HOW DOES THE USE OF TELEMONITORING IN ADULT PATIENTS WITH UNCONTROLLED HYPERTENSION IMPROVE BLOOD PRESSURE CONTROL? AN INTEGRATIVE REVIEW

A Scholarly Project

Submitted To The Faculty Of

Liberty University

In Partial Fulfillment Of

The Requirements for the Degree

Of Doctor of Nursing Practice

By

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Lynchburg, Virginia

December 2022

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ABSTRACT

Hypertension is an evolving problem worldwide and it constitutes a great risk for cardiovascular diseases. Despite the research and new drugs on the market to manage high blood pressure, hypertension remains the leading cause of disability-adjusted life and death worldwide. With many people suffering from hypertension around the world, and the burden of uncontrolled hypertension, it is imperative to find an intervention that can improve blood pressure control. To better target uncontrolled hypertension, the conventional method of management of high blood pressure based on in-person visits has shown some limitations and it must be combined with a contemporary approach that allows for fast decision-making and fast results. One measure that has been identified to improve blood pressure control is the use of telemonitoring. Telemonitoring is a remote delivery of care that provides a quick transfer of information between a healthcare professional and a patient. Telemonitoring improves access to care, patient education, counseling, medication management, and titration, improve adherence to care plans, improves healthcare cost, speeds up healthcare delivery and decision-making strategies, and improves the overall health of patients. There is strong evidence in research studies showing that telemonitoring can improve blood pressure control and prevent cardiovascular events in patients with uncontrolled hypertension. However, challenges remain relating to the sustainability and long-term clinical effectiveness of telemonitoring.

Keywords: telemonitoring, hypertension, standard care, blood pressure, home monitoring, adults, uncontrolled hypertension.

Dedication

First and foremost, I would like to thank the Almighty Lord Jehovah for successfully leading me through this demanding, difficult, yet exciting journey. I give him all the glory for supporting and showering me with his blessings since the first day I engaged in the pursuit of my doctorate.

I dedicate this doctoral work to the people who have had the most significant and positive influences in my life, particularly my late parents, Charlotte and Michel Tomfeu, who have taught me the real meaning of hard, dedication, and commitment to success, to my brother Jephte Tomfeu and my sister Pulcherie Tomfeu, whose lives were taken too soon due to complications of cardiovascular diseases. Dear mother, father, brother, and sister, you ignited the fire to complete the research on these health issues and to help people not only by preventing but also by healing cardiovascular diseases in me.

Acknowledgments

I would like to express my profound gratitude to the DNP and Psychiatric Mental Health program faculty at Liberty University, for providing me with the instruction, assistance, and skills necessary to complete this DNP program. Thank you for your guidance, your prayers, and your continued support during this difficult journey.

I would like to thank my first Chair, Dr. Deidra Simpson, who mentored and guided me in the first part of my project. You set the path for a successful journey. For that, I am very grateful.

I would like to sincerely thank my current Chair, Dr. Cynthia Goodrich, who did not hesitate to step in when Dr. Deidra Simpson could not continue with me. Thank you for accepting to chair my research, for giving me invaluable guidance throughout this research, for raising the bar high, for being patient and sincere with me, and for praying with me for the successful completion of this project. My research project would not be where it is without Dr. Simpson laying the foundation, and Dr. Goodrich masterfully implementing a blueprint.

I would like to express my deep and sincere gratitude to my husband, Dr. Atanis Kadjemse. Thank you for stepping in whenever I needed your help, and for your vision, and motivation throughout this challenging, yet fulfilling journey. Your love, support, and patience deeply inspired me and enabled me to pursue this tasking dream of mine. Without you, this would not have been possible, and I will forever be grateful for your unconditional support and guidance.

My sincere thanks to my children Josepha Kadjemse, Michaela Kadjemse, and Marie Carole Kadjemse; you have defined me as your role model, and this has motivated me to carry on and make you proud. You have shown maturity and you have understood and supported me during

my long absences and the countless hours I have spent studying, writing, or working. Thank you for your unconditional love; I am blessed to have you!

I would like to acknowledge all my siblings, especially my sisters, Gisele Tomfeu, Danielle Tomfeu, and Dorcas Tomfeu, for cheering, praying, and supporting me in any way possible. Thank you for being there whenever I needed you during this journey, and for believing in me. Your encouragements were a valuable motivator during this doctoral journey.

Finally, I would like to thank my friends and all the people who have supported me in any way possible. Your presence around me was very valuable and necessary to keep my focus and motivated.

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SECTION ONE: FORMULATING THE REVIEW QUESTION

The purpose of this scholarly project was to use existing literature to conduct an integrative review to determine the level of evidence that shows an improvement in blood pressure through telemonitoring. It is estimated that about one billion people worldwide suffer from high blood pressure, and there are about 10.7 million deaths from hypertension, about 211.8 million disability-adjusted lives, and the number of people with hypertension is projected to reach 1.5 billion in 2025 (Parati, 2017). It is imperative to find an intervention that can improve patients' outcomes. Telemonitoring can be added to existing practice to help manage hypertension in patients with poorly controlled blood pressure. This integrative review evaluated the use of telemonitoring in adult patients with uncontrolled hypertension to improve blood pressure control. This scholarly project also analyzed existing literature to determine the effect of telemonitoring use on adult patients with uncontrolled hypertension regarding the six core competencies that are essential to the Advance Practice Nurse role, which are DNP Essential I, II, III, IV, VII, and VIII (see Appendix D).

This scholarly project was a literature review that included sound arguments for why uncontrolled hypertension in adult patients in primary care can lead to adverse cardiovascular events without telemonitoring. The project aimed to improve blood pressure control to prevent cardiovascular events in adult patients via telemonitoring.

Defining Concepts and Variables

Telemonitoring refers to the remote delivery of healthcare. Blood pressure telemonitoring is the measurement of blood pressure by patients at home and is shared with healthcare providers through a remote mobile device or computer for treatment adjustments. This provides a

supportive environment in which the patient can freely participate in their care with the help of a healthcare provider in the comfort of their home. Uncontrolled hypertension is when blood pressure remains high despite taking medications. Standard care involves an in-person meeting with a provider in a healthcare establishment to receive care. During a telemonitoring intervention, patients can measure their blood pressure and monitor their progress with the help of a healthcare professional.

The Rationale for Conducting the Review

It is estimated that about 1.13 billion people have hypertension worldwide and only one in four people have their blood pressure under control, as many die due to complications of uncontrolled high blood pressure (Yatabe et al., 2018). High blood pressure is a silent killer and does not usually come with real symptoms of sickness. Many patients with high blood pressure do not follow up with their care and their medication when they do not feel sick. Some patients do not also measure their blood pressure when they leave the provider's office. Even though awareness has been increased about hypertension over the years, it is important to improve prevention and treatment to prevent cardiovascular events, disability-adjusted life, and deaths due to uncontrolled hypertension. Telemonitoring encompasses blood pressure reading, medication management, and patient education about their condition. Does the use of telemonitoring in adult patients with uncontrolled hypertension improve blood pressure control?

Problem Statement

Uncontrolled hypertension in adult patients in a primary care setting can lead to adverse cardiovascular events.

Purpose of the Project

The purpose of this scholarly project was to use existing literature to conduct an integrative review to determine if blood pressure readings are improved through telemonitoring. This project will help to sensitize providers around the world about the complications that uncontrolled hypertension among adult patients with uncontrolled hypertension presents, as well as to provide them with strategies and interventions to improve blood pressure control. This was done by reviewing previous and contemporary literature on what is presently known about uncontrolled hypertension in adult patients and the suggestions as well as implications for research, practice, and education that will improve patient outcomes (Toronto & Remington, 2020).

Inclusion/Exclusion (for the Literature)

During this literature review, the inclusions were articles that reported healthcare delivery of adult patients with hypertension through telemonitoring. All articles used in this project were articles published in peer-reviewed journals. They were full text, written in English, and published within the last five years. The exclusions were book chapters, comments, viewpoints, articles that report blood pressure in patients less than 18 years of age, and articles without any related high blood pressure conditions. This also excluded low levels of evidence and used only articles with a high level of evidence.

Conceptual Framework

Whittemore & Knafl

The conceptual framework used to guide this project is Whittemore and Knafl's model to apply research findings and improve patient outcomes. This framework was used based on problem identification, literature search, data evaluation, data analysis, interpretation, and

presentation (Whittemore & Knafl, 2005). They developed data analysis methodologies that include data reduction, display, comparison, conclusion, and verification in their integrative review framework to solve methodological inadequacies and increase the rigor of the integrative review.

Toronto & Remington

Toronto & Remington (2020) provide a step by step guide to conducting an integrative review. Their manual was used to direct the process of this integrative review. They recognized the value of the integrative review to nursing to address questions they have about the practice and improve patient outcomes. Hence, the importance of using a systematic method to search, collect, evaluate and synthesize the results of previous studies (Toronto and Remington, 2020).

PRISMA Statement

he Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) aim is to improve reporting while conducting an integrative review (see Appendix C). A Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flowchart was used for the data extraction process and articles were selected by relevance using a broad and structured filtered method (Toronto & Remington, 2020).

Melnyk's Level of Evidence

The articles pertinent to the project were used according to their quality and measured using Melnyk's strength of evidence table (Melnyk & Fineout-Overholt, 2015). This helped to assess the strength of the articles reviewed and grouped them from Level I to Level VII with the trusted and reliable sources being at the top of the pyramid. Level I and Level II were used for

this project. According to this guide, the likelihood that the results will be reliable and able to create comparable or identical results increases with a methodology's position on the pyramid.

Integrative Review Stages

Problem Identification

Based on Whittemore and Knafl's model, the identified problem that provides the reason for this integrative review is the increasing number of patients with uncontrolled hypertension in the United States and around the world. Uncontrolled blood pressure among adult patients can lead to cardiovascular events. It is estimated about 1.13 billion people have hypertension around the world, and only one in four people have their blood pressure under control, as many die due to complications of uncontrolled high blood pressure (Yatabe et al., 2018).

Literature Search

This integrative review was completed using a literature review of evidence-based research of articles that discuss the improvement of blood pressure using telemonitoring. The systematic search used the following databases: National Guideline Clearinghouse, Pub Med, Cochran Database of Systematic Reviews, Ebsco, CINAHL, and Jerry Falwell library. About 330 articles were found and then narrowed down to 50 for eligibility. Another 35 articles were excluded after a review of their content. Fifteen useful articles were retained and used to support this literature review.

Data Evaluation

The data evaluation was completed based on the relevance and quality of the data. The articles pertinent to the project were used according to their quality and measured using

Melnyk's strength of evidence table (Melnyk & Fineout-Overholt, 2015). The quality of the data sources was appraised for methodological rigor and informational value.

Data Analysis

A Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flowchart was used to select the articles by relevance using a broad and structured filtered method (Toronto & Remington, 2020). This phase includes ordering the data, coding, and categorizing according to the themes. This phase is considered the very difficult part of the integrative review process as it can be susceptible to errors. This project synthesized numerous sources in themes that are considered positive predictors to improve blood pressure.

Interpretation

The research result interpretation was completed by following Whittemore and Knafl's model to apply research findings and improve patient outcomes. The interpretation of related findings provided useful information on how they relate to the topic. The four themes retained during this project were adherence, cost, state of telemonitoring and overall outcomes. According to Whittemore and Knafl (2005), conflicting evidence requires the need for additional research following a review question to resolve the variance.

Presentation

The last section of Whittemore and Knafl's model, which is the presentation, presents the interpretation of findings with explicit details and implications for the research. Information presented for telemonitoring in improving blood pressure will help in practice change. This provides useful information that will help clinicians to improve their practice, the standard of

care, and patient outcomes through telemonitoring. While conducting an integrative review, the presentation phase should provide explicit details of the findings, implications for practice, limitations of the research, and dissemination (Whittemore & Knafl, 2005).

SECTION TWO: COMPREHENSIVE AND SYSTEMATIC SEARCH

Search Organization and Reporting Strategies

This project was an integrative review of critically appraised research using mostly an important level of evidence, based on the Melnyk strength of evidence table. The search used the following databases: National Guideline Clearinghouse, Pub Med, Cochran Database of Systematic Reviews, Ebsco, CINAHL, and Jerry Falwell at Liberty University Library. The search parameters included full articles, articles written in English, and published within the last five years. Keywords such as hypertension, blood pressure, telemonitoring, telehealth, e-health, mobile health, telemedicine, information technology, remote care, home monitoring, adults, home blood pressure, and uncontrolled hypertension were used during the search. Some search criteria contained Boolean terms such as "and", "or", or "with" to narrow down the articles to allow for more comprehensive searches (Toronto & Remington, 2020). The project used a qualitative review to measure the outcomes, and synthesize and interpret the effectiveness of telemonitoring on uncontrolled blood pressure (Yatabe et al., 2018).

A Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flowchart was used to select the articles by relevance using a broad and structured filtered method (Toronto & Remington, 2020).

Terminology

The terminology used in this project was words such as telemonitoring, standard care, database, uncontrolled hypertension, and search engine. Telemonitoring refers to the remote delivery of healthcare. This provides a supportive environment in which the patient can freely participate in their care with the help of a healthcare provider in the comfort of their home. Standard care involves an in-person meeting with a provider in a healthcare establishment to receive care. A database is an electronic collection of materials such as reports, books, journals, and more that are published and can be found online. Uncontrolled hypertension is when blood pressure remains high despite taking medications.

SECTION THREE: MANAGING THE COLLECTED DATA

Search Organization

While conducting the systematic search, articles were collected from online databases through the Jerry Falwell Library. The articles concerning telemonitoring were collected and used. A Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flowchart was used to select the articles by relevance using a broad and structured filtered method (Toronto & Remington, 2020). About 330 articles were found that included blood pressure telemonitoring. Articles excluded were those related to blood pressure in patients less than 18 years of age and articles in other languages than English (see Appendix C).

Combining Search Terms Using Boolean Logic

Keywords such as hypertension, blood pressure, telemonitoring, telehealth, e-health, mobile health, telemedicine, information technology, remote care, home monitoring, adults, home blood pressure, and uncontrolled hypertension were used during the search. Some search

criteria contained Boolean terms such as "and", "or", or "with" to narrow down the articles to allow for more comprehensive searches (Toronto & Remington, 2020).

Searching Considerations to Increase Rigor

Further reviews of articles were done by title and relevance to the topic and compared against the inclusion and exclusion criteria, which yield about 330 articles. Some articles addressed patients with previously diagnosed cardiovascular events, inpatients, and pregnant women; articles that were duplicated, and those without a full text were reviewed and removed. The content and abstracts were revised for the articles that remained and were reviewed according to the content relevance and the clinical question, which yielded 50 articles. Other records were assessed by full-text eligibility, which yielded 35 articles. Fifteen useful articles with full-text reports were assessed for eligibility and retained after a quality appraisal, assessment, and data synthesis, and were organized by how closely they supported the clinical question. A literature review matrix was used to organize the data collected in the selected articles which were further appraised through a thematic analysis to stress the results relevant to the clinical question (see Appendix E).

SECTION FOUR: QUALITY APPRAISAL

Sources of Bias

During this project, fifteen useful articles with full text were retained. This was based on how closely they supported the clinical question. When using articles for research, it is vital to rigorously evaluate the content to avoid bias. Few articles directly addressed the topic of the research. When assessing research articles for bias, the researcher should evaluate the articles for transferability, credibility, confirmability, and dependability (Toronto & Remington, 2020). Few

articles demonstrated similar biases that were not limited to the population sample and the amount of supporting articles.

Internal Validity

During this research, the articles were collected and reported using a table of evidence. This provides thorough detail about the quality of the article selected, the abstract, as well as the objective analysis. Using this method allowed me to take a general approach when analyzing the topic, which helped to expand the search, and prevented potential interpretations of the topic (Toronto & Remington, 2020). The external validity of some studies that contained small sample sizes was questioned, which recommended adding proactive additional supports to add sustainability and long-term clinical effectiveness. They also recommended that proficient implementation of the intervention on a large scale, with well-designed studies to decide on the applicability of the results be accomplished.

Appraisal Tools (Literature Matrix)

This scholarly project was an integrative review of critically appraised research using mostly an elevated level of evidence, based on Melnyk's strength of evidence table. The articles pertinent to the project were used if they satisfied the inclusion and exclusion criteria and were examined according to their quality and measured using Melnyk's strength of evidence table (Melnyk & Fineout-Overholt, 2015). This ensured a thorough selection of articles based on their relevance to the clinical question. The selected articles were synthesized with findings, research quality, and eligibility, and organized using a literature matrix. These articles were assessed and evaluated based on the value of their methodology and how relevant their contents were to the topic (see Appendix E).

Multiple studies revealed a significant increase in blood pressure control when using telemonitoring. Park et al.'s (2021) findings aligned with Fuchs et al.'s (2018) to show an increase in overall patient outcomes when using telemonitoring. Park et al. (2021) noted a significant reduction in cardiovascular risk in patients using telemonitoring compared to traditional care. Both studies showed significant improvement in patient systolic and diastolic pressure compared to the period of no potential intervention. Similarly, Wang et al. (2021), and Duan et al. (2017) suggested not only did telemonitoring improve blood pressure, but it provided better education to patients to improve their overall health. Wang et al. also noted that patients received more training and guidance on how to monitor their blood pressure, as well as how to titrate their medication to meet the targeted blood pressure. Margolis et al. (2018) and Choi et al. (2021) showed an effective reduction in blood pressure in patients with uncontrolled hypertension with sustained effects on overall health. Choi et al. noted that patient satisfaction increased, and patients were able to receive the appropriate training in the use of tools required for telemonitoring, which decreased their anxiety and provided an overall long-term outcome.

Zhang et al.'s (2021) findings aligned with Cavero-Redondo et al.'s (2021) and Yatabe et al.'s (2021) when they demonstrated a significant reduction in blood pressure through telemonitoring. These researchers all attributed the reduction in blood pressure to patient adherence to the treatment plan. According to Yatabe et al., patients who received an interactive approach with healthcare providers through videoconferencing were more eager to follow treatment plans than the control group. Similarly, Cavero-Redondo et al. noted increasing adherence to treatment through e-health, which contributed to a significant reduction in blood pressure, improved quality of life, and improved physical activity compliance.

Many studies discussed the use of telemonitoring to improve blood pressure control due to the continuity and accessibility of care and overall improvement in healthcare costs. McManus et al., (2021), Ionov et al. (2021), and Yatabe et al. (2018) concluded that using telemonitoring not only decreased blood pressure in patients with uncontrolled hypertension but also contributed to the reduction of healthcare costs. Yatabe et al. noted that many patients, whose blood pressure was monitored remotely, showed a decrease in emergency room visits, as well as a decrease in the waiting line for in-person visits. Likewise, Ionov et al. argued that telemonitoring was cost-effective in the long term, as patients who received remote counseling intervention during telemonitoring were able to reach and maintain their target blood pressure.

Applicability of Results

Many searches revealed a significant increase in blood pressure control when using telemonitoring. With the recent expansion of remote care throughout the nation, it is important to note that telemonitoring can provide a great platform to improve the health of many patients suffering from blood pressure. This constitutes a great tool to meet the immediate needs of the patients and frequent monitoring without the burden of waiting for appointments in person. Telemonitoring expands access to care, improves patient adherence to the treatment plan, and positively impacts their outcomes. However, while researchers support the efficacy of telemonitoring to improve patients' outcomes, further research was needed to analyze the sustainability and long-term clinical effectiveness.

Reporting Guidelines

This project was guided by the reporting guidelines established by Whitmore and Knafl (2005) regarding integrative reviews of clinical research. To analyze and disseminate the

research findings, a visual diagram was created to help structure the process. This included an extensive range of different articles that helped to stress the effectiveness of telemonitoring in reducing blood pressure through a descriptive analysis of the appraised articles. A Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flowchart was used to select the articles by relevance using a broad and structured filtered method (Toronto & Remington, 2020).

SECTION FIVE: DATA ANALYSIS AND SYNTHESIS

For this integrative review, a wide range of critically appraised literature was analyzed to evaluate the effectiveness of telemonitoring to decrease high blood pressure in adult patients. Abstract data from peer-reviewed articles were grouped using thematic elements, synthesized, and then reported using a structured literature matrix. The information that was relevant to the clinical question as well as descriptive elements were synthesized.

Data Analysis Methods

The articles were arranged and grouped according to the patient outcomes, with some articles reporting many outcomes. Data were analyzed using the unifying pattern approach of data analysis, which includes the following six phases: familiarizing with data, generating codes, searching for themes, reviewing themes, defining, and naming themes, and producing the report (Toronto & Remington, 2020). An abstracted literature matrix was used to present the information, which was also expanded to include supplemental information pertinent to the topic using the guideline for integrative review analysis provided by Whittemore and Knafl (2005). A different column was used to group proven data results that were relevant to the research outcomes. The results were then narrowed down, and whenever possible, other columns were

created with additional descriptive analysis to reduce data and divide pertinent data that applied to the clinical question.

Descriptive Results

For this integrative review, a comprehensive and descriptive analysis of many articles related to the effectiveness of telemonitoring in reducing high blood pressure was elaborated and common themes were noted to guide the process. This section was based on a thematic analysis of the reports that were directed by the clinical question. Since there are no guidelines to structure the report of the integrative review, an abstracted literature matrix was used to present the information, which was also expanded to include supplemental information pertinent to the topic using the guideline for integrative review analysis provided by Whittemore and Knafl (2005).

The themes relevant to the research topic used in this study are elaborated on in this section. These themes are considered positive predictors to improve blood pressure telemonitoring effectiveness. The themes have been extended from the research topic and supplemental questions, and are associated with the use of telemonitoring to improve blood pressure control.

Adherence

Zhang et al. (2021) discussed the effectiveness of telemonitoring in the improvement of blood pressure control and adherence to the treatment plan. They concluded that blood pressure telemonitoring improved blood pressure control and adherence to treatment in patients with uncontrolled hypertension.

Cavero-Redondo et al. (2021) compared the effect of multiple e-healths monitoring on reducing systolic and diastolic pressure, controlling blood pressure, improving quality of life, increasing adherence to treatment, and improving physical activity compliance. Even though they found that e-health was a powerful intervention for blood pressure self-management, and control, they called for more designed studies to demonstrate that over the years, e-health could improve disease management with new clinical guidelines. Yatabe et al. (2021) performed a similar study where they compared the efficacy of home blood pressure monitoring and videoconferencing. The authors found that adding videoconferencing to home blood pressure telemonitoring improved adherence and blood pressure control, but suggested that studies are needed when treating patients on a larger scale.

Cost

A study performed by McManus et al., (2021) compared telemonitoring to standard care and found that adding digital care to standard care and self-monitoring can be cost-effective and improve blood pressure results. Similarly, Yatabe et al. performed a similar study (2018) in prospective randomized studies of patients with uncontrolled blood pressure without cardiovascular events over 36 months. They aimed to determine the effectiveness and the amount of time required to achieve the target blood pressure while combining telemonitoring with treatment adjustment in patients. The authors concluded that this approach resulted in a shorter time to reach target blood pressure, decreased frequent emergency room visits, improved treatment adherence, reduced medical costs, prevented cardiovascular complications, and improved quality of life.

Ionov et al. (2021) evaluated blood pressure telemonitoring and remote counseling interventions' effectiveness in reducing blood pressure in adult patients with uncontrolled hypertension. Their study was a 3-month prospective randomized study of 246 patients with uncontrolled blood pressure. It was noted that adding remote counseling to telemonitoring highly improved blood pressure control and was cost-effective in the long term as it decrease healthcare costs. They also added that larger randomized studies with long-term follow-ups are needed to validate the study.

State of Telemonitoring

The benefits of telemonitoring are undeniable, as it improves patients' outcomes. Pan et al. (2018) used a randomized controlled trial of patients with uncontrolled blood pressure in a local community health center. They evaluated the outcome of home telemonitoring and noted that telemonitoring was an effective tool in achieving blood pressure control compared to standard care alone due to accessibility and continuity of care. They also noted that further studies are needed to evaluate the long-term outcomes of telemonitoring. Similarly, Santos et al.'s (2022) study was a systematic review with a meta-analysis that investigated the effectiveness of the use of telemonitoring in patients with high blood pressure and or diabetes. They confirmed that telemonitoring was an effective tool to achieve target blood pressure in patients with high blood pressure and or diabetes with easy access to continue care. However, they recommended further studies on the African and South American continents to evaluate future cardiovascular health events and the source of telemonitoring.

Pan et al. (2018), Grant et al. (2019) and Santos et al. (2022) revealed that continued access to care was a key factor in reducing blood pressure in patients with

uncontrolled hypertension. Likewise, Grant et al. found that many patients reached their target blood pressure easily when facilitators and barriers to self-monitoring and telemonitoring interventions were uncovered. They concluded that telemonitoring offered more benefits to practice and improved outcomes due to its accessibility, and continuity of care, along with effective communication, patient education, and improved blood pressure. Along a similar line, Pan et al. (2018) targeted a small community of patients who had a problem with easy access to care and demonstrated that patients who had easy access to care at any time were able to continue their treatment, as they could reach or communicate their health concerns to providers at any time, which helped in reaching the target blood pressure.

Overall Outcomes

Park et al. (2021) conducted a systematic review of randomized controlled trial studies to determine the effectiveness and usefulness of remote blood pressure monitoring compared to standard care in reducing systolic and diastolic blood pressure as well as control rates. The authors concluded that telemonitoring was an effective instrument to speed up the delivery of care and decision-making strategies, improve adherence to treatment plans, improve overall health, and control blood pressure. They determined that telemonitoring was practical and clinically effective in reducing blood pressure in patients with uncontrolled hypertension compared to standard care. Similarly, Fuchs et al. (2018) performed a randomized controlled trial of patients aged 30 to 75 years who took up to two medications with uncontrolled blood pressure to determine the effectiveness of telemonitoring to reduce blood pressure and improve lifestyle compared to standard care. They noted potential outcomes with improved decision-making strategies while using telemonitoring compared to standard care.

Wang et al. (2021) compared blood pressure telemonitoring without healthcare professional intervention and blood pressure telemonitoring with interventions such as patient education, medication titration, or lifestyle counseling. The authors found that pairing self-monitoring with co-intervention may help to significantly improve blood pressure control, decrease the number of clinic visits, and prevent atherosclerosis and arteriosclerosis. Along the same line, Duan et al. (2017) compared the efficacy of telemonitoring and standard care in patients with uncontrolled hypertension and sought to determine if adding different intervention components could influence the size of blood pressure outcomes. The authors concluded that home blood pressure telemonitoring can have a significant impact on blood pressure control compared to traditional care when they are paired with additional supports. They also noted the uncertainty in sustainability and long-term efficacy and called for future large-scale studies with well-designed randomized controlled trials with extensive follow-up care.

In a cluster randomized trial of 450 patients with uncontrolled blood pressure, Margolis et al. (2018) investigated the long-term effect of telemonitoring. They found that blood pressure telemonitoring had sustained effects for up to 24 months, which was 12 months after the end of the intervention. They recommended further studies for continued monitoring for long-term maintenance. Likewise, Choi et al. (2021) assessed the effectiveness of nurse-controlled blood pressure telemonitoring using a mobile phone, computer, telephone line, patient education, text messages, and traditional office care in urban areas. The authors reported that nurse-controlled telemonitoring can improve blood pressure control more than routine care in the long term. However, they noted that some studies included in the analysis lacked quality and called for more proficient implementations of the intervention system in long term.

Synthesis

Park et al.'s (2021) findings aligned with Fuchs et al.'s (2018) to show an increase in overall patient outcomes when using telemonitoring. Park et al. noted a significant reduction in cardiovascular risk in patients using telemonitoring compared to traditional care. Both studies showed significant improvement in patient systolic and diastolic pressure compared to the period of no potential intervention. A fall of 2 mmHg in Systolic Blood Pressure has been reported to reduce the incidence of ischemic Cardiovascular diseases and stroke by 7% (Park et al.2021).

Similarly, Wang et al.'s (2021), and Duan et al.'s (2017) findings suggested that not only did telemonitoring improve blood pressure, but it provided better education to patients to improve their overall health. Wang et al. also noted that patients received more training and guidance on how to monitor their pressure, as well as how to titrate their medication to meet the target blood pressure. Margolis et al.'s (2018) and Choi et al.'s (2021) findings showed an effective reduction in blood pressure in patients with uncontrolled hypertension with sustained effects on overall health. Choi et al. noted that patient satisfaction increased, and they were able to receive the appropriate training in the use of tools required for telemonitoring, which decreased patient anxiety. However, these studies questioned the sustainability and long-term efficacy of telemonitoring.

Zhang et al.'s (2021) findings aligned with Cavero-Redondo et al.'s (2021) and Yatabe et al.'s (2021) when they demonstrated a significant reduction in blood pressure through telemonitoring. These authors attributed these findings to patient adherence to the treatment plan. According to Yatabe et al. (2021), patients who received an interactive approach with healthcare providers through videoconferencing were more eager to follow treatment plans than the control group. Similarly, Cavero-Redondo et al. (2021) noted increased adherence to treatment through

e-healths, which contributed to a significant reduction in patient blood pressure, improved quality of life, and improved physical activity compliance.

Many studies discussed the use of telemonitoring to improve blood pressure control due to the continuity and accessibility of care and overall improvement in healthcare costs. McManus et al. (2021), Ionov et al. (2021), and Yatabe et al. (2018) concluded that using telemonitoring not only decreased the blood pressure in patients with uncontrolled hypertension but also contributed to the reduction of healthcare costs. Yatabe et al. noted that many patients whose blood pressure was monitored remotely showed a decrease in both emergency room visits and in waiting in lines for in-person visits with an overall improvement in healthcare costs. Likewise, Ionov et al. argued that telemonitoring was cost-effective in the long, as patients who received remote counseling intervention during telemonitoring were able to reach and maintain their target blood pressure which prevented cardiovascular events.

Conclusion

Despite the efficacy of blood pressure screening, diagnosis, and treatment, high blood pressure remains the main risk factor for cardiovascular diseases, disability, and death worldwide (Choi, 2021). In this integrative review, many articles were reviewed, analyzed, and synthesized to evaluate the effectiveness of telemonitoring to improve uncontrolled hypertension. While few articles questioned the sustainability and long-term clinical effectiveness of telemonitoring to improve blood pressure, many articles supported that telemonitoring was effective in improving blood pressure control in patients with uncontrolled hypertension. These studies have evaluated the effectiveness of telemonitoring technology and found it effective to improve blood pressure control, improve adherence and access to care, decreasing healthcare costs, and improve overall

patient outcomes. As a result of this literature review, the clinical question was answered, as many articles reviewed supported the efficacy of telemonitoring to improve blood pressure in adult patients with uncontrolled hypertension.

Ethical Considerations

This study complied with the Office of Human Research Protections (OHRP) regulations regarding the protection of human subjects in research studies. The project was submitted for approval to the Liberty University Institutional Review Board (IRB) and was approved and considered to be exempt (see Appendix A). A Collaborative Institutional Training Initiative (CITI) course on biomedical and health science research was also completed (see Appendix B).

TIMELINE

Milestone	Description	Estimated Completion Date
Preliminary Literary Analysis	Preliminary articles search and matrix	5/29/22
CITI Training Completion Certificate	Complete CITI Training Exercises and examinations	7/1/22
Scholarly Project Proposal draft	Proposal Sections final draft submitted	7/24/22
Proposal Defense	Preliminary proposal (PowerPoint) defense to the chair	8/11/22
IRB Exemption permission	RB Exemption Received	8/12/22
Scholarly Project	Proposal Sections 1-3 Final	8/28/22
Scholarly Project	Proposal Sections 1-5 Final	9/25/22
Summary & analysis	Submit spreadsheet assignment	9/25/22
Scholarly Project Defense	Scholarly Project Defense	10/9/22

PowerPoint assignment	PowerPoint assignment submitted

SECTION SIX: DISCUSSION

Implications for Practice/Future Work

The benefits of telemonitoring are undeniable, as it improves patients' outcomes. It is estimated that about one-third of adults with high blood pressure are uninformed about their disease process and nearly half of them have uncontrolled hypertension (omboni, 2019). With the recent expansion of remote care throughout the nation, it is important to note that telemonitoring can provide a great platform to improve the health of many patients suffering from blood pressure. This constitutes a great tool to meet the immediate needs of the patients and frequent monitoring without the burden of waiting for appointments in person. Telemonitoring expands access to care, can improve awareness about blood pressure, improves patient adherence to the treatment plan, and positively impacts their outcomes. Telemonitoring will not only improve patient outcomes but will also improve the standard of care and organizational workflow. However, while researches support the efficacy of telemonitoring to improve patients' outcomes, further research is needed to analyze the sustainability and long-term clinical effectiveness.

Dissemination

The results of this project were presented at my current healthcare practice to many healthcare providers during one of our quality assurance meetings to improve the organization's

practice and outcome. This project will also be published to help guide the care of patients with uncontrolled hypertension and establish new standards of care.

This integrative review will also educate many healthcare providers and patients with uncontrolled hypertension around the world. With evidence showing that telemonitoring can speed up the delivery of care and decision-making strategies, decrease blood pressure, and prevent cardiovascular events, many healthcare organizations must incorporate telemonitoring into their practice (Park et al., 2021). The expected outcome of this project will be the use of telemonitoring to improve patient outcomes and organizational practice.

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Appendices

Appendix A

Institutional Review Board (IRB) Approval Letter

External] IRB-FY22-23-181 - Initial: Non-Human Subjects Research

do-not-reply@cayuse.com

- Goodrich, Cindy (Nursing).
- Bakop, Lucie

Fri 8/12/2022 11:10 AM

August 12, 2022

Lucie Bakop

Cynthia Goodrich

Re: IRB Application - IRB-FY22-23-181 IN ADULT PATIENTS WITH UNCONTROLLED BLOOD PRESSURE, HOW DOES ADDING TELEMONITORING TO STANDARD CARE ENHANCE BLOOD PRESSURE: AN INTEGRATIVE REVIEW

Dear Lucie Bakop and Cynthia Goodrich,

The Liberty University Institutional Review Board (IRB) has reviewed your application in accordance with the Office for Human Research Protections (OHRP) and Food and Drug Administration (FDA) regulations and finds your study does not classify as human subjects' research. This means you may begin your project with the data-safeguarding methods mentioned in your IRB application.

Decision: No Human Subjects Research

Explanation: Your study is not considered human subjects research for the following reason: It will not involve the collection of identifiable, private information from or about living individuals (45 CFR 46.102).

Please note that this decision only applies to your current application, and any modifications to your protocol must be reported to the Liberty University IRB for verification of continued non-human subjects research status. You may report these changes by completing a modification submission through your Cayuse IRB account.

If you have any questions about this determination or need assistance in determining whether possible modifications to your protocol would change your application's status, please email us at irb@liberty.edu.

Sincerely,

G. Michele Baker, MA, CIP

Administrative Chair of Institutional Research

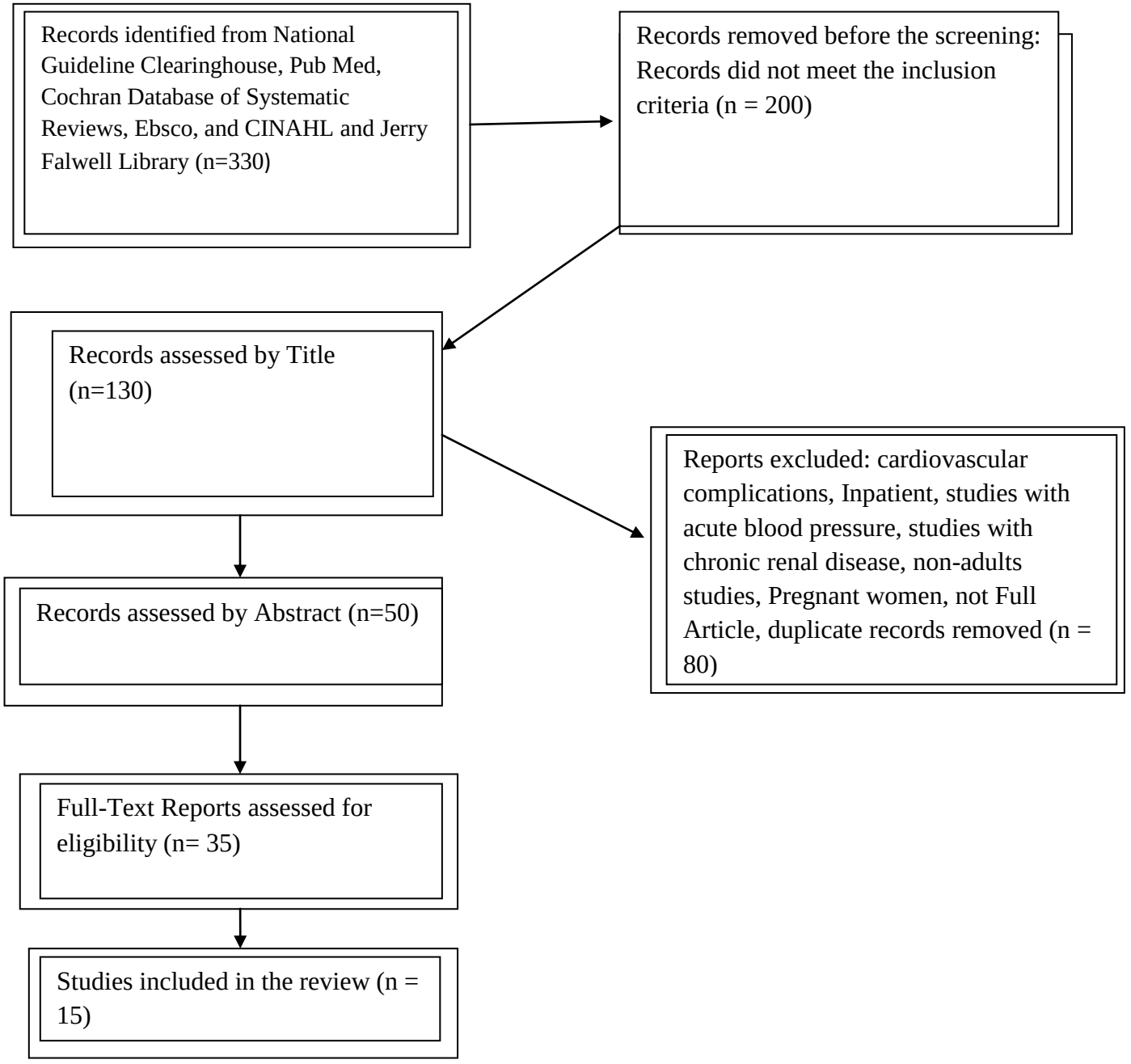
Research Ethics Office

Appendix B

CITI Training Certificate

Appendix C

PRISMA Flow Diagram



From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. doi: 10.1136/bmj.n7

Appendix D

Essentials of Doctoral Education for Advanced Practice Nursing

I. Scientific Underpinnings for Practice	To address the current and future practices regarding uncontrolled hypertension, it is important to use a scientific approach through evidence-based research. This integrates new technologies and knowledge into evidence-based practice to improve practice and patient outcomes.
II. Organizational and Systems for Quality Improvement and Systems Thinking	During this integrative review, the DNP graduate was able to evaluate the current system of healthcare delivery to find strategies based on scientific findings, which can meet the current and future needs of adult patients with uncontrolled hypertension.
III. Clinical Scholarship and Analytic Methods for Evidence-Based Practice	This integrative review was done using a literature review of evidence-based research articles, which show improvement in blood pressure through telemonitoring. During this project, about fifteen evidence-based articles with full text were retained after quality by how closely they support the clinical question.
IV. Information Systems/Technology and Patient Care Technology for Improvement and Transformation of Health Care	Healthcare information systems and technology can help provide high-quality care. Telemonitoring technology can be added to existing practice to help manage hypertension in patients with poorly controlled blood pressure. Technology has improved safety and care, facilitated research, and communicated

	research results, to sustain continuity of care.
VII. Clinical Prevention and Population Health	This integrative review identified a better approach to uncontrolled blood pressure and can help to educate healthcare professionals on how to prevent cardiovascular events or death by adding telemonitoring to standard care. This can improve the standard of care and help design guidelines on poorly managed hypertension in adults patient, and prevent death.
VIII. Advanced Nursing Practice	The Advance Practice Nurse used high clinical judgment and skills to evaluate qualitative review research, measure outcomes, and synthesize and interpret the effectiveness of telemonitoring on uncontrolled blood pressure. It is the responsibility of the Advance Practice Nurse to increase hypertension awareness, ensure compliance, and improve the standard of care.

From: The Essentials of Doctoral Education for Advanced Nursing Practice available to download from http://www.aacn.nche.edu/DNP/index/htm

Appendix E

Evidence Table

Clinical Question: how does the use of telemonitoring in adult patients with uncontrolled hypertension improve blood pressure control?

Author (year)	**Study Purpose/ Objective(s)**	**Design, Sampling Method, & Subjects**	**Intervention & Outcomes**	**LOE**	**Study Strengths & Limitations**
Cavero-Redondo, I., Saz-Lara, A., Sequí-Dominguez, I., Gómez-Guijarro, M. D., Ruiz-Grao, M. C., Martinez-Vizcaino, V., & Álvarez-Bueno, C. (2021). Comparative effect of eHealth interventions on hypertension management-related outcomes: A network meta-analysis. *International Journal of Nursing Studies, 124*, 104085-104085. https://doi.org/10.1016/j.ijnurstu.2021.104085	The purpose of the study was to compare the effectiveness of different electronic health in decreasing hypertension and improving the quality of life.	Samples of fifty one articles were searched using a systematic review through online databases.	Findings indicates effectiveness of telemonitoring in reducing systolic and diastolic pressure, controlling blood pressure, improving quality of life, increasing adherence to treatment, and improving physical	Level I: Meta-analysis.	This study has some limitations as limited number of samples and the different tools used to measure outcomes.

			activity compliance.		
Choi, W., Kim, N., Kim, A., & Woo, H. (2021). Nurse-coordinated blood pressure telemonitoring for urban hypertensive patients: A systematic review and meta-analysis. *International Journal of Environmental Research and Public Health*, *18*(13), 6892. https://doi.org/10.3390/ijerph18136892	The purpose of the study was identifying the effectiveness of home blood pressure via telemonitoring in patients with uncontrolled blood pressure.	A sample of 2483 patients with stage 2 hypertension in 61 control centers.	The study reveals significant increase in blood pressure control when using telemonitoring which improved their overall outcome.	Level II: Cluster-randomized trials	The limitation here was the lack of follow up care.
Duan, Y., Xie, Z., Dong, F., Wu, Z., Lin, Z., Sun, N., & Xu, J. (2017). Effectiveness of home blood pressure telemonitoring: A systematic review and meta-analysis of randomised controlled studies. *Journal of Human Hypertension*, *31*(7), 427-437. https://doi.org/10.1038/jhh.2016.99	The aimed of the study was to identify the effectiveness of telemonitoring on patient with uncontrolled blood pressure.	The study was a sample of 13 875 participants with uncontrolled high blood pressure.	The authors concluded that home blood pressure telemonitoring can have a significant impact on blood pressure control compared to traditional care when	Level I: Meta analysis.	The study presents some limitations as non medical studies were eliminated and was only limited to medical studies.

			they are paired with additional supports.		
Fuchs, S. C., Harzheim, E., Iochpe, C., David, C. N. d., Gonçalves, M. R., Sesin, G. P., Costa, C. M., Moreira, L. B., & Fuchs, F. D. (2018). Technologies for innovative monitoring to reduce blood pressure and change lifestyle using mobile phones in adult and elderly populations (TIM study): Protocol for a randomized controlled trial. *JMIR Research Protocols, 7*(8), e169-e169. https://doi.org/10.2196/resprot.9619	This study was done to evaluate the effectiveness of technologies in controlling blood pressure.	This study uses a sample of 231 patients with uncontrolled blood pressure in primary care settings.	Findings noted potential outcomes with improved decision-making strategies while using telemonitoring compared to standard care. indicate that technology use can have a great impact on quality of care and practice workflow	Level II: A randomized controlled trial	This study used implementations that were only limited to high blood pressure.
Grant, S., Hodgkinson, J., Schwartz, C., Bradburn, P., Franssen, M., Hobbs, F. R., Jowett, S. McManus, R. J., & Greenfield, S.	The purpose of the study was to evaluate the effectiveness of telemonitorin	This is a sample of 40 participants in a primary care	The authors concluded that telemonitoring offered	Level II: A randomized controlled trial.	The study presented some limitations as the population sample

(2019). Using mHealth for the management of hypertension in UK primary care: An embedded qualitative study of the TASMINH4 randomized controlled trial. *British Journal of General Practice, 69*(686), e612-e620. https://doi.org/10.3399/bjgp19X704585	g, in the management of patient with uncontrolled hypertension.	setting.	more benefits to practice and improved outcomes due to its accessibility, and continuity of care, along with effective communication, patient education, and improved blood pressure.		was only limited to a certain group.
Ionov, M. V., Zhukova, O. V., Yudina, Y. S., Avdonina, N. G., Emelyanov, I. V., Kurapeev, D. I., Zvartau, N. E., & Konradi, A. O. (2021). Value-based approach to blood pressure telemonitoring and remote counseling in hypertensive patients. *Blood Pressure, 30*(1), 20-30. https://doi.org/10.1080/08037051.2020.1813015	The purpose of the study was to analyse the value telemonitoring in improving the outcome of patient with hypertension.	A sample of 240 patients with uncontrolled blood pressure in an ambulatory setting.	The findings indicatetelemonitoring provided a great continuity of care, remote counseling, which highly improved blood pressure control	Level II: Randomized control trials.	The study used a small population size and was only for a short period of time.

			and decreased healthcare cost.		
Margolis, K. L., Asche, S. E., Dehmer, S. P., Bergdall, A. R., Green, B. B., Sperl-Hillen, J. M., Nyboer, R. A., Pawloski, P. A., Maciosek, M. V., Trower, N. K., & O'Connor, P. J. (2018). Long- term outcomes of the effects of home blood pressure telemonitoring and pharmacist management on blood pressure among adults with uncontrolled hypertension: Follow-up of a cluster randomized clinical trial. *JAMA Network Open, 1*(5), e181617. https://doi.org/10.1001/jamanetworkopen.2018.1617	The purpose of the study was to evaluate the long-term outcomes of the effects of home blood pressure telemonitoring among adults' patients with uncontrolled high blood pressure.	This is a sample of 450 patients with uncontrolled blood pressure in 16 primary care clinics.	The study shows a significant decrease in blood pressure in patients when using telemonitoring with improved decision-making strategies.	Level II: Randomized control trials.	This study presents some limitations as the authors called for more studies. .
McManus, R. J., Little, P., Stuart, B., Morton, K., Raftery, J., Kelly, J., Bradbury, K., Zhang, J., Zhu, S., Murray, E., May, C. R.,	To evaluate the effectiveness of home and online monitoring of blood	A sample of 622 patients with uncontrolled blood pressure in	Findings indicate that, in primary care, adding digital	Level II: A randomized controlled trial.	The study did not include data about patient adherence to the

Mair, F. S., Michie, S., Smith, P., Band, R., Ogburn, E., Allen, J., Rice, C., Nuttall, J., . . HOME BP investigators.(2021). Home and online management and evaluation of blood pressure (HOME BP) using a digital intervention in poorly controlled hypertension: Randomised controlled trial. *BMJ, 372*, m4858-m4858. https://doi.org/10.1136/BMJ.m4858	pressure is poorly controlled hypertension.	the primary care office.	care to standard care and self-monitoring can be cost-effective and improve blood pressure results.		treatment regimen, which has a great impact on lowering blood pressure. Also, the study use minimization, which has can reduce the effect of randomization. .
Pan, F., Wu, H., Liu, C., Zhang, X., Peng, W., Wei, X., & Gao, W. (2018). Effects of home telemonitoring on the control of high blood pressure: A randomised control trial in the fangzhuang community health center, beijing. *Australian Journal of Primary Health*, *24*(5), 398. https://doi.org/10.1071/PY17187	The study was done to evaluate the effectiveness of home telemonitoring in controlling high blood pressure.	This was a sample of 110 hypertensive patients in a local community center.	The study shows that patients who had easy access to care at any time were able to continue their treatment, as they could reach or communi	Level II: A randomized controlled trial.	The limitation of the study was that studies were completed only in 180 days, and the authors called for further studies with many days.

			cate their health concerns to providers at any time, which helped in reaching the target blood pressure.		
Park, S., Shin, J., Park, J., & Choi, W. (2021). An updated meta-analysis of remote blood pressure monitoring in urban-dwelling patients with hypertension. *International Journal of Environmental Research and Public Health, 18*(20), 10583. https://doi.org/10.3390/ijerph182010583	The purpose of the study was to evaluate the effectiveness of remote blood pressure monitoring in hypertensive patients living in urban areas.	A sample of 32 independent studies of patients with uncontrolled blood pressure in urban areas.	Findings indicate that telemonitoring was an effective tool in achieving blood pressure control compared to standard care alone due to accessibility and continuity of care.	Level I: A systematic review of meta-analysis.	This study presents some limitations in terms of language barriers of article selected and a small size of articles selected.
Santos, D. S., Batistelli, C. R. S., Lara, Marina Marilac Dos Santos, Ferreira, E. d. S., Moreira, T. R., &	The purpose of this study was to evaluate the effectiveness	This study was based on a sample of 209 articles	Findings indicate that the use of telemonit	Level I: A systematic review	The study limitation is based on the limited

Cotta, R. M. M. (2022). The effectiveness of the use of telehealth programs in the care of individuals with hypertension and, or diabetes mellitus: Systematic review and meta-analysis. *Diabetology and Metabolic Syndrome, 14*(1), 76-76. https://doi.org/10.1186/s13098-022-00846-5	of telehealth programs in managing the care of patients with hypertension and diabetes.	using systematic review and meta-analysis.	oring in controlling high blood pressure and diabetes with easy and continuous access to continue care.	and meta-analysis.	number of articles for inclusion in the meta-analysis of hypertension.
Wang, J., Li, Y., Chia, Y., Cheng, H., Minh, H. V., Siddique, S., Sogunuru, G. P., Tay, J. C., Teo, B. W., Tsoi, K., Turana, Y., Wang, T., Zhang, Y., Kario, K., Hypertension Cardiovascular Outcome Prevention, Evidence (HOPE) Asia Network, & the Hypertension Cardiovascular Outcome Prevention, Evidence (HOPE) Asia Network. (2021). Telemedicine in the management of hypertension: Evolving technological	The purpose of this study was to evaluate the usefulness of telemedicine in improving uncontrolled hypertension in differed communities.	This was a sample of 7037 patients in 23 randomized controlled trials.	This study shows that telemedicine may eventually improve blood pressure and prevent cardiovascular events in patient with uncontrolled hypertension with interventi	Level 1: A systematic review and meta-analysis.	This study presented some limitations on the fact that the study was only limited to telemonitoring, and no co-interventions studies were added.

platforms for blood pressure telemonitoring. *The Journal of Clinical Hypertension (Greenwich, Conn.), 23*(3), 435-439. https://doi.org/10.1111/jch.14194			ons such as patient education, medication titration, or lifestyle counseling.		
Yatabe, M. S., Yatabe, J., Asayama, K., Staessen, J. A., Mujaj, B., Thijs, L., Ito, K., Sonoo, T., Morimoto, S., & Ichihara, A. (2018). The rationale and design of reduction of uncontrolled hypertension by remote monitoring and telemedicine (REMOTE) study. *Blood Pressure, 27*(2), 99-105. https://doi.org/10.1080/08037051.2017.1406306	To compare traditional care and telemonitoring care in the management of uncontrolled blood pressure in the primary setting.	A sample of 444 patients, with uncontrolled hypertension in multi-primary care settings.	Findings indicate that combining telemonitoring with traditional care significantly reduces the rate of uncontrolled hypertension, cardiovascular events and overall healthcare cost.	Level II: A randomized controlled trial	The study was conducted in the multi-center with visits length different from one center to another with a reduction in the length of treatment.
Yatabe, J., Yatabe, M. S., Okada, R., & Ichihara, A. (2021).	The purpose of the study was to	A total of 159 patients	The study shows that	Level II: A random	The study sample was

Efficacy of telemedicine in hypertension care through home blood pressure monitoring and videoconferencing: Randomized controlled trial. *JMIR Cardio, 5*(2), e27347-e27347. https://doi.org/10.2196/27347	examine the safety and usefulness of telemotoring for the management of patient with hypertension.	with uncontrolled hypertension.	patient were able to achieve better hypertension control through adherence to treatment plan.	ized controlled trial	smaller than the intended sample.
Zhang, D., Huang, Q., Li, Y., & Wang, J. (2021). A randomized controlled trial on home blood pressure monitoring and quality of care in stage 2 and 3 hypertension. *Hypertension Research, 44*(5), 533-540. https://doi.org/10.1038/s41440-020-00602-0	The purpose of this study was to analyze the effectiveness of home blood pressure monitoring to improve treatment adherence and decrease blood pressure in patient with stage 2 and 3 hypertension.	This was a sample of 96 patients in 18 hospitals.	The study shows that home blood pressure monitoring significantly improve treatment adherence and clinic blood pressure in patients with stage 2 and 3 hypertension.	Level II: A randomized controlled trial	This study presented some limitations due to the fact that only pills counts methods were used to determine adherence to treatment and white coat hypertension influencing the blood pressure readings in clinics.