseline, 6, 12, and 18 months.</p> <p>Secondary outcomes will clinical variables; knowledge, attitudes, adherence, to the Mediterranean diet, level of physical activity, depression, anxiety, medication adherence, and health resources use.</p>	<p>This article is a study protocol of a randomized controlled trial. There were no results revealed in this article.</p>	<p>The findings of this study could be useful for ischemic heart disease patients as well for patients with other chronic diseases.</p>	<p>Level VII</p>

Citation	Purpose	Sample/ Setting	Design/ Framework	Variables/ Instruments	Results	Implications	Level of Evidence
<p>Hamine, S., Gerth-Guyette, E., Faulx, D., Green, B., Ginsburg, A. (2015). Impact of mHealth chronic disease management on treatment adherence and patient outcomes. <i>Journal of Medical Internet Research</i> 17(2), 1-15</p>	<p>Evaluate the effectiveness of mHealth in supporting the adherence of patients to chronic diseases management, and the usability, feasibility, and acceptability of mAdherence tools and platforms in chronic disease management among patient and health care providers.</p>	<p>Databases for studies that assessed the role of mAdherence in chronic disease management of diabetes mellitus, cardiovascular disease, and chronic lung diseases from 1980 through May 2014.</p> <p>107 articles met all inclusion criteria.</p>	<p>Systematic Review</p>	<p>57.9% of the sample studies assessed usability, feasibility, and acceptability or patient preferences for mAdherence interventions.</p> <p>38.3% of the sample studies evaluated the impact of mAdherence tools on clinical outcomes.</p>	<p>This review found that the usability, feasibility, and acceptability of mHealth tools for chronic disease management adherence were generally high among both patients and providers.</p>	<p>Further evaluation of mAdherence tools will be critical, especially research that informs how these tools overcome barriers to chronic disease management.</p>	<p>Level I</p>

Citation	Purpose	Sample/ Setting	Design/ Framework	Variables/ Instruments	Results	Implications	Level of Evidence
Han, E., Yu Chin Quek, R., Mieng Tan, S., Singh, S., Shirax, F., Gea-Sanchez, M., Legido-Quigley, H. (2019). The role of community-based nursing interventions in improving outcomes for individuals with cardiovascular disease	To examine the role of community-based nursing interventions in improving outcomes for community-swelling individuals with cardiovascular disease.	28 studies Inclusion criteria: primary research studies reporting on the outcomes of interventions led by, or primarily delivered by, nurses for individuals with CVD in community settings, all study designs, including controlled trials, cohort studies, cross-sectional studies and qualitative studies, and studies published in any language from inception to March 16, 2018.	Systematic Review and narrative synthesis	Four key areas included self-care, health, health care utilization, and quality of care.	Significant improvements were reported inpatient's knowledge and ability to self-manage, severity of disease, functional status, quality of life, risk of death, hospital readmission days, emergency department visits, healthcare costs and satisfaction with care.	The overall evidence is positive regarding the role of community-based nursing interventions in improving outcomes for individuals with cardiovascular disease.	Level I

Citation	Purpose	Sample/ Setting	Design/ Framework	Variables/ Instruments	Results	Implications	Level of Evidence
<p>Hong, P., Chen, K., Chang, Y., Cheng, S., Chiang, H. (2021). Effectiveness of theory-based health information technology interventions on coronary artery disease self-management behavior. <i>Journal of Nursing Scholarship</i>. 53(4) 418-427. doi:10.1111/jnu.12661</p>	<p>To investigate the effects of a self-efficacy theory-based health information technology intervention implemented through blood control and patient self-management.</p>	<p>60 subjects were randomly assigned to either the immediate intervention (experimental) group or the waitlist control group.</p>	<p>Clinical randomized waitlist-controlled trial</p>	<p>The primary endpoint was systolic blood pressure (SBP) at three months; secondary end points included self-management behavior and quality of life (QOL).</p>	<p>SBP significantly improved for the intervention group at three months, where there was also significant improvement in self-management behavior and QOL.</p>	<p>The use of a theory-based health information technology treatment compared with usual care resulted in a significant improvement in SBP, self-management behavior, and QOL in patients with coronary artery disease.</p>	<p>Level II</p>

Citation	Purpose	Sample/ Setting	Design/ Framework	Variables/ Instruments	Results	Implications	Level of Evidence
<p>Jiang, X., Ming, W., You, J. (2019). The cost-effectiveness of digital health interventions on the management of cardiovascular diseases. <i>Journal of medical internet research</i> 21(6), 1-11. https://www.jmir.org/2019/6/e13166/</p>	<p>The aim of this study was to perform a systematic review of the decision analytic model-based studies evaluating the cost-effectiveness of digital health interventions (DHIs) on the management of CVD.</p>	<p>14 studies met the defined criteria. Heart failure and stroke were two of the most frequent CVDs that were managed by DHI</p>	<p>Systematic Review</p>	<p>The primary outcome collected was the cost-effectiveness of DHIs, presented by incremental cost per additional quality-adjusted life year (QALY).</p>	<p>The DHIs gained higher QALY with cost saving in 43% of the studies and gained QALY at a higher cost at acceptable incremental cost-effectiveness ration in 57% of studies.</p>	<p>All the included studies found the DHIs to be cost-effective.</p>	<p>Level I</p>

Citation	Purpose	Sample/ Setting	Design/ Framework	Variables/ Instruments	Results	Implications	Level of Evidence
Kendzerska, T., Ahu, D., Gershon A., Edwards, J., Peixoto, C., Robillard, R., Kendall, C. (2021). The effects of the health system response to the COVID-19 pandemic on chronic disease management. <i>Risk Management and Health Policy</i> , 2021(14), 575-584.	To provide an overview of how individuals with chronic conditions have been affected by changes in adaption in the healthcare system, healthcare utilization, and socioeconomic and environmental risk factors in response to the COVID-19 pandemic.	English language articles published between January 2020 and January 2021 regarding the COVID-19 pandemic and chronic disease management.	Narrative Review	Healthcare characteristics and utilization by individuals with chronic conditions, reductions in chronic disease-related ED visits and hospitalizations, deployment of telemedicine for chronic disease management, shortages of medicine supply for individuals with chronic disease, psychosocial and mental health considerations, sleep disruption and disorders during COVID-19.	In-person primary and specialty care for individuals with chronic conditions have substantially decreased due to government restriction of elective and non-urgent healthcare visits, as well as greater instilled fear over potential COVID-19 exposure during in-person visits.	The information summarized and provided by this review can be used as a foundation for further research studies and to guide healthcare service delivery in later stages of the pandemic, the post-pandemic phase, and during the next outbreak.	Level V

Citation	Purpose	Sample/ Setting	Design/ Framework	Variables/ Instruments	Results	Implications	Level of Evidence
<p>Ito, K., Shrank, W., Avorn J., Patrick, A., Brennan, T., Antman, E., Choudhry, N. (2012). Comparative cost-effectiveness of interventions to improve medication adherence after myocardial infarction. <i>Health Services Research</i>, 47(6) 2097-2117. https://doi.org/10.1111/j.1475-6773.2012.01462.x</p>	<p>To evaluate the comparative cost-effectiveness of interventions to improve adherence to evidence-based medications among post myocardial infarction (MI) patients.</p>	<p>Markov model simulating a hypothetical cohort of 65-year-old post-MI patients who were prescribed secondary prevention medications.</p>	<p>Model inputs were extracted from published literature.</p>	<p>The main outcome was an incremental cost-effectiveness ratio as measured by cost per quality-adjusted life year gained.</p>	<p>Compared with usual care, only mailed education had both improved health outcomes and reduced spending.</p>	<p>Mailed education and a polypill, once available, may be the cost-saving strategies for improving post-MI medication adherence.</p>	<p>Level V</p>

Citation	Purpose	Sample/ Setting	Design/ Framework	Variables/ Instruments	Results	Implications	Level of Evidence
Mamuya, W. (2012). Cardiac rehabilitation past, present and future. <i>Cardiovascular Diagnosis & Therapy</i> , 2(1) 38-49. https://doi.org/10.3978/j.issn.2223-3652.2012.01.02	To present an overview of cardiac rehabilitation as a tool for secondary prevention of cardiovascular disease and its current status as a performance measure in the care of patients with cardiac disease.	Articles pertaining to cardiac rehab.	Literature Review	Exercise training, tobacco cessation, nutritional intake, weight management, lipid management, blood pressure, diabetes, psychosocial and professional issues, sexual counseling, alcohol,	Cardiac rehab is both clinically effective and cost-effective.	Cardiac rehabilitation is underutilized and should be considered going forward.	Level V

Citation	Purpose	Sample/ Setting	Design/ Framework	Variables/ Instruments	Results	Implications	Level of Evidence
<p>Mejia, A., Richardson, G., Pattenden, J., Cockayne, S., Lewin, R. (2014). Cost-effectiveness of a nurse facilitated, cognitive behavioural self-management programme compared with usual care using a CBT manual along for patient with heart failure. <i>International Journal of Nursing Studies</i>, 51(2014) 1214-1220. http://dx.doi.org/10.1016/j.ijnurstu.2014.01.009</p>	<p>To assess the cost-effectiveness of a nurse facilitated, cognitive behavioural self-management program for patients with heart failure compared with usual care including the unfacilitated access to the same manual, from the perspective of the NHS</p>	<p>Data was obtained from a multi-center, randomized controlled open trial conducted in seven center in the United Kingdom (UD)between 2006 and 2008.</p>	<p>Randomized controlled open trial conducted in seven centers in the UK.</p>	<p>Effectiveness was estimated as Quality-Adjusted Life Years.</p>	<p>There were no substantial differences in the utility scores between treatment groups in all follow-up assessments, in the use of medications or outpatient visits and both groups report a similarly frequency of contact with health care professionals.</p>	<p>There is little evidence that the addition of the intervention has any effect on costs or outcomes.</p>	<p>Level II</p>

Citation	Purpose	Sample/ Setting	Design/ Framework	Variables/ Instruments	Results	Implications	Level of Evidence
<p>Nakayama, A., Takayama, N., Kobayashi, M., Hyodo, K., Maeshima, N., Takayuki, F., Morita, H., Komuro. (2020). Remote cardiac rehabilitation is a good alternative of outpatient cardiac rehabilitation in the COVID-19 era. <i>Environmental Health and Preventative Medicine</i>. 25(48)</p>	<p>Evaluate remote cardiac rehabilitation (CR) as a viable alternative to the outpatient CR program</p>	<p>Outpatient CR group n=69, remote CR group n=30, non-CR group n=137.</p>	<p>The study prospectively investigated patient hospitalized for heart failure (HF) with a left ventricular ejection fraction (LVEF) of <50%.</p>	<p>Emergency readmission rate within 30 days of discharge, EQ-5D score</p>	<p>The emergency readmission rate within 30 days of discharge was lower in the remote CR group than the non-CR group. The EQ-5D score was higher in the remote CR group than in the outpatient CR group 30 days after discharge.</p>	<p>Remote CR is as effective as outpatient CR for improving the short-term prognosis of patients hospitalized for heart failure post-discharge.</p>	<p>Level IV</p>

Citation	Purpose	Sample/ Setting	Design/ Framework	Variables/ Instruments	Results	Implications	Level of Evidence
Richardson, C., Franklin, B., Moy, M., Jackson, E. (2019). Advances in rehabilitation for chronic diseases. <i>BMJ</i> 2019;365:l2191 doi: 10.1136/bmj.l2191	This review summarized randomized controlled trials, meta-analyses, epidemiologic reports, and clinical and observational studies evaluating the impact of cardiopulmonary rehabilitation on CVD and COPD, with additional information about new developments and ongoing clinical trials.	The authors reviewed and identified manuscripts for their focus on elements of cardiac and pulmonary rehabilitation that were relevant to primary care physicians.	Literature review	Evidence for benefit of in-person cardiac and pulmonary rehabilitation programs.	Comprehensive cardiac and pulmonary rehabilitation programs are effective evidence-based strategies that directly deal with the behavioral risk factors that lead to CVD and COPD, improving health related outcomes including function, HRQL, risk of readmission to hospital, and mortality.	There is an opportunity to substantially improve health outcomes by increasing the reach and engagement of such programs.	Level III

Citation	Purpose	Sample/ Setting	Design/ Framework	Variables/ Instruments	Results	Implications	Level of Evidence
<p>Spaulding, E., Marvel, F., Lee, M., Yang, W., Demo, R., Wang, J., Xun, H., Shah, L., Weng, D., Fasanu, O., Carter, J., Sheidy, J., McLin, R., Flowers, J., Majmudar, M., Vilarino, V., Lumelsky, D., Bhardwaj, V., Padula, W.,...Martin, S. (2019). Corrie health digital platform for self-management in secondary prevention after acute myocardial infarction. <i>Circulation: Cardiovascular Quality and Outcomes.</i></p>	<p>The aim of this study is self-management, adherence to guideline-directed therapy, and cardiovascular risk reduction.</p>	<p>The prospective will primarily compare time to first readmission within 30 days post discharge among patients with Corrie to patients in the historical standard of care comparison group.</p>	<p>Three-phase MiCORE study. (Myocardial infarction, Combined-device, Recovery Enhancement)</p>	<p>Follow-up was conducted at 3- and 30-days post-discharge from the hospital.</p>	<p>The results from this study have not yet been released. The final recruitment process was finalized in March 2019.</p>	<p>The MiCORE study will provide a wealth of information about clinical integration of Corrie, an innovative, patient-centered, action-oriented DHI aimed at self-management, adherence to guideline-directed therapy, and cardiovascular risk reduction.</p>	<p>Level VI</p>

Citation	Purpose	Sample/ Setting	Design/ Framework	Variables/ Instruments	Results	Implications	Level of Evidence
<p>Stuart, K., Wyld, B., Bastiaans, K., Stocks, N., Brinkworth, G., Mohr, P., Noakes, M. (2012). A telephone-supported cardiovascular lifestyle programme (CLIP) for lipid reduction and weight loss in general practice patients. <i>Public Health Nutrition</i>, 17(3), 640-647. https://doi.org.10.1017/S1368980013000220</p>	<p>To evaluate a primary prevention care model using telephone support delivered through an existing health call center to general practitioner-referred patients at risk of developing CVD, using objective measures of CVD risk reduction and weight loss.</p>	<p>Participants were randomized into two groups, those receiving telephone-supported comprehensive lifestyle intervention program (CLIP) and those receiving usual care from their general practitioner.</p>	<p>Randomized controlled pilot trial</p>	<p>LDL-cholesterol, DMI, total cholesterol, systolic blood pressure, diastolic blood pressure, weight, waist circumference.</p>	<p>CLIP participants demonstrated significantly greater reductions in LDL-C and total cholesterol at Week 12 when compared with the control group. There were no significant treatment effects for systolic blood pressure, diastolic blood pressure, weight, or waist circumference.</p>	<p>Delivering CLIP through an existing telephone health service is effective in achieving reductions in LDL-C and total cholesterol.</p>	<p>Level II</p>

Citation	Purpose	Sample/ Setting	Design/ Framework	Variables/ Instruments	Results	Implications	Level of Evidence
<p>Turan Kavradim, S., Ozer, Z., Boz, I. (2020). Effectiveness of telehealth interventions as a part of secondary preventions in coronary artery disease. <i>Cardiovascular Journal of Caring Sciences</i>, 2020(34) 585-603. https://doi.org/10.1111/scs.12785</p>	<p>The aim of this study is to evaluate the effectiveness of telehealth interventions as a part of secondary prevention compared to routine care in those with coronary artery disease (CAD).</p>	<p>24 Peer-reviewed, published randomized controlled trials of people with coronary artery diseases.</p> <p>Inclusion criteria included: participants \geq 18 years old with CAD, studies with telephone calls, text messages and telemonitoring, telehealth intervention group compared with routine care, at least one measurable outcome to reduce the risk factors.</p>	<p>Systematic review and meta-analysis</p>	<p>Waist circumference, medication adherence, smoking cessation, blood pressure, physical activity and lipid change results.</p>	<p>Telehealth interventions had positive outcomes on waist circumference, blood pressure, total cholesterol, triglyceride, medication adherence, physical activity and smoking cessation but not HDL and LDL cholesterol.</p>	<p>Nurses can use telehealth interventions to manage adherence to lifestyle changes.</p>	<p>Level I</p>

Citation	Purpose	Sample/ Setting	Design/ Framework	Variables/ Instruments	Results	Implications	Level of Evidence
Engen-Verheul, M., Keizer, N., Veer, S., Kemps, H., Reimer, W., Jaspers, M., Peek, N. (2014). Evaluating the effect of a web-based quality improvement system with feedback and outreach visits on guideline concordance in the field of cardiac rehabilitation.	The aim is to assess the effectiveness of a web-based quality improvement system with indicator-based performance feedback and educational outreach visits to overcome organizational barriers for guideline concordance in multidisciplinary teams in the field of cardiac rehabilitation (CR).	Conducted in 18 Dutch cardiac rehab clinics using an electronic patient record with CDS at the point of care.	Multicenter cluster-randomized trial with a balanced incomplete block design.	Physical functioning, psychological functioning, social functioning, cardiovascular risk profile, lifestyle factors	The results to this study may inform similar initiatives in other medical domains on how to use indicator-based performance feedback and outreach visits for improving the quality of care.	This article provides a better understanding of actors facilitating implementation of guidelines in multidisciplinary care teams.	Level VII

Citation	Purpose	Sample/ Setting	Design/ Framework	Variables/ Instruments	Results	Implications	Level of Evidence
<p>Vanfield, M., Karunanithi, M. (2015). Information and communication technology-based cardiac rehabilitation homecare programs. <i>Dovepress, 2015</i>(3), 69-79. https://doi.org/10.2147/SHT.T.S75395</p>	<p>Introduce Telehealth solutions to overcome some of the barriers to the traditional delivery of cardiac rehabilitation (CR).</p>	<p>Patients with coronary artery disease.</p> <p>Studies that described patients as having either an acute myocardial infarction, a diagnosis of acute coronary syndrome, or have undergone a revascularization procedure.</p>	<p>Literature review</p>	<p>Development issues that prevent the implementation of the telehealth interventions.</p>	<p>Obstacles to uptake have been identified as a lack of reimbursement for physicians offering remote medical treatment, regulatory and professional liability concerns, and accuracy of data.</p>	<p>These solutions have been shown to overcome some of the barriers in CR participation and show potential as alternative or complementary options for individuals that find traditional center-based CR programs difficult to commit to.</p>	<p>Level VII</p>

Appendix B

Critical Appraisal of the Systematic Review: Oxman, Cook, & Guyatt (1994)

Aggarwal, M., Ornish, D., Josephson, R., Brown, T., Ostfeld, R., Gordon, C., Madan, Shivank, M, Allen, K., Khetan, A., Mahmud, A., Freeman, A., Aspry, K. (2021).

1. Were the search methods used to find evidence (original research) on the primary question or questions stated? No Partially Yes
 - The article reviewed the evidence base for lifestyle modification interventions for the secondary prevention of CVD.

2. Was the search for evidence reasonably comprehensive? No Partially Yes
 - The results are pulled from a total of eight systematic reviews, cohort studies, and meta-analysis.

3. Were the criteria used for deciding which studies to include in the over reported?

No Partially Yes

 - The criteria for deciding which studies to include were not clearly stated.

4. Was bias in the selection of studies avoided? No Partially Yes
 - The authors stated they have no conflicts of interest to disclose.

5. Were the criteria used for assessing the validity of the included studies reported?

No Partially Yes

 - The criteria for assessing the validity of the studies was not clearly stated.

6. Was the validity of all of the studies referred to in the text assessed with the use of appropriate criteria (either in selecting the studies for inclusion or in analyzing the studies that were cited)? No Partially Yes
 - The results of the systematic reviews and meta-analysis were reviewed in Table 1.

7. Were the methods used to combine the findings of the relevant studies (to reach a conclusion) reported? No Partially Yes

- The lifestyle interventions are demonstrated in Table 2 from the Critical Care Model framework.

8. Were the findings of the relevant studies combined appropriately relative to the primary question that the overview addresses? No Partially Yes

- The findings of the literature review are comprehensively summarized in the conclusion section.

9. Was the conclusion made by the author or authors supported by the data and/or analysis reported in the overview? No Partially Yes

- The researchers state that CVD outcomes are significantly improved by adherence to healthy lifestyle behaviors, however large gaps exist.

10. How would rate the scientific quality of this review?

Extensive flaws		Major flaws		Minor flaws		Minimal flaws	
1	2	3	4	<u>5</u>	6	7	

Appendix C

Critical Appraisal of the Systematic Review: Oxman, Cook, & Guyatt (1994)

Brors, G., Pettersen, T., Hansen, T., Fridlund, B., Holvold, L., Lund, H., Norekval, T. (2019).

1. Were the search methods used to find evidence (original research) on the primary question or questions stated? No Partially Yes
 - The protocol for the systematic review was registered in the International Prospective Register of Systematic Reviews (PROSPERO).

2. Was the search for evidence reasonably comprehensive? No Partially Yes
 - The search strategy included studies from the previous 15 years to reflect the most relevant work with e-Health for patients with CVD. There were 24 publications that met the criteria.

3. Were the criteria used for deciding which studies to include in the over reported?

No Partially Yes

 - The inclusion and exclusion criteria are stated by the researchers.

4. Was bias in the selection of studies avoided? No Partially Yes
 - The systematic review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.

5. Were the criteria used for assessing the validity of the included studies reported?

No Partially Yes

 - The eligibility criteria are presented in Table 1 of the article.

6. Was the validity of all of the studies referred to in the text assessed with the use of appropriate criteria (either in selecting the studies for inclusion or in analyzing the studies that were cited)? No Partially Yes

- The quality appraisal was systematically assessed by two independent researchers (GB and TRP) using the Joanna Briggs Institute (JBI) critical appraisal tool for RCTs.

7. Were the methods used to combine the findings of the relevant studies (to reach a conclusion) reported? No Partially Yes

- The article was able to support the use of e-Health secondary prevention for patients with CVD, however there was a wide variability of secondary prevention program components.

8. Were the findings of the relevant studies combined appropriately relative to the primary question that the overview addresses? No Partially Yes

- The aim of the systematic review was to identify the effectiveness of different delivery modes for e-Health secondary prevention programs. The findings are reflective of the primary question.

9. Was the conclusion made by the author or authors supported by the data and/or analysis reported in the overview? No Partially Yes

- The systematic review shows evidence to support the use of e-Health for secondary prevention of CVD.

10. How would rate the scientific quality of this review?

Extensive flaws		Major flaws		Minor flaws		Minimal flaws	
1	2	3	4	5	<u>6</u>	7	

Appendix D

Critical Appraisal of the Systematic Review: Oxman, Cook, & Guyatt (1994)

Hamine, S., Gerth-Guyette, E., Faulx, D., Green, B., Ginsburg, A. (2015).

1. Were the search methods used to find evidence (original research) on the primary question or questions stated? No Partially Yes
 - The aim of the review was to evaluate the effectiveness of mHealth in supporting adherence of patients to chronic disease management.

2. Was the search for evidence reasonably comprehensive? No Partially Yes
 - The systematic review identified 107 articles that met their search criteria.

3. Were the criteria used for deciding which studies to include in the over reported?

No Partially Yes

 - The inclusion and exclusion criteria are clearly stated and can be found on page three of the article.

4. Was bias in the selection of studies avoided? No Partially Yes
 - The researchers had no conflicts of interest to be noted.

5. Were the criteria used for assessing the validity of the included studies reported?

No Partially Yes

 - The article states that they did not weigh the quality of evidence or study design against the reported results.

6. Was the validity of all of the studies referred to in the text assessed with the use of appropriate criteria (either in selecting the studies for inclusion or in analyzing the studies that were cited)? No Partially Yes

- Table 2 of the article does provide a comprehensive outline of the diseases examined along with the article effectiveness count, however this is not examined at an individual study level.

7. Were the methods used to combine the findings of the relevant studies (to reach a conclusion) reported? No Partially Yes

- The researchers search PubMed, Embase, and EBSCO databases dating 1980 to May 2014.

8. Were the findings of the relevant studies combined appropriately relative to the primary question that the overview addresses? No Partially Yes

- The findings were consistent with the primary question of the researchers.

9. Was the conclusion made by the author or authors supported by the data and/or analysis reported in the overview? No Partially Yes

- The conclusion of the article is that mAdherence is a high-impact tool to improve health outcomes for those with chronic conditions, however further evaluation will be critical for further disease management.

10. How would rate the scientific quality of this review?

Extensive flaws		Major flaws		Minor flaws		Minimal flaws	
1	2	3	<u>4</u>	5	6	7	

Appendix E

Critical Appraisal of the Systematic Review: Oxman, Cook, & Guyatt (1994)

Han, E., Yu Chin Quek, R., Mieng Tan, S., Singh, S., Shirax, F., Gea-Sanchez, M., Legido-Quigley, H. (2019)

1. Were the search methods used to find evidence (original research) on the primary question or questions stated? No Partially Yes

- A search strategy was developed and refined with contributions from an information specialist.

2. Was the search for evidence reasonably comprehensive? No Partially Yes

- All databases (CINAHL, Global Health, LILACS, Africa-Wide Information, IMEMR and WPRIM) were searched independently by two reviewers to ensure accurate retrieval.

3. Were the criteria used for deciding which studies to include in the over reported?

No Partially Yes

- The inclusion and exclusion criteria are listed in item 2.2.

4. Was bias in the selection of studies avoided? No Partially Yes

- The risk of bias of each study was assessed independently by two of three reviewers and any disagreements were resolved by discussion.

5. Were the criteria used for assessing the validity of the included studies reported?

No Partially Yes

- Five reviewers were involved in the screening process. Two reviewers independently screened the search results by title and abstract for potential eligibility.

6. Was the validity of all of the studies referred to in the text assessed with the use of appropriate criteria (either in selecting the studies for inclusion or in analyzing the studies that were cited)? No Partially Yes

- Tables 1 through 5 describe the characteristics, findings, and risk of bias of the studies broken down by category of study focus.

7. Were the methods used to combine the findings of the relevant studies (to reach a conclusion) reported? No Partially Yes

- The review was able to create findings on community-based nursing interventions.

8. Were the findings of the relevant studies combined appropriately relative to the primary question that the overview addresses? No Partially Yes

- The objective of the study was to examine the role of community-based nursing interventions in improving outcomes for community-dwelling individuals with CVD. The study found that community-based nursing interventions can improve outcomes for patients with CVD.

9. Was the conclusion made by the author or authors supported by the data and/or analysis reported in the overview? No Partially Yes

- The outcomes that are improved by community-based nursing include patients' knowledge and ability to self-manage, severity of disease, functional status, quality of life, risk of death, hospital readmission days, emergency department visits, healthcare costs and satisfaction with care.

10. How would rate the scientific quality of this review?

Extensive flaws

Major flaws

Minor flaws

Minimal flaws

1

2

3

4

5

6

7

Appendix F

Critical Appraisal of the Systematic Review: Oxman, Cook, & Guyatt (1994)

Jiang, X., Ming, W., You, J. (2019).

1. Were the search methods used to find evidence (original research) on the primary question or questions stated? No Partially Yes
 - The purpose of this study was to conduct a systematic review of decision analytic model-based health economic analyses of DHIs for CVD management.

2. Was the search for evidence reasonably comprehensive? No Partially Yes
 - Multiple databases were searched and investigated for the purposes of this review. There was a surge of publications in the early 2000s, therefore the databases were searched back to 2001.

3. Were the criteria used for deciding which studies to include in the over reported?

No Partially Yes

 - The inclusion and exclusion criteria were clearly stated on page three of the article.

4. Was bias in the selection of studies avoided? No Partially Yes
 - The articles were meticulously reviewed by a team of investigators. One practiced the primary search, two reviewed the abstracts independently, and disagreements were discussed by a third investigator.

5. Were the criteria used for assessing the validity of the included studies reported?

No Partially Yes

 - The Consolidated Health Economic Evaluation Reporting Standards (CHEERS) checklist was used to assess the methodological quality of each study.

6. Was the validity of all of the studies referred to in the text assessed with the use of appropriate criteria (either in selecting the studies for inclusion or in analyzing the studies that were cited)? No Partially Yes

- Table 1 of the article described the characteristics and quality assessments of the selected studies.

7. Were the methods used to combine the findings of the relevant studies (to reach a conclusion) reported? No Partially Yes

- The assessment of the study quality found that the majority of the methodology items met the requirements of the CHEERS checklist.

8. Were the findings of the relevant studies combined appropriately relative to the primary question that the overview addresses? No Partially Yes

- The review found growing evidence that evaluated cost-effectiveness of digital health interventions.

9. Was the conclusion made by the author or authors supported by the data and/or analysis reported in the overview? No Partially Yes

- All of the studies examined found digital health interventions to be cost-effective in this review.

10. How would rate the scientific quality of this review?

Extensive flaws		Major flaws		Minor flaws		Minimal flaws	
1	2	3	4	<u>5</u>	6	7	

Appendix G

Critical Appraisal of the Systematic Review: Oxman, Cook, & Guyatt (1994)

Turan Kavradim, S., Ozer, Z., Boz, I. (2020).

1. Were the search methods used to find evidence (original research) on the primary question or questions stated? No Partially Yes
 - The review followed the Preferred Reporting Items for Systematic Reviews Meta-Analyses and the Cochrane Systematic Review Handbook.

2. Was the search for evidence reasonably comprehensive? No Partially Yes
 - The search investigated a wide variety of databases and searched for articles that were written in English. The date restrictions for the articles ranged from 2000 to 2018 due to the increase in technological developments after 2000.

3. Were the criteria used for deciding which studies to include in the over reported?

No Partially Yes

 - The inclusion and exclusion criteria were clearly stated on page 586 of the article.

4. Was bias in the selection of studies avoided? No Partially Yes
 - Risks of bias were independently assessed for each study by two of the authors using the Cochrane risks of bias tool.

5. Were the criteria used for assessing the validity of the included studies reported?

No Partially Yes

 - The researchers demonstrated their selection process via their PRISMA flow diagram in Figure 1 of the article.

6. Was the validity of all of the studies referred to in the text assessed with the use of appropriate criteria (either in selecting the studies for inclusion or in analyzing the studies that were cited)? No Partially Yes

- The quality appraisal of the selected 24 studies were provided in Table 3 of the article.
7. Were the methods used to combine the findings of the relevant studies (to reach a conclusion) reported? No Partially Yes
- The telehealth interventions were classified as telephone calls, text messages, telephone calls in combination with messages, and telemonitoring.
8. Were the findings of the relevant studies combined appropriately relative to the primary question that the overview addresses? No Partially Yes
- The aim of this review was to examine the effects of telehealth compared to routine care for secondary prevention in coronary artery disease. The findings demonstrate that telehealth interventions are effective on adherence to lifestyle changes.
9. Was the conclusion made by the author or authors supported by the data and/or analysis reported in the overview? No Partially Yes
- The findings of this study are important in order for health professionals who care for individuals with coronary artery disease to make a difference in the way they change and develop nursing care.
10. How would rate the scientific quality of this review?

Extensive flaws		Major flaws		Minor flaws		Minimal flaws	
1	2	3	<u>4</u>	5	6	7	

Table 1*Databases Searched and Data Abstraction Method*

Date of Search	Keyword Used	Database/Source Used	Number of Results		
			Listed	Reviewed	Used
1/22/21	Cardiovascular Disease AND Cost effectiveness AND patient education	CINAHL Complete	92	8	4
1/22/21	Cardiovascular Disease AND Nursing Intervention AND Cost-Effectiveness AND Prevention	WSU Krueger Library OneSearch	10,476	12	3
7/31/21	Coronary Artery Disease AND e Health AND Patient Education AND Outpatient AND Recovering AND digital health	WSU Krueger Library OneSearch	12	12	3
7/31/21	Coronary Artery Disease AND Patient Education AND Outpatient AND digital health AND COVID-19	WSU Krueger Library OneSearch	24	1	1
8/2/21	Cardiovascular Disease AND Outpatient AND Digital Health AND Patient Education	CINAHL	5	5	1
8/3/21	Coronary Artery Disease AND Heart Failure AND digital health AND management AND prevention AND patient education AND COVID-19	Nursing and Allied Health Premium	27	8	5
10/23/21	Cardiac rehabilitation AND Telehealth AND	WSU Krueger Library OneSearch	78	10	3

	coronary artery disease AND ehealth				
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Table 2*Literature Review Framework*

Level and Description according to Framework from Ackley, Swan, Ladwig, and Tucker (2008)		Number of articles used in inquiry
Level I	Evidence from a systematic review or meta-analysis of all relevant RCTs (randomized controlled trial) or evidence-based clinical practice guidelines based on systematic reviews of RCTs or three or more RCTs of good quality that have similar results.	6
Level II	Evidence from at least one well-designed RCT.	3
Level III	Evidence from well-designed controlled trials without randomization.	1
Level IV	Evidence from well-designed case-control or cohort studies.	1
Level V	Evidence from systematic reviews of descriptive and qualitative studies.	4
Level VI	Evidence from a single descriptive or qualitative study.	2
Level VII	Evidence from the opinion of authorities and/or reports of expert committees.	4

Figure 1

Secondary Prevention of CVD via Cardiac Telehealth Rehabilitation Concept Map

