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Impact of Telehealth Versus Traditional Visits on Pain Management Patients Utilizing Medical Cannabis During the COVID-19 Pandemic

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Abstract

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MBA, University of Colorado at Colorado Springs, 2015

MSc, University of Idaho, 2008

BS, University of Idaho, 2003

Dissertation Submitted in Partial Fulfillment

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Abstract

Alternatives to traditional office visits have become a necessity with the recent COVID-19 outbreak, resulting in an unmatched surge in telehealth adoption. The present study was an investigation of the impact of telehealth versus traditional office visits in medical cannabis clinics treating patients for chronic pain. With 50,000,000 American adults experiencing pain and over 750,000 overdoses attributed to opioid usage, collecting research-driven evidence to increase the availability of safe, effective, and nonopioid treatment options will create positive social change. The Donabedian model was applied to measure the quality of care, focusing on structure (cannabis clinics), process (telehealth vs. traditional office visits), and outcome (visual analog scale [VAS]). The study utilized a quasi-experimental, retrospective analysis of data using multiple linear regression comparing the impact of telemedicine visits versus traditional office visits on treating five pain types in a medical cannabis clinic during a pandemic. The main finding of this study indicated that telemedicine visits were as effective as traditional office visits in treating pain. However, there was not statistically significant data to suggest that cannabis-derived medicines resulted in improved outcomes in the five pain types studied (general, back, arthritic, cancer, and migraine). Across all pain types and subjects there was an overall decrease in pain from initial visit (7.44) to follow-up visit (6.29) a decrease of 15.4% on the VAS. Expanding healthcare service treatment options that are safe, effective, and accessible in caring for chronic pain will prevent disease, improve health outcomes, and improve quality of care all leading to positive social change.

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Table of Contents

List of Tables

List of Figures

Chapter 1: Introduction to the Study

Chronic pain, opioid misuse, and the overprescribing of opioid medications are extremely prevalent in the United States, necessitating innovative solutions that are safe, effective, accessible, and nonaddictive (Volkow & Collins, 2017). Forty-seven thousand Americans died of opioid misuse in 2017, approximately 128 deaths per day, with more than 2 million Americans currently living with opioid addiction (Pitcher et al., 2019). The limited number of alternative medications for chronic pain that are devoid of serious side effects limit the ability of health care providers to treat chronic pain effectively (Volkow, 2018). There is a significant need for chronic pain services that minimize the risk of abuse, utilize nonopioid analgesics to improve treatment options, and are more accessible to all patients (Kaye et al., 2017).

Compounds that target the endocannabinoid system (ECS) are a potential solution, with evidence suggesting medications that target the ECS are effective in treating pain and improving quality of life without risk of abuse (VanDolah et al., 2019). Growing evidence suggests the therapeutic benefits of cannabis in the treatment of chronic pain, that ECS medicines result in the reduction of opioid usage, and states with legal medicinal cannabis laws have a lower mean opioid overdose mortality rate (Baron, 2018).

People living in rural and remote areas of the country have less access to evidence-based pain services and experience significant remote health disadvantages (Scriven et al., 2019). Telehealth has proven to be an effective delivery option for addressing pain management with recent literature suggesting the pandemic created the

expeditious adoption of telehealth versus face-to-face visits to sustain delivery of care to patients (Andrews et al., 2020). Improved levels of both patient and clinician satisfaction with the use of telehealth provides opportunities for improving access to quality care. Combining ECS medications with telehealth access creates a potential solution in addressing pain management during pandemics.

Background

In 2015, for the first time in 100 years, life expectancy in the United States experienced a sustained decline of 0.3 years, a direct correlation to opioid misuse (DeWeerdt, 2019). Fifty million Americans suffer from daily chronic pain with half of those individuals lacking a safe, effective, accessible, nonopioid option for pain management (Dahlhamer et al., 2018). Expanding healthcare service treatment options that are safe and effective in caring for chronic pain will prevent disease, improve health, and increase access to evidence-based preventive services.

While researchers continue to investigate nonopioid analgesics and have explored both efficacy and satisfaction of telemedicine in treating chronic pain, as well as the effectiveness of cannabinoids in treating chronic pain, there is a gap in understanding these variables together during a pandemic. No research has addressed whether telemedicine impacts pain management differently than traditional office visits in medical cannabis clinics during a pandemic. The current pandemic has drastically shifted the delivery of care, with telemedicine at the forefront based on the need for social distancing (Mahoney, 2020). A further understanding of the impacts of telemedicine in a variety of healthcare service organizations (HSO) is needed.

Problem Statement

The specific research problem I addressed through this study, was the lack of current research on the use of telemedicine versus traditional office visits during the pandemic impacting the outcome of pain, in pain patients treated in a medical cannabis clinic. Glynn et al. (2021) studied chronic pain care via telehealth to rural patients at U.S. Department of Veterans Affairs (VA) clinics, concluding that telehealth was a successful tool in delivering treatment, improving access to care, and decreasing travel burden and costs. Uscher-Pines et al. (2020) studied patients with opioid use disorder (OUD) and the impact of telemedicine, barriers encountered, and implications for quality of care concluding both positive effects (i.e., quality of interactions, increased patient access) and negative effects (i.e., less structure and accountability, less information to inform clinical decision making, establishing a connection, technological issues, and shorter visits) characteristics of utilizing telemedicine during a pandemic. There is currently no literature to support whether telemedicine would have a similar impact in medical cannabis clinics. Mahoney (2020) researched clinicians to understand the use of telehealth technologies in the rapid adoption and introduction of telemedicine during the pandemic. The results of the study identified several advantages and disadvantages: including continuity of care, access to expert staff, to the limitations of telehealth in a long-term or assisted care facilities. Access to care remains a top advantage for the utilization of telehealth, the burden of travel continues to be a barrier to both access and quality of care. No data currently exists in the literature on telehealth and medical cannabis clinics, and the impact telehealth has on the patients access to care, treatment,

and outcomes. The research problem aligns with the Health Services program because a lack of safe, effective, non-addictive, non-opioid treatments for treating chronic pain has impacted healthcare service treatment options available to healthcare providers. Expanding healthcare service treatment options that are safe and effective in caring for chronic pain will prevent disease, improve health, and increase access to evidence-based preventive services (Yue et al., 2019). These improved healthcare service treatment options will enhance quality of care, an important domain of care delivery in the health services industry.

Purpose of the Study

The purpose of this quasi-experimental quantitative study was to expand nonopioid health service treatment options by comparing the impact of telemedicine visits versus traditional office visits on treating pain in a medical cannabis clinic during a pandemic. Specifically, in this study I considered the independent variable of utilizing telemedicine versus traditional office visits and the dependent variable of pain in several medical conditions (i.e., general pain, migraines, cancer, arthritis, and back pain).

Research Questions and Hypotheses

RQ1: What is the relationship between telehealth technology and traditional office visits when comparing pain management levels in patients dealing with arthritic pain during the pandemic?

$H_0$1 – There is no statistically significant difference in pain management levels in arthritic patients.

$H_1$1 – There is a statistically significant difference in pain management levels in arthritic patients.

RQ2: What is the relationship between telehealth technology and traditional office visits when comparing pain management levels in patients dealing with back pain during the pandemic?

$H_0$2 – There is no statistically significant difference in pain management levels in back pain patients.

$H_1$2 – There is a statistically significant difference in pain management in back pain patients.

RQ3: What is the relationship between telehealth technology and traditional office visits when comparing pain management levels in patients dealing with migraine pain during the pandemic?

$H_0$3 – There is no statistically significant difference in pain management levels in migraine patients.

$H_1$3 – There is a statistically significant difference in pain management levels in migraine patients.

RQ4: What is the relationship between telehealth technology and traditional office visits when comparing pain management levels in patients dealing with general (nerve, post-trauma, menstrual) pain during the pandemic?

$H_0$4 – There is no statistically significant difference in pain management levels in general pain patients.

$H_1$4 – There is a statistically significant difference in pain management levels in general pain patients.

RQ5: What is the relationship between telehealth technology and traditional office visits when comparing pain management levels in patients dealing with cancer during the pandemic?

$H_0$5 – There is no statistically significant difference in pain management levels in cancer patients.

$H_1$5 – There is a statistically significant difference in pain management levels in cancer patients.

Theoretical Framework

The theory that grounds this study is Donabedian's (1988) theory of relationships between structure, process, and outcome constructs as a measure of quality care. Donabedian theorized that structure measures, impact process measures, which affect outcome measures. Per Donabedian's theory, with structure being held constant, improvements in the process (e.g., telemedicine vs. traditional visits) will create positive patient outcomes and improve quality of care. Outcome measures are the ultimate validator of effectiveness and quality of healthcare. If the change to telemedicine results in improved outcome measures, the theory will have applications to medical cannabis clinics and create further research opportunities for these.

The Donabedian model was used to provide evidence of quality systems. Applying the model to my current study design, structure will remain constant as all patients came from a single medical cannabis clinic. Telemedicine was the clinical

service or process focused on the care delivered to patients, and outcome measures (pain management) were analyzed to determine whether the Donabedian Model holds true for assessing quality of care within a medical cannabis clinic.

Nature of the Study

To address the research questions in this quantitative study, I used a quasi-experimental design utilizing retrospective data extracted from patient medical records from a single medical cannabis clinic.

The CED Clinic, located in Chestnut Hill, Massachusetts was founded in 2017 by Benjamin Caplan, MD to provide medical services to individuals seeking cannabis treatment. The clinic champions a holistic approach to healthcare and wellness that includes medicinal cannabis. The CED is an organization dedicated to combating, through education and information, stigmas associated with cannabis. Advances in science, medical research, and modern product controls underscore the ability of medicinal cannabis to be a viable and empowering treatment option for patients. Under Dr. Caplan, CED believes that discussions concerning cannabis, and knowledge concerning its benefits, must be more accessible if the misinformation around cannabis is to be overcome. The CED Foundation seeks to shine a light upon research, data, and science that support medicinal cannabis' beneficial aspects.

Patient data from traditional office visits collected from 2017 to 2020, prior to the start of the COVID-19 pandemic, were compared to patient data collected post pandemic when the CED clinic transitioned to only telemedicine appointments. The same patient

intake form was utilized for both visit types (i.e., traditional office visits and telehealth visits), collecting identical patient data pre- and post-pandemic.

The CED clinic patient intake form is a series of 75 questions used to collect demographic information, medical conditions, medical history, patient agreement and consent, and a series of questions regarding cannabis usage, history, dosage, expenses, and cannabis perspectives. Of these 75 questions, for patients experiencing pain, a visual analog scale (VAS) is presented to understand how much pain the medical condition is causing for the patient. The VAS captures pain levels on a scale from 1 to 10, with a score of 10 being worst pain imaginable. Follow-up visits require the same intake form to be completed, allowing the clinicians to determine whether the treatment plans are changing pain management levels. A comparison of these electronic health records pre- and post-pandemic allowed me to determine whether there is a relationship between telehealth and traditional office visits in changing pain management levels in those patients dealing with chronic pain.

Chronic pain patients were broken into five separate categories to determine whether the medical condition, or type of pain, may play a part in the relationship between telehealth and traditional office visits. The five medical conditions I initially explored were arthritic pain, back pain, migraine pain, general pain, and cancer related pain.

Definitions

Telehealth: the use of electronic information and telecommunications technologies to support long-distance clinical health care, patient and professional health-related education, public health, and health administration.

Telemedicine: the remote diagnosis and treatment of patients by means of telecommunications technology.

Traditional office visit: face-to-face office visit with a primary care provider, billable encounters that result from evaluation and management services provide to the patient.

General pain: an unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage.

Back pain: pain felt in the low or upper back. Causes of pain in the low and upper back include conditions affecting the bony spine; discs between the vertebrae; ligaments around the spine and discs; spinal inflammation; spinal cord and nerves; muscles.

Arthritis: the swelling and tenderness of one or more of a person's joints. The main symptoms of arthritis are joint pain and stiffness, which typically worsen with age.

Migraine: a recurrent throbbing headache that typically affects one side of the head and is often accompanied by nausea and disturbed vision.

Cancer pain: described as dull aching, pressure, burning, or tingling and can be caused by the cancer itself or the treatments.

Medical marijuana: marijuana used as recommended or prescribed by a doctor in the treatment of a medical condition.

Visual Analog Scale (VAS): a measurement instrument that tries to measure a characteristic or attitude that is believed to range across a continuum of values and cannot easily be directly measured. It is often used in epidemiologic and clinical research to measure the intensity or frequency of various symptoms.

Assumptions

Several paradigm assumptions are inherent in all quantitative research studies, including the nature of reality, role of values, and the methodological and epistemological assumptions. During this study, it was assumed that the retrospective information collected from the CED clinics patients was accurate and representative of the medical history and conditions impacting the patients, and that the patient intake forms were answered truthfully. An assumption of this study was that the treatment option (i.e., telehealth vs. traditional office visits) delivered by the clinic had the potential to impact health outcomes. Another assumption was that the collected data and patient intake forms followed the same guidelines between telehealth and traditional office visits and were provided in a non-biased manner.

Scope and Delimitations

Telemedicine has been shown to be highly effective, potentially equivalent to traditional office visits during the pandemic, improving access to care through the utilization of telemedicine creates opportunities for many sick patients who are not able to visit their doctor in a traditional office setting.

For this research, I used preexisting medical health records from medical cannabis patients 18 years and older in the state of Massachusetts. Data were self-reported pain

outcomes using a VAS pain scale in assessing the relationship between telehealth and traditional office visits during the COVID-19 pandemic. The sample population was limited to medical marijuana patients undergoing pain management treatment at Dr. Caplan's clinic.

Limitations

The utilization of a single site is the most significant limitation to the research. A weak external validity will impact the extent to which the study results can be applied to other medical cannabis clinics. Study replication by independent investigators will help to restore the weak external validity. Other limitations include the completeness of the data set, an equal amount of telehealth patients to compare with traditional office visits. Retrospective quasi-experimental study designs are known for their limitation; including unmeasured confounders, response rate could introduce response bias, incomplete data sets, randomization is also not used limiting the ability of the study to conclude a causal association between variables (Schweizer, 2016). Controlling for new patients versus continuing patients will need to be addressed as there could be potential differences between the two.

Significance

With over 50,000,000 American adults experiencing pain most days for the past six months and over 750,000 overdoses attributed to current healthcare service treatment options, a significant difference can be made by exploring both nonopioid treatment options as well as delivery of treatment (Dahlhamer et al., 2018).

The novel coronavirus has defined our past 2 years of life; mandated quarantines ordered across the globe impacted how people with acute and chronic conditions received medical care and treatment (Andrews et al., 2020). Alternatives to traditional office visits became a necessity, resulting in an unmatched surge in telehealth. Overall satisfaction with telehealth has been high, with many patients and providers wanting to continue the use after the pandemic (Andrews et al., 2020). With 47 states having cannabis legislation in place, understanding whether telehealth is impactful within medical cannabis HSOs will provide further evidence to support increasing access to care during times of crisis. This research study will have positive impacts empowering healthcare workers to utilize nonopioid treatment options and make use of advancing technologies providing improved access to care.

This study is significant in that it addresses service treatment options available for treating pain and seeks to understand if telemedicine offers improvements in patient outcomes (pain management) versus traditional office visits in medical cannabis clinics. If improved patient outcomes result, utilizing telemedicine in medical cannabis clinics will improve access to non-opioid analgesics, resulting in improvements in quality of care.

Summary

The pandemic has created challenges in the delivery of health care for patients dealing with pain. Telemedicine and medical cannabis create pathways aligned with the Joint Commissions pain assessment and management accreditation as well as access to quality health care, a challenge exacerbated by the recent pandemic (Baker, 2017).

Understanding how to deliver high quality, accessible care during times of crisis remains an unknown across a variety of HSO's. Telemedicine and telehealth provide a potential pathway forward as the uncertainty of the pandemic and future health care crises loom for future generations. Reducing pain, overdose deaths, and opioid addiction, as well as expanding access to quality health care, will have a profound impact on the United States healthcare system.

Chapter 1 provided a brief introduction to the opioid crisis, health care delivery options during times of health care crises, and potential solutions to ensure consistent delivery of quality and accessible healthcare. The purpose and problem statement were discussed, transitioning to the research questions and hypotheses this research looks to address. The Donabedian model was discussed along with its relevance to quality of care based on structure, process, and outcomes. Chapter 1 continued with a series of defined terms relative to the research study, a concise rationale for the design, and the assumptions and limitations of the study. A brief discussion of the positive social change associated with the research topic and the significance of accessible, quality health care during the pandemic rounded out the chapter.

Chapter 2: Literature Review

Does the utilization of telemedicine vs traditional office visits during the pandemic impact the outcome of pain, among pain suffering patients treated in a medical cannabis clinic? The purpose of this quasi-experimental quantitative study was to expand nonopioid health service treatment options by comparing the relationship between telemedicine visits and traditional office visits on treating pain in a medical cannabis clinic during a pandemic. Specifically, this study considers the independent variable of utilizing telemedicine versus traditional office visits and the dependent variable of pain in several medical conditions (general pain, migraines, cancer, arthritis, and back pain).

Glynn et al. (2021) studied chronic pain care via telehealth to rural patients at VA clinics and concluded that telehealth is a successful tool in delivering treatment, improving access to care, and decreasing travel burden and costs. Uscher-Pines et al. (2020) studied patients with OUD and the impact of telemedicine, barriers encountered and implications for quality of care concluding both positives (quality of interactions, increased patient access) and negatives (less structure and accountability, less information to inform clinical decision making, establishing a connection, technological issues, and shorter visits) characteristics of utilizing telemedicine during a pandemic. Mahoney (2020) researched clinicians to understand the use of telehealth technologies during the rapid adoption and introduction of telemedicine during the pandemic. Mahoney identified several advantages and disadvantages, including continuity of care, access to expert staff, and the limitations of telehealth in a long-term or assisted care facilities. Access to care remains a top advantage for the utilization of telehealth, as the

burden of travel continues to be a barrier to both access and quality of care. No data currently exists in the literature regarding telehealth and medical cannabis clinics, and the impact telehealth has on the patients access to care, treatment, and outcomes.

Chapter 2 outlines the literature search strategy and the search engines utilized in gathering data in support of the research study. Key terms are discussed including an analysis of the Donabedian theory along with the overall scope of the literature review. Chapter 2 concludes with an analysis of the study design and literature supporting the use of a quasi-experimental design.

Literature Search Strategy

The literature review focused on a variety of factors, including pain management, telemedicine, cannabinoids, and health care during a pandemic. The key words searched included *pain management, cannabis, telemedicine, cannabis clinics, endocannabinoid system, in-person visits, controlling health care costs, health care access, rural healthcare, cost effectiveness of telehealth, telehealth vs face to face, opioids, Donabedian model, evidence-based practices,* and *telemedicine during a pandemic*. Databases utilized were Thoreau multi database and Google Scholar linked through the Walden Library. Searches were limited to peer-reviewed journal articles; all documents were accessed electronically through the Walden University Library, published from 2016–2021, with articles discussing the theoretical foundation dating back earlier based on the original publication in 1966 by Avedis Donabedian.

Theoretical Foundation

The Donabedian Model

The theoretical approach applied to this study is based on the Donabedian model, a tripartite approach created by Avedis Donabedian, assessing health care quality through a structure, process, outcome model (Donabedian, 1988). The Donabedian model offers a simple and logical approach to defining and measuring quality in health care. A directional influence appears among the components of the model; however, the components are not characteristics of quality and serve as processes to acquire information about the presence or absence of quality elements within healthcare systems (Rupp, 2018).

Structure relates to the environment of care, including quality of providers, facility design, equipment, and technology. Structure is a necessary determinant of quality and alone is not enough to ensure high quality (Rupp, 2018). *Process* reflects the interactions between providers and patients, which is considered the most direct and reliable approach to assessing quality. The final component of the trio, *outcome*, relates to the change in health status attributed to the health care received, with both positive and negative outcomes possible (Rupp, 2018). Donabedian noted poor outcomes may occur with high quality care and vice versa, positive outcomes did not necessarily equate to high quality care, but the probability of positive outcomes improved with high quality care. To summarize the model, when a causal relationship between process and outcome is established, valid assumptions about quality can be made, without a causal relationship neither process nor outcome can be used to assess quality (Donabedian, 1988).

Historical Donabedian Studies

Andrews et al. (2020) conducted an integrative review of the literature guided by the Donabedian model to examine the evidence on patient and provider satisfaction with the use of telemedicine during the COVID-19 pandemic. The outcome of the 18 peer-reviewed articles provided additional evidence that the use of telehealth and telemedicine resulted in elevated levels of satisfaction from both patients and providers. The study examined both process and outcome identifying a causal relationship between telehealth and telemedicine, the process, and an outcome of high satisfaction. While Andrews et al.'s study was guided by the Donabedian model and found evidence of a process outcome causal relationships, several limitations were noted. The study was short in duration, some of the research articles were published pre-proof, validity and reliability of the study instruments were not addressed, and election bias was significant as surveyed participants had no choice but to use telehealth during the pandemic.

Although the uptake of telehealth and telemedicine has been slow, the necessity of these processes was accelerated by the COVID-19 pandemic. Medical cannabis facilities were no exception to the rule with the CED clinic (structure) moving to 100% telemedicine visits to maximize patient safety. The application of the Donabedian model towards patient satisfaction during the pandemic lends itself to the current study in that it can be applied during a pandemic and was effective in defining quality through a process outcome causal relationship. This foundation was applied in a similar fashion with the current study, understanding the processes of traditional office visits versus telehealth applications in improving pain management (outcome).

The Binder et al. (2021) case report described the leadership process of applying the Donabedian model in structuring an early response to COVID-19 relative to emergency care. Structure and process changes were implemented because of the pandemic to maintain quality clinical outcomes using the Donabedian model as their guide. The key finding of Binder et al.'s research was that pandemic responses can be structured using the Donabedian model of quality through an analysis of structure and process data. The interventions in both structure and process led to positive outcomes as defined by the Donabedian model; however, there were limits to the generalizability of the study being a private hospital with many available resources. The structure of the hospital also lent itself easily to many of the structure changes that were implemented which may not be true of all hospital settings.

The utilization of a known quality model and the results of this research indicate that the Donabedian model can be used as a pandemic response tool to ensure patient and staff safety outcomes (Binder et al., 2021). While the study had limitations, it provides grounds for exploring the Donabedian model utilizing other HSOs during the COVID-19 pandemic. The process of changing how care is delivered to ensure patient safety, a positive quality outcome, lends itself to this model and further exploration of the structure-process-outcome model. This foundation was applied with the current study, understanding the processes of traditional office visits versus telehealth applications in improving pain management (outcome).

Pain Management

Chronic pain is a complicated, debilitating, multidimensional condition, which drastically impacts quality of life, limiting the ability to work and sleep and affecting social interactions with friends and family, and is associated with high economic and social burden (Yasri & Wiwanitkit, 2020). Dahlhamer et al. (2018) provided a report on the prevalence of chronic pain hoping to improve existing estimates for the effective implementation of chronic pain interventions in the United States. With chronic pain being the most common reason adults seek medical care and an estimated 20.4% of U.S. adults experiencing chronic pain, better pain management options are needed. High-impact pain leads to mobility restrictions, opioid dependence, anxiety, depression, and a reduced quality of life, contributing to an estimated $560 billion each year in direct medical costs, lost productivity, and disability programs (Dahlhamer et al., 2018). Healthy People 2020, the nation's science-based health objectives, developed an objective to decrease the prevalence of adults having high-impact chronic pain (Dahlhamer, 2018).

A retrospective, quantitative analysis of prospectively collected data was conducted by Knezevic et al. (2017) to assess the compliance of chronic opioid consumption in an outpatient setting to determine if repeated urine drug testing would improve prescription compliance. An analysis of 500 patients currently utilizing opioid mediations for chronic pain was conducted, with patients asked to provide supervised urine toxicology screens during standard clinic visits, without prior notification. The utilization of repeated drug tests, in combination with education and disclosure resulted

in 63.6% of the patients having improved prescription compliance. The study authors reviewed several other retrospective studies to examine how urine testing impacted opioid consumption and illicit drug use in combatting chronic pain. The authors found mixed results; however, each of the studies confirmed that a retrospective analysis of data was sufficient in trending data and drawing statistical conclusions. Limitations included the utilization of a single site, with future research needing to explore larger populations.

Utilizing a single site, with a larger population size would help to overcome the limitations of this study but confirmed a retrospective quantitative data analysis can be utilized in chronic pain patient populations (Knezevic et al., 2017).

Opioid dependence, misuse, and addiction has rapidly evolved into a public health crisis with the National Institute of Health launching initiatives in several scientific areas, in relation to this research study; treatment of chronic pain, finding safe and effective, nonaddictive interventions to manage chronic pain (Volkow & Collins, 2017). Treatment of chronic pain has taken a multitude of treatment pathways from opioid analgesic with abuse deterrent properties, to researching compounds that target other opioid receptors, to compounds that target the ECS. Strong evidence exists on the efficacy of cannabinoids in treating chronic pain; medications that target the ECS without cognitive impairment or the rewarding effects seen with opioid use (Volkow & Collins, 2017).

Medical Cannabis

The use of medical cannabis and cannabis-based medicines in treating pain has steadily increased over the past decade, with chronic pain cited as the most common ailment for utilizing cannabinoid treatment (Capano et al., 2019). The natural source of

cannabinoids, widespread use, low addiction and dependency risk, and safety profile have flagged cannabinoids as potential therapeutics; including pain control with quality evidence that cannabinoids reduce pain (Capano et al., 2019). The opioid epidemic and a search for alternative treatment options has piqued the interest of policy makers, scientists, and patients to explore medical cannabinoids as a safer option. A corresponding surge in research, studies, and clinical research trials has followed suit, with researchers seeking to better understand the impact of these medicines in treating several ailments. However, a lack of consensus still exists into the effectiveness of these medicines.

A recent systematic review and meta-analysis of existing literature aimed to determine the efficacy and safety of selective cannabinoids compared to standard of care or placebo in treating neuropathic pain was completed by Meng et al. (2017). The researchers found select cannabinoid medicines (i.e., dronabinol, nabilone, and nabiximols) all man-made forms of cannabis, could be used as adjunct analgesics in patients with neuropathic pain and improved quality of life, sleep, patients' reports of positive change, and improved sensory pain thresholds.

Campbell et al. (2019) worked to better understand the evidence associated with the use of medical cannabis in treating chronic non-cancer pain through a systematic data review. The researchers found varying data ranging from moderate to substantial evidence for the efficacy of medical cannabinoids in the treatment of chronic pain, primarily driven by pain type. Neuropathic pain, multiple sclerosis pain, visceral pain, and several other pain conditions (fibromyalgia, arthritic, and musculoskeletal pain) were

reviewed with varying conclusions found. Improvements in pain scores, significant reductions in pain scores, and superior to placebo in reducing overall pain intensity were noted throughout the review; however, significance and sample sizes were borderline (Campbell et al., 2019). Careful consideration of both significance and sample size was incorporated into this dissertation to avoid the limitations of Campbell et al.'s review.

With cannabinoid medicines legalized in 36 states, some as recently as 2021 and cannabidiol (CBD) federally legal, peer-reviewed research is limited. A significant research gap currently exists; a more thorough understanding of the therapeutic impacts of this plant medicine and how it can be used to improve quality of life, decrease opioid dependence, and improve access to effective treatment options during pandemics exist.

Pandemic Pain Management

The Coronavirus pandemic (COVID-19) has forced healthcare systems worldwide to redistribute healthcare resources, discontinuing non-urgent services; creating significant changes to the delivery of healthcare systems based on implemented social distancing and safety precautions (Puntillo et al., 2020). The closure of pain treatment centers combined with lockdowns has affected pain management practices and patients across the globe. Increased mental health issues and financial burdens have resulted in further concerns for this patient population, creating the necessity to explore strategies that are able to overcome the difficulties associated with delivering chronic pain patient care during a pandemic (Yasri & Wiwanitkit, 2020).

Niles et al. (2021) conducted a quantitative analysis of clinical drug screening patterns and results at a national clinical laboratory before and during the COVID-19

pandemic. Weekly test volumes for both prescription and illicit drugs decreased by 70% from baseline through the height of the pandemic. However, positivity for non-prescribed fentanyl increased significantly (35%) along with heroin (44%) among individuals who continued testing during the pandemic. Significant increases in deadly drug combinations were also found in those tested creating the need for health care and public health resources dedicated to addressing chronic pain treatment during a pandemic. A total of 872,762 specimens were reviewed to determine what trends were occurring during the pandemic, focusing on drug misuse, noncompliance, and positivity for non-prescribed drugs (Niles et al., 2021). The study found that significant increases in non-prescribed usage occurred during the pandemic, with fentanyl drug combinations increasing as well. Chronic pain combined with stress, change, job losses, loneliness, and depression are all known to trigger medication overuse, with the pandemic being a main driver of these stressors. This study adds further validity for the need of alternative treatment options to combat chronic pain management during the pandemic and points to further research gaps in the existing literature.

Puntillo et al. (2020) conducted a review to better understand the impact of COVID-19 on chronic pain treatment and the strategies to implement and overcome the imposed obstacles in delivering patient care. Key characteristics of patients diagnosed with chronic pain (elderly, disabled, multi-morbidity, multi-treatments, cognitive disorders, emotional disorders, high dosage patients, and intrathecal drug delivery system were compared based on two challenges: standard and during COVID-19 pandemic (Puntillo et al., 2020). The increased challenges faced during the pandemic resulted in the

remote treatment of patients. A focus on continuity of care and pain medications were identified as the primary objectives for risk mitigation of patients and healthcare providers and for regulating access to pain services (Puntillo et al., 2020). The recommendations of the research (Puntillo et al., 2020, p. 4):

1. Infection control: temperature checks, social distancing, hand hygiene, face masks and gloves during patient care, cleaning of surfaces
2. Triage risk of COVID-19 screening patients and personnel for symptoms of COVID-19.
3. Triage pain procedures, suspend elective cases, proceed with emergent, and case by case for urgent.
4. Suspend in-person visits, consider acuity and severity of pain, comorbid psychiatric conditions, occupational considerations, likelihood of meaningful benefit, likelihood of patient be started on opioids and need for physical examination.
5. Adapt ongoing therapy to reduce risk of COVID-19.
6. Perform urgent procedures with minimum personnel.
7. Telehealth and telemedicine

Telemedicine is a real-time two-way interactive communication conducted remotely with an audio-visual device. Telehealth is a more modern term referring to all health and social care uses of technology including digital communication technology, live video conferencing, mobile apps, and Internet of Things (IoT) devices and has

emerged in recent years as a new treatment model in most fields of medicine (Tuckson et al., 2017).

Telehealth and telemedicine deliver face to face service, an imperative component of pain consultation and assures continuity of care after hospital discharge. Technical solutions, with different costs and benefits, have been utilized for remote evaluation and treatment of chronic pain including telephone consultation, email, mobile health, i.e., healthcare application on smartphone, tablets or laptops, messages and image sharing with instant messaging applications between patients and healthcare professionals is growing worldwide (Puntillo et al., 2020). However, the review identified that not enough data exists to determine if telehealth is in fact a viable solution for treating chronic pain patients during a pandemic.

Eccleston et al. (2020) reviewed four factors to help guide healthcare professionals caring for patients with chronic pain during COVID-19 and provided guidance on how to rapidly transition to remote care technology. The four factors included the public health consequences of COVID-19 for patients with pain; consequences of not treating for the duration of the pandemic; options for remote assessment and management of chronic pain patients; and evidence supporting telemedicine therapies (Eccleston et al., 2020). Eccleston et al. (2020) provided a list of practical recommendations for the rapid introduction of remote pain management as well as research priorities for remotely supported health; including an understanding of technology options, that technical problems are going to happen and it's OK, understanding appointment scheduling considerations, complementary resources,

reinforce the positives, problem solving, experiential learning, setting goals, self-help activities, and remembering the context. The research priorities discussed the need for further real-world evaluations of treating chronic pain utilizing telehealth technologies, an objective of the current research proposal.

Unlike other vital signs, pain, the fifth vital sign, is inherently subjective, so reporting of pain experience is extremely variable between patients with elderly, disabled patients, and patients with cognitive or emotional disorders including opioid addiction can make telehealth appointments more difficult (Puntillo et al., 2020). While there are many noted advantages of telehealth there are several challenges telemedicine must work to overcome; primarily the evidence on telemedicine efficacy in treating chronic pain and studies to determine the quality of telemedicine visits compared to traditional clinic patient visits (Puntillo et al., 2020).

Telemedicine

Telehealth programs have long held promise for addressing health disparities perpetuated by inadequate healthcare access, although the uptake of telehealth programs in practice has been quite limited until recently (Hirko et al., 2020). Due to lockdown, travel restrictions, social and physical distancing requirements, or fear that health care facilities may be infected, the significant disruptions in pain practices could have alarming consequences for individuals, society, and whole of health care system and providers (Ghai et al., 2020). With COVID-19 has come an increase in telehealth, with telemedicine emerging as a key technology for efficient communication and a sustainable solution in providing essential health care services and should be considered for chronic

pain patients (Ghai et al., 2020). Research conducted by Ghai et al. (2020) describes the challenges associated with treating chronic pain patients during COVID-19 and the use of telemedicine as a key technology for efficient communication and a sustainable solution to provide essential health care services for chronic paint patients. The unique challenges and exceptional demands placed on health systems during the COVID-19 pandemic has interrupted the care of chronic pain patients leading to increased pain, decline in quality of life, and increased anxiety and depression, therefore telemedicine was researched to address the disruption in treating this patient population (Ghai et al., 2020). Full-scale use of telemedicine in chronic pain is rare. Use of telemedicine in chronic pain is usually focused on psychological interventions, exercise, and mindfulness-based stress reduction therapies (Ghai et al., 2020).

Telemedicine offers numerous advantages especially in routine/non-urgent care; reduce the need of personal protective equipment leading to reduction in resource consumption, improve access to health care and reduce resource use across the already stressed healthcare infrastructure during current pandemic (Ghai et al., 2020). All these factors provide substantial economic savings. However, there is a lack of clarity on medical legal implications through the utilizing of telemedicine. Telemedicine cannot replace clinical medicine based on in-person consultation and physical examination and chances of misdiagnosis and inability to conduct radiological investigations for diagnosis add further limitations to telemedicine (Ghai et al., 2020). The beneficial effects of telemedicine are promising, substantial uncertainty remains around many aspects of

studies related to telemedicine, include small sample size, small effect size, methodological flaws, long-term evaluation, and adverse events (Ghai et al., 2020).

Lin et al. (2017) studied the effectiveness and cost-effectiveness of an internet and mobile based intervention for effectively treating individuals with chronic back pain, with secondary outcomes related to quality of life, pain intensity, and pain related disability (Lin et al., 2017). Internet and mobile based interventions were found to reduce current healthcare deficiencies and were a promising approach for addressing chronic pain. The research by Lin et al. (2017) provided evidence that telehealth applications could be effective in addressing healthcare access, cost effectiveness, and outlined an interesting set of research questions, however these were not applied during a pandemic and only focused on chronic back pain.

Mahoney (2020) researched three wound, ostomy, and continence (WOC) clinicians to describe the use of telemedicine technologies during the rapid adoption and introduction to telemedicine during the pandemic. Mahoney (2020) discusses several advantages and disadvantages including continuity of care, access to expert staff, to the limitations of telemedicine in in long-term or assisted care facilities. Mahoney (2020) provides further information around the advantages, disadvantages, and limitations that may occur during the transition from face-to-face visits to telemedicine during the pandemic, in a very niche patient population. Access to care remains a top advantage for the utilization of telemedicine, with the burden of travel a continued barrier to both access and quality of care.

Uscher-Pines et al. (2020) studied the experiences of front-line clinicians transitioning to telemedicine during the early stages of the COVID-19 pandemic. The researchers focused on patients with OUD and the impact of telemedicine, the barriers encountered and implications for quality of care (Uscher-Pines, et al., 2020). The study found there were a combination of positives, including quality of interactions and increased patient access along with several negatives; less structure and accountability, less information to inform clinical decision making, establishing a connection, technological issues, and shorter visits (Uscher-Pines et al., 2020). The researchers indicated that additional research into the quality and widespread safety need further exploration for this patient population. Currently no literature to support if telemedicine would have a similar impact in medical cannabis clinics with regards to patient and clinician satisfaction and if the same advantages and disadvantages would be applicable.

With opioid related harms impacting rural communities disproportionally, Glynn et al. (2021) established a pilot project to study chronic pain care via telehealth to rural patients at VA clinics. Telehealth services can help address this disparity by bringing evidence-based, biopsychosocial chronic-pain services to rural and underserved patients with chronic pain (Glynn et al., 2021). The Telehealth pilot program offered pain education classes, cognitive–behavioral therapy groups, opioid-safety education, and acupuncture education, delivering 501 encounters to patients, and supported training, administration, and equipment acquisition. The pilot program increased access to safer medications, alternatives to opioids, enhanced pain education and improved psychotherapy. The primary aim of the study was met; feasibility of delivering pain

services by telehealth. The research by Glynn et al. (2021) provides evidence that telehealth is a successful tool in delivering treatment, improving access to care, decreasing travel burden and costs, and enhancing ability to participate in behavioral pain groups. No data currently in the literature which discusses telehealth and medical cannabis clinics, and the impact telehealth has on the patients access to care, treatment, and outcomes.

Healthcare Access

Inequities in education, poverty, unemployment, economic opportunities, and other social determinants contribute to persistent health disparities between those living in America's rural and urban regions (Hirko et al., 2020). These characteristics and circumstances present unique challenges for rural communities in response to the coronavirus disease 2019 pandemic. Preexisting health conditions, coupled with lower access to health care and higher poverty rates, place rural communities at particularly high risk for chronic disease complications. Rural hospital systems are managing chronic disease burden in an aging population with already limited access to healthcare providers, which is even more pronounced with current social distancing measures. Despite these challenges, rural health systems and providers have responded to a rapidly evolving crisis. Telehealth is one strategy that has been quickly deployed in response to the pandemic yet may also have far reaching benefits for rural health (Hirko et al., 2020).

Telehealth programs have long held promise for addressing health disparities perpetuated by inadequate healthcare access; programs are now being utilized to provide

continued access to care, and to manage the potential surge in visits from virus-related concerns, and the closure of outpatient offices.

Munson Healthcare (MHC) a rural hospital system in Michigan, urgently expanded telehealth services and has implemented multiple telehealth programs to address patients' needs and mitigate the adverse impact on the health of patients, providers, and staff (Hirko et al., 2020). MHC health system networks are now offering virtual telemedicine visits to patients, via video or telephonic visits, a complete and unprecedented transformation when almost none of these rural providers participated in telehealth prior to this pandemic. More than 14, 000 visits have occurred via video platforms in the past 6 weeks, providing safe access to care while also protecting providers and care teams (Hirko, et al., 2020). MHC is implementing telehealth solutions in its four long-term care sites, so patients can connect with specialists via video visits, reducing the need for patients to travel to provider practices, and thus reduce potential COVID-19 exposure (Hirko, et al., 2020). While the MHC results have been positive there are still investments in infrastructure and training needed and to consider a comprehensive strategy to ensure sustainability of telehealth programs following the COVID-19 pandemic. Further research is needed to determine if medical cannabis clinics will have similar positive results.

The negative impact of social changes prompted by the COVID-19 crisis may disproportionately affect individuals living with long-term pain. Living with chronic pain threatens an individuals' fundamental social needs for autonomy (agency or independence), belonging (social connection), and justice (fairness) (Karos et al., 2020).

COVID-19 poses a challenge for patients seeking to access pain management. Pain management is a fundamental right; however, COVID-19 affects access for patients with complex medical conditions (e.g., people with comorbid mental health conditions and addiction) and widen existing inequities in relation to pain management for socially disadvantaged population. In the absence face-to-face contact, telehealth is increasingly being recommended as a first line of care for those dealing with chronic pain. This transition to telehealth allows for high-quality care without travelling, increasing patient access to care, and new ways of delivering pain management (Karos et al., 2020).

Preventing a population-level increase in the severity and impact of chronic pain is critical during the pandemic. Medical cannabis and cannabis-based medicines combined with telemedicine technologies has the potential to mitigate the severity and overall impact of chronic pain during the pandemic and further research is needed to expand upon this hypothesis.

Research Method

Quasi-Experimental

Quasi-experimental studies evaluate the association between an intervention and an outcome using experiments in which the intervention is not randomly assigned (Schweizer et al., 2016). Quasi-experimental studies can be categorized into three major types: interrupted time series designs, designs with control groups, and designs without control groups. Quasi-experimental studies are susceptible to selection bias; carefully designing the study and the analytical approaches are key to avoiding known pitfalls of this study design (Schweizer et al., 2016).

Quasi-experimental studies can measure the impact of large-scale interventions or policy changes when data is reported in aggregate and multiple measures of an outcome over time (e.g., monthly rates) are collected. Quasi-experimental studies evaluate real-world effectiveness of an intervention implemented by an HSO not the efficacy of an intervention under research conditions, creating more generalizable studies with better external validity.

Quasi-experimental studies can utilize data collected retrospectively, prospectively, or a combination of both, however retrospective studies are associated with higher risks of bias (Schweizer et al., 2016). Four major considerations should be considered when utilizing a quasi-experimental design:

1. The addition of a control group that does not receive the intervention.
2. Design the study to reduce bias.
    a. Include a non-equivalent depending.
    b. Utilizing a removed treatment design.
    c. Utilizing a repeated treatment design.
    d. Utilizing a switching replication design.
3. Collect evenly spaced observations in both the baseline and intervention.
4. Utilizing an appropriate analysis plan
    a. Avoid autocorrelated observations.
    b. Utilize regression analysis or interrupted time series analysis (ITSA).

Schweizer et al. (2016) provides detailed considerations for designing, analyzing, and writing quasi-experimental studies.

With careful design and analysis quasi-experimental designs can achieve internal validity approaching randomized clinical trials and greater external validity than randomized clinical trials. Statistical analyses can strengthen the validity of quasi-experimental studies as well. Randomized control trials can't address may of the clinical and policy questions that exists, therefore a carefully crafted and designed quasi-experimental study is often the only viable option when researching the impact of intervention and outcome over time.

A quasi-experimental study design was utilized for this research as it's able to support a hypothesis using real-world data, identifying a causal relationship between an intervention and an outcome.

Quasi-Experimental Design in the Literature

Davis et al. (2019) researched the efficacy of behavioral interventions in OUDs and if treatment responses vary by development age or sex (Davis et al., 2019). The study utilized a quasi-experimental design to demonstrate variance in latency to opioid use based on the intervention used. As the youth were not randomly assigned to treatment conditions a quasi-experimental design was used. Based on the use of propensity weighting to adjust for baseline differences in subjects the study had the potential for increased selection and other biases which could affect the internal validity (Davis et al., 2019). Sample sizes were also smaller than anticipated in this study, creating larger confidence intervals, indicating that some of the studies estimates may not be repeatable in other study designs.

Pardos-Gascon et al. (2021) evaluated the efficacy of mindfulness-based cognitive therapy on patients with chronic pain, utilizing a quasi-experimental design of repeated measures pre-and post-test, with an intra group comparison of measurement before and after the intervention (*n*= 57). The researchers hypothesized that an intervention based on MBCT-CP will have a positive impact on levels of pain, anxiety, depression, self-efficacy, quality of life, and sleep attributes. The MBCT was efficient for the reduction of sleep disturbances, intensity of present pain, and depression, and for the improvement of self-efficacy, mental quality of life, and the quantity of sleep. The lack of a control group and long-term follow-up were two of the main limitations of the study. However, this study was multi-center which adds to its validity and may be of importance when designing the current research study as a control group will not be researched.

Vicente et al. (2020) analyzed the impact of a formative / informative intervention on the treatment of non-cancer chronic pain in primary care utilizing a quasi-experimental design with pre and post follow-up of the patient cohort. Primary variables were the number of incidents at baseline and after the intervention with secondary variables of age, sex, prescriptions, and duration of analgesic treatment analyzed in 2,465 incidents. A lack of control group, diagnostic records related to prescription and ensuring all active medications were dispensed and consumed were the discussed limitations of the study (Vicente et al., 2020). Even with limitations the study was able to show that interventions reduced the number of patients with prescription incidents and the quasi-experimental design was the best option based on the more significant ethical concerns associated with a randomized clinical trial.

Summary

The review has demonstrated that recent research on pain management, cannabis-based medicines, telemedicine, and healthcare access during a pandemic exists but has never been studied in a single combined study. Telemedicine offers numerous advantages especially in routine/non-urgent care; reduces the need of personal protective equipment leading to reduction in resource consumption, improves access to health care and reduces resource use across the already stressed healthcare infrastructure during current pandemic (Ghai et al., 2020). All these factors provide substantial economic savings in a time where financial burdens are drastically impacting societies abilities to cover rent and mortgage payments, let alone the associated health care costs we all face.

There currently is no research on the impact of utilizing telemedicine in medical cannabis clinics and if pain is managed as well through the utilization of telemedicine versus traditional face to face visits, as has been researched in other health service organizations, let alone during a pandemic.

The closure of pain treatment centers combined with lockdowns has affected pain management practices and patients across the globe. Increased mental health issues and financial burdens have resulted in further concerns for this patient population, creating the necessity to explore strategies that are able to overcome the difficulties associated with delivering chronic pain patient care during a pandemic (Yasri & Wiwanitkit, 2020).

My research utilized medical cannabis facilities and patients' electronic health records along with a pain VAS to determine if the utilization of telemedicine during the

pandemic has resulted in equivalent outcomes in pain management to traditional face to face visits and was the first study of its kind to explore this relationship.

This quasi-experimental research study assessed the intervention of telemedicine in determining the impact of pain management, the outcome, utilizing the Donabedian model of quality analysis through structure, process, outcome.

This study provided further understanding of the effectiveness of both cannabis-based medicines and telehealth in addressing pain management.

Chapter 3 outlines the methodology and research design used to explore the research questions, define the key variables of the research study, answer the five hypotheses, and provide data on the statistical analysis to ensure that both the internal and external validity are not threats to the study by avoiding the limitations that are inherently part of quasi-experimental studies.

Chapter 3: Research Method

The purpose of this quasi-experimental quantitative study was to determine whether the use of telemedicine versus traditional office visits during the pandemic impacted the outcome of pain among pain-suffering patients treated in a medical cannabis clinic. Specifically, this study is focused on the independent variable of telemedicine versus traditional office visits and the dependent variable of pain in several medical conditions (general pain, migraines, cancer, arthritis, and back pain). Expanding nonopioid health service treatment options is one of several pathways to address chronic pain in the United States and to curb the raging opioid epidemic. The Donabedian (1988) model of quality improvement guided the research study through the analysis of structure, process, and outcome by determining whether improvements in the process (i.e., telemedicine vs. traditional visits) created positive patient outcomes and improve quality of care.

In Chapter 3, I describe the research design and rationale; explain the research setting sample, setting, and treatment; provide an overview of the data being collected and its subsequent analysis; discuss ethical concerns and potential threats to the research design, and conclude with a summary of the chapter.

Research Design and Rationale

For this study, I used a quasi-experimental quantitative research design to compare how chronic pain patients responded to telehealth visits during the COVID-19 pandemic. Comparing these data with previous traditional office visits, prior to the pandemic, helped to better understand the impact (positive, negative, or neutral) of

innovative technologies in the treatment of chronic pain. Research Questions 1 through 5 include the following variables: gender, age, medical condition prompting visit, pain score before/after treatments, and treatment process telemedicine vs traditional. Table 1 outlines each of the study variables, their specific measures, variable type, and response category.

Table 1

Operational Measures for Key Independent and Dependent Variables

Variables	Specific measures	Response category	Type of variable
VAS Pain Scale	Before treatment, quarterly follow-up	Scale 1–10, 10 being worst pain imaginable	Ordinal (dependent)
Gender	Gender of subjects	1 = Male 2 = Female 3 = Choose not to disclose	Nominal
Age	Age in Years	1 = 18–24 2 = 25–34 3 = 35–44 4 = 45–54 5 = 55–64 6 = 65-older	Interval
Treatment type	Type of visit	1 = Telehealth 2 = Traditional office visit	Nominal (independent)
Medical condition		1 = General pain 2 = Migraines 3 = Cancer pain 4 = Arthritic pain 5 = Back pain	Nominal

Note. VAS = Visual Analog Scale.

The quasi-experimental, non-equivalent group, pretest–posttest, longitudinal study design utilized the analysis of secondary data consisting of approximately 17,000 patient files in the form of electronic medical records (EMRs) stored at the CED clinic, a medical cannabis clinic in the state of Massachusetts. EMRs from the CED clinic were

used to collect demographics (gender, age), medical conditions (arthritis, back pain, injury, headache, muscle pain, nerve pain, cancer), treatment type (telehealth vs traditional) and VAS pain scale measurements. The CED clinic collected a series of 60+ questions prior to admission and a series of follow-up questions during and after treatment through the utilization of their EMR system and survey tools. The VAS is a validated pain scale used to measure pain outcome measurements and collected by the CED clinic that was utilized in this research study. Examining the VAS before and after treatment, combined with the treatment type, allowed for the examination of mean VAS scale differences between telehealth and traditional office visits on the treatment of chronic pain.

A quantitative, quasi-experimental, non-equivalent, pretest-posttest, longitudinal study design was both practical and appropriate based on the patient population, available data, and the hypotheses requiring a set of quantitative data to determine the impact of the independent variable (treatment type) on pain severity before and after treatment. While interventional research is typically conducted through randomized control trials, the utilization of secondary, archived data limited the use of randomization or a control group.

Setting and Treatment

The structure or setting of this research study was the CED Clinic, a medical cannabis clinic in Massachusetts founded in 2017 to provide medical services and oversight to individuals seeking cannabis treatment. The CED clinic champions a holistic approach to healthcare and wellness and provides a comfortable and professional

environment where patients and clinicians can openly discuss medical cannabis and its benefits.

The Donabedian model was used to provide evidence of quality systems with structure (CED clinic) remaining constant as all patients came from a single medical cannabis clinic. The Donabedian theory views the relationships between structure, process, and outcome as a measure of quality care (Donabedian, 1988). Donabedian (1988) theorized that structure measures, impact process measures, which affect outcome measures. Telemedicine or traditional office visits were the treatment or processes analyzed. A focus on care delivered to chronic pain patients through two process types and the analysis of outcome measures (VAS) determined that the Donabedian model held true for assessing quality of care within a medical cannabis clinic.

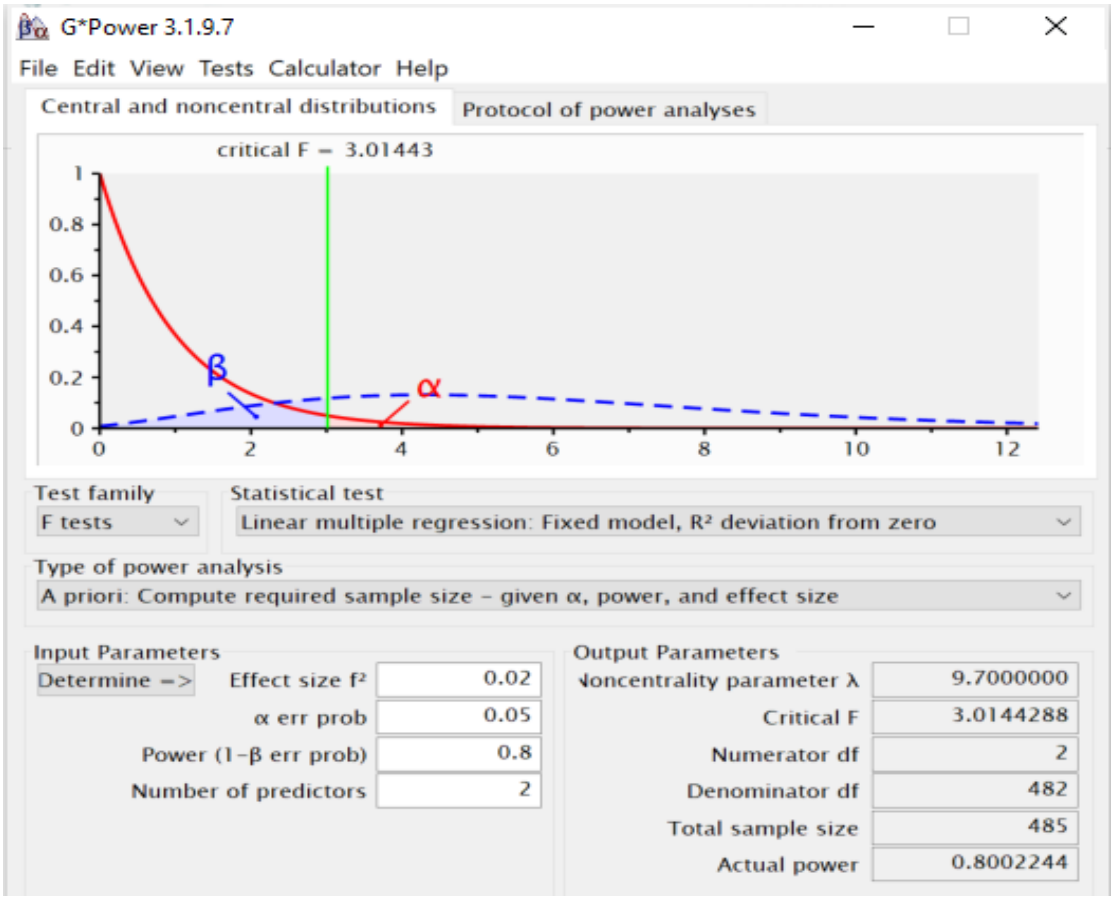
Research Sample

The sample for this research study consisted of patients who utilize the CED clinic. The sample population within the CED clinic (17,000+) was further queried by treatment type (telemedicine vs traditional office visits), separating the patients into two date range groups based on pre and post pandemic status: 2017–2020 (pre-pandemic) and 2020 (post-lockdown, currently only offering telehealth visits). The sample data were further queried by medical conditions, focusing on the following five medical conditions: general pain, migraines, cancer pain, arthritic pain, and back pain. All age groups and genders were included and only patients who had completed the VAS were included in the research sample. The power analysis and sample size calculations were calculated using the following three variables: effect size, power (1-β), significance level (α), and

type of analysis (see Kang, 2021). The effect size represents a minimal clinically meaningful difference, set at small (0.02) for this analysis. Utilizing G*Power (Version 3.1.9.7), an a priori power analysis, *F* test, linear multiple regression fixed model, R^2, deviation from zero was analyzed. A small effect size of 0.02, power of 0.8, significance of 0.05, and two independent predictor variables (visit type and medical condition) resulted in minimum of 485 subjects (see Figure 1).

Figure 1

Sample Size Analysis



Data Collection

The research sample data were supplied by Dr. Benjamin Caplan, Founder of the CED Clinic, in the form of de-identified patient data from the clinic EHR software. The de-identified patient data ensured that patient confidentiality was maintained throughout the study per HIPPA regulations. There were 17,584 total patients in the database at the time of the analysis. Patients were separated by treatment type (telemedicine vs traditional office visit). Each of the treatment groups was further divided by medical condition (general pain, migraines, cancer pain, arthritic pain, and back pain) with each medical condition numerically coded 1-5 as detailed in Table 1. VAS scores for pain (scored 1-10), collected prior to clinic admission as well as throughout clinic treatment, were pulled from each patient file. All data were imported into a Microsoft Excel file spreadsheet for ease of use and data sorting. Patient age and gender were also collected for informational purposes and generalization. Data were imported into IBM SPSS Statistics (Version 28) for statistical analysis and interpretation.

Data Analytics

Sample size and power analysis tools were used to calculate the number of study participants required to confirm if each of the null hypotheses had any impact on the study results.

RQ1: What is the relationship between telehealth technology and traditional office visits when comparing pain management levels in patients dealing with arthritic pain during the pandemic?

$H_0$1 – There is no statistically significant difference in pain management levels in arthritic patients.

$H_1$1 – There is a statistically significant difference in pain management levels in arthritic patients.

RQ2: What is the relationship between telehealth technology and traditional office visits when comparing pain management levels in patients dealing with back pain during the pandemic?

$H_0$2 – There is no statistically significant difference in pain management levels in back pain patients.

$H_1$2 – There is a statistically significant difference in pain management in back pain patients.

RQ3: What is the relationship between telehealth technology and traditional office visits when comparing pain management levels in patients dealing with migraine pain during the pandemic?

$H_0$3 – There is no statistically significant difference in pain management levels in migraine patients.

$H_1$3 – There is a statistically significant difference in pain management levels in migraine patients.

RQ4: What is the relationship between telehealth technology and traditional office visits when comparing pain management levels in patients dealing with general (nerve, post-trauma, menstrual) pain during the pandemic?

$H_0$4 – There is no statistically significant difference in pain management levels in general pain patients.

$H_1$4 – There is a statistically significant difference in pain management levels in general pain patients.

RQ5: What is the relationship between telehealth technology and traditional office visits when comparing pain management levels in patients dealing with cancer during the pandemic?

$H_0$5 – There is no statistically significant difference in pain management levels in cancer patients.

$H_1$5 – There is a statistically significant difference in pain management levels in cancer patients.

I used multiple linear regression making several key assumptions which were confirmed prior to analyzing the data. Categorical variables were recoded as dummy variables as outlined in Table 1, and a series of bivariate analyses were conducted. The four assumptions included: (a) the existence of a linear relationship between the outcome and the independent variables, which was determined through the utilization of a scatter plot, (b) multivariate normality, assumption that data is normally distributed, defined by the errors between observed and predicted are normally distributed, which was determined through a histogram, (c) no multicollinearity, confirmed by analyzing the variation inflation factor (VIF) and (d) homoscedasticity, to understand if the variance of errors are similar across independent variables. Homoscedasticity was analyzed by comparing a scatterplot of residuals versus predicted values. All assumptions were met.

Ethical Considerations and Threats

The utilization of a single site was the most significant limitation to the research. A weak external validity impacted the extent to which the study results could be applied to other medical cannabis clinics, patients, and outcomes. Study replication by independent investigators will help to restore the weak external validity. All patient data have been collected by the CED clinic via online/electronic surveys and questionnaires. Limitations of these collection methods are well researched and include the absence of the interviewer, the ability to reach all patients, completeness of the data set, identity verification of patients providing data, and a lack of quality random sampling could lead to questionable statistic confidence and margin of error (Wright, 2006). Working to ensure an equal amount of randomized telehealth patients to traditional office visits helped to reduce study threats and improve upon the confidence of the data. Retrospective quasi-experimental study designs are known for their limitations, including unmeasured confounders, response rate that could introduce response bias, incomplete data sets, and randomization not being used, limiting the ability of the study to conclude a causal association between variables (Schweizer, 2016). Controlling for new patients versus continuing patients was addressed to control potential differences between the two. All patients within the clinic had a unique patient ID so that the patient remains de-identified, and all patients have previously consented to the use of their data for further research and publication, eliminating any significant ethical concerns.

Summary

The purpose of this quasi-experimental quantitative study was to determine whether the use of telemedicine versus traditional office visits during the pandemic impacted the outcome of pain among pain suffering patients treated in a medical cannabis clinic. Specifically, this study considered the independent variable of telemedicine versus traditional office visits and the dependent variable of pain in several medical conditions (general pain, migraines, cancer, arthritis, and back pain). The quasi-experimental, non-equivalent group, pretest-posttest, longitudinal study design utilized the analysis of secondary data consisting of approximately 17,000 patient files in the form of EMRs stored at the CED clinic, a medical cannabis clinic in the state of Massachusetts. Multiple regression analysis was conducted to analyze the data, utilizing a sample set of 454 patients. Study threats were discussed and were considered as the analyses were being conducted.

Chapter 4 reviews the method, the collected data, and the analyses and interpretation of the research data. Research findings are discussed along with interpretation of each of the research questions and hypotheses. Research limitations are discussed along with the implications of the research.

Chapter 4: Results

In this chapter, I review demographics of the study population, data collection, statistical data analysis, the research questions and hypotheses and a summary of the statistical data. The purpose of this quantitative study was to determine the relationship between telehealth technology and traditional office visits when comparing pain levels in patients dealing with pain (cancer, general, arthritic, migraine, and back) during the COVID-19 pandemic. I analyzed the independent variable visit type (telemedicine and traditional office visits) and the dependent variable of repeat VAS scores across each of the pain groups (strata). An ANOVA statistical test was completed and *p* values for two of the research hypotheses were calculated (arthritic and back pain) based on adequate sample sizes.

The research questions and corresponding hypotheses were as follows:

RQ1: What is the relationship between telehealth technology and traditional office visits when comparing pain management levels in patients dealing with arthritic pain during the pandemic?

$H_0$1 – There is no statistically significant difference in pain management levels in arthritic patients.

$H_1$1 – There is a statistically significant difference in pain management levels in arthritic patients.

RQ2: What is the relationship between telehealth technology and traditional office visits when comparing pain management levels in patients dealing with back pain during the pandemic?

$H_0$2 – There is no statistically significant difference in pain management levels in back pain patients.

$H_1$2 – There is a statistically significant difference in pain management in back pain patients.

RQ3: What is the relationship between telehealth technology and traditional office visits when comparing pain management levels in patients dealing with migraine pain during the pandemic?

$H_0$3 – There is no statistically significant difference in pain management levels in migraine patients.

$H_1$3 – There is a statistically significant difference in pain management levels in migraine patients.

RQ4: What is the relationship between telehealth technology and traditional office visits when comparing pain management levels in patients dealing with general (nerve, post-trauma, menstrual) pain during the pandemic?

$H_0$4 – There is no statistically significant difference in pain management levels in general pain patients.

$H_1$4 – There is a statistically significant difference in pain management levels in general pain patients.

RQ5: What is the relationship between telehealth technology and traditional office visits when comparing pain management levels in patients dealing with cancer during the pandemic?

$H_0$5 – There is no statistically significant difference in pain management levels in cancer patients.

$H_1$5 – There is a statistically significant difference in pain management levels in cancer patients.

Data Collection

Upon Walden Institutional Review Board (IRB) approval, number 01-19-22-0602045, secondary archived data in the form of electronic health records were de-identified by the partner facility and re-coded with a unique patient identifier. The data files ranged from 2017 to 2022 and represented approximately 17,000 medical cannabis patients. I combined all files into a master file and further organized and edited them, so the final Excel file consisted of eight columns (Patient ID, Visit Type, Gender, Age, Health Condition, VAS, Repeat Visit within 3-5 months, and VAS Repeat). The final file contained 2,323 patients who met each of the acceptance criteria. The data were imported into SPSS (Version 28) for statistical testing.

Descriptive Statistics

The descriptive statistical output data for all 2,323 medical cannabis patients with repeat visits occurring within 3–5 months of their initial visit showed that 1215 (52.3%) utilized traditional visits, whereas 1108 (47.7%) used telemedicine visits. The descriptive statistical output data for gender or sex of the study participants revealed that, among the 2,323 medical cannabis patients, 1034 (44.5%) were female, 1282 (54.6%) were male, and 21 (0.9%) identified as “other.”

Table 2 represents the descriptive statistical output of both the initial pain scores (VAS) and the follow-up visit (post-treatment) pain scores (VAS repeat). The mean VAS was 7.44 with a standard deviation of 1.915 while the repeat VAS had a mean of 6.29 and a standard deviation of 1.886. Figures 2 and 3 represent histograms for both VAS and repeat VAS.

Table 2

Descriptive Statistics: VAS Initial and Repeat Pain Scores

		VAS	VAS Repeat
N	Valid	2323	2323
	Missing	0	0
M		7.44	6.29
Mdn		8.00	6.00
SD		1.915	1.886
Minimum		0	3
Maximum		10	10

Figure 2

Histogram of VAS Pain Scores

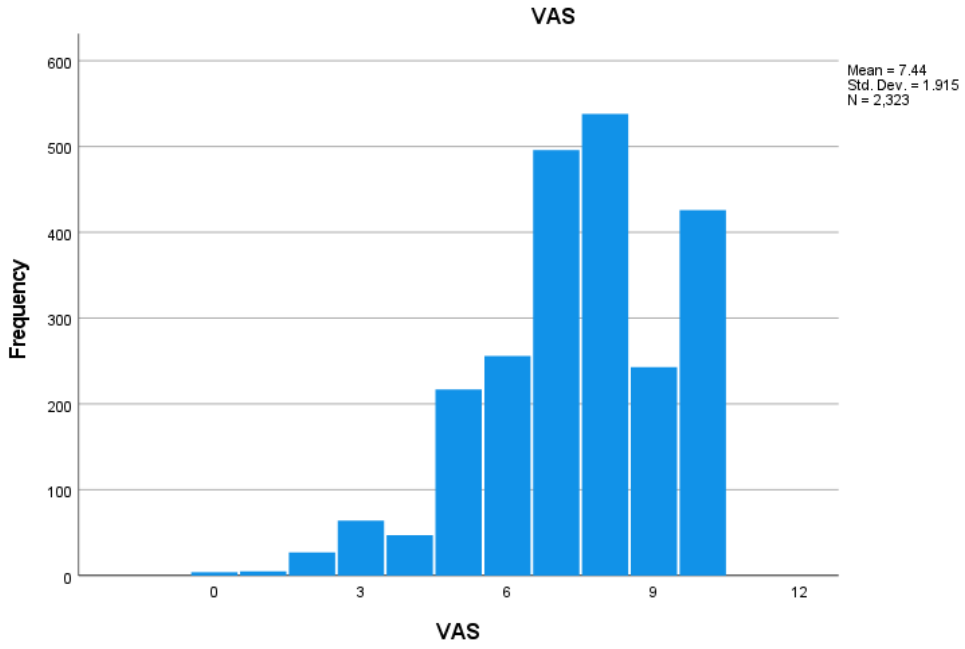


Figure 3

Histogram of Repeat VAS Pain Scores

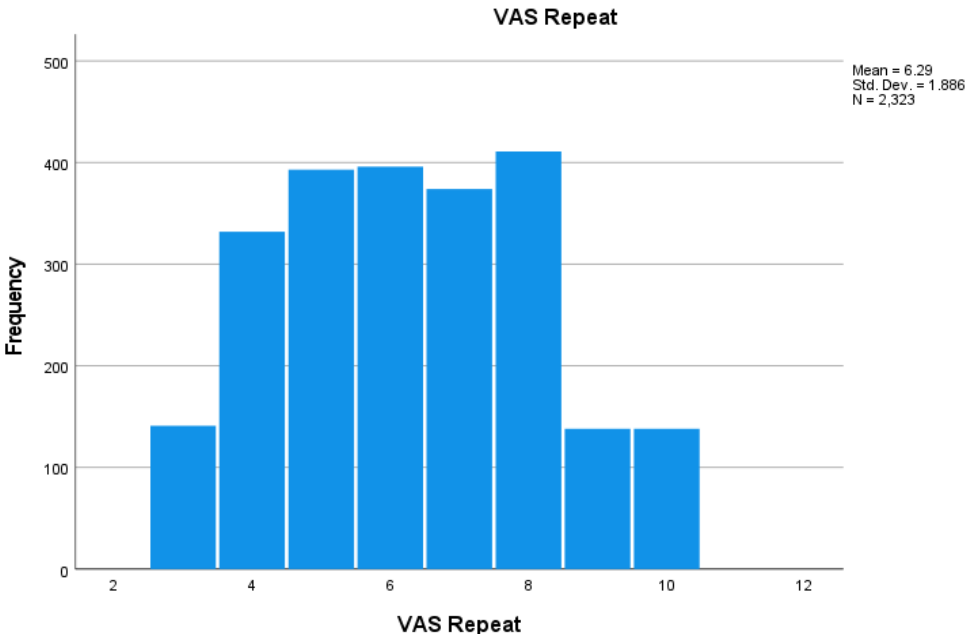


Table 3 represents the descriptive statistical data output of distribution of the medical conditions which prompted the patients visit, with backpain being the most frequent medical condition and cancer pain being the least frequent medical condition.

Table 3

Descriptive Statistics: Medical Conditions of Pain Patients

Medical condition	*N*	%
General pain	457	19.7
Migraines	237	10.2
Cancer pain	121	5.2
Arthritic pain	600	25.8
Back pain	908	39.1

The power analysis and sample size calculations completed in Chapter 3 utilized a small effect size of 0.02, power of 0.8, and a significance of 0.05 resulting in a minimum of 485 subjects per medical condition; only two of the five groups (arthritic and back) reached the appropriate sample size per the power analysis.

Two-Way Tests

Two-way tests were conducted to analyze the difference between the means of repeat VAS for each categorical independent variable (gender, medical condition, and visit type) and correlations of repeat VAS with each continuous independent variable (VAS, age, and repeat VAS). The analysis of variance (ANOVA) was done to determine if the independent variables affect the dependent variable (repeat VAS) while the correlation coefficient, *r*, describes the strength and direction of the linear relationship between quantitative variables. The correlation coefficient also acts as an inferential

statistic, testing if a significant relationship exists between two variables, the closer the value to 1 or -1 the more correlated the variables are. The Levene statistic was conducted to determine the homogeneity of variance between variables, a required assumption of one-way ANOVA, with the null hypothesis being that the variances are equal across all samples. Tables 4-12 represent the statistical output of the two-way tests, each of which show no observed effect or statistical significance between repeat VAS and gender, medical condition, or visit type, all with p values >0.05, and eta squared values of 0.00, indicating visit type, medical condition, nor gender influences the variance in VAS repeat score. The null hypothesis for each of the Levene's tests can be rejected, as none of the data points were statistically significant and therefore the variances meet the assumption of equal variance.

Table 4

Statistical Output: Two-Way Test VAS Repeat and Visit Type

Descriptive

Telemedicine or Traditional	*M*	*N*	*SD*
Traditional	6.29	1215	1.880
Telemedicine	6.30	1108	1.893
Total	6.29	2323	1.886

Table 5

Statistical Output: Homogeneity of Variances VAS Repeat and Visit Type

		Levene Statistic	*df*1	*df*2	Sig.
VAS Repeat	Based on Mean	.092	1	2321	.762

Table 6

Statistical Output: ANOVA and Effect Size VAS Repeat and Visit Type

		SS	*df*	*MS*	*F*	Sig.	Eta	Eta Squared
VAS Repeat * Telemedicine or Traditional	Between groups	.056	1	.056	.016	.900	.003	.000
	Within groups	8257.718	2321	3.558				
	Total	8257.774	2322					

Table 7

Statistical Output: Two-Way Test VAS Repeat and Medical Condition

	Descriptive		
Health Issue	*M*	*N*	*SD*
General Pain	6.30	457	1.961
Migraines	6.35	237	1.981
Cancer Pain	6.10	121	1.912
Arthritic Pain	6.27	600	1.806
Back Pain	6.32	908	1.872
Total	6.29	2323	1.886

Table 8

Statistical Output: Homogeneity of Variances VAS Repeat and Medical Condition

		Levene Statistic	*df*1	*df*2	Sig.
VAS Repeat	Based on Mean	1.778	4	2318	.131

Table 9

Statistical Output: ANOVA and Effect Size VAS Repeat and Medical Condition

		SS	*df*	*MS*	*F*	Sig.	Eta	Eta Squared
VAS Repeat * Medical Condition	Between groups	6.253	4	1.563	.439	.780	.028	.001
	Within groups	8251.521	2318	3.560				
	Total	8257.774	2322					

Table 10

Statistical Output: Two-Way Test VAS Repeat and Gender

Descriptive

	N	*M*	*SD*
Female	1034	6.27	1.869
Male	1268	6.32	1.902
Other	21	5.90	1.786
Total	2323	6.29	1.886

Table 11

Statistical Output: Homogeneity of Variances VAS Repeat and Gender

		Levene Statistic	*df*1	*df*2	Sig.
VAS Repeat	Based on Mean	.576	2	2320	.562

Table 12

Statistical Output: ANOVA and Effect Size VAS Repeat and Gender

		SS	*df*	*MS*	*F*	Sig.	Eta	Eta Squared
VAS Repeat * Gender	Between groups (combined)	4.412	2	2.203	.650	.538	.023	.001
	Within groups	8253.362	2320	3.557				
	Total	8257.774	2322					

Table 13 summarizes the correlation data between repeat VAS and the continuous independent variables of VAS and age. VAS repeat and VAS were not correlated and not statistically significant, $r(2323) = .001$, $p > .05$. VAS repeat and age were not correlated and were not statistically significant, $r(2323) = -.003$, $p > .05$. VAS and age were not correlated and were not statistically significant, $r(2323) = .011$, $p > .05$

Table 13

Statistical Output: Correlation Data

Variables	*M*	*SD*	*N*
VAS Repeat	6.29	1.886	2323
VAS	7.44	1.915	2323
Age	43.75	15.489	2323

Variables		VAS Repeat	VAS	Age
VAS Repeat	Pearson Correlation	1	.001	-.003
	Sig. (2-tailed)		.977	.870
	N	2323	2323	2323
VAS	Pearson Correlation	.001	1	.011
	Sig. (2-tailed)	.977		.609
	N	2323	2323	2323
Age	Pearson Correlation	-.003	.011	1
	Sig. (2-tailed)	.870	.609	
	N	2323	2323	2323

Multiple Linear Regression

Multiple linear regression was conducted to determine if the hypothesized models could predict the value of a single dependent variable (repeat VAS) based on two or more independent variables (age, gender, VAS, visit type, and pain condition). The independent variables of age, gender, VAS, and visit type were consistent between each of the analyses, modifying pain condition for each analysis as a selection variable; filtering out "other" gender (n = 21) and creating a specific filter to only include selected pain type. Sample size constraints only permitted for the statistically meaningful analysis of two of the five hypotheses (arthritic pain and back pain) as the sample sizes were >485 subjects. General pain, migraines, and cancer pain were each analyzed however were not included in the analyses based on sample size. A final regression analysis included all pain conditions which allowed for comparisons of pain across conditions. The b coefficient for each dummy was compared to the omitted condition (general pain) and interpreted as the difference in the mean after adjusting for covariates.

An analysis of standard residuals was conducted for each of the three reported analyses, which indicated that the data contained no outliers. To determine if collinearity was met, tolerance and VIF were analyzed for each of the three analyses. Tests indicated that multicollinearity was not relevant as all values for VIF were less than 10 and Tolerance greater than 0.1. The data met the assumption of independent errors, with Durbin-Watson values ranging from 2.04-2.15. Histograms of standardized residuals were indicative of normally distributed data, represented by a bell-curve shape as were

the P-P plots, with data points in close proximity to the line. Scatterplot analyses met the assumptions of homogeneity of variance and linearity.

Tables 14-18 are the outputs of a multiple linear regression conducted to see if age, gender, original pain score (VAS), visit type, gender, and arthritic pain levels predicted the VAS repeat of arthritic patients. Significance was not met, $p = .836$ (Table 15). No further analysis was conducted as statistical significance was not met.

Table 14

Regression: Descriptive Statistics Arthritic Pain

Variables	*M*	*SD*	*N*
VAS Repeat	6.27	1.808	599
Age	46.20	15.530	599
VAS	7.46	1.869	599
VisitType = Telemedicine	.4491	.49782	599
Gender = Female	.4608	.49888	599

Note. Selecting only cases for which Health Issue = Arthritic Pain

Table 15

Regression: ANOVA Arthritic Pain

Model		*SS*	*df*	*MS*	*F*	Sig.
1	Regression	4.751	4	1.188	.362	.836
	Residual	1948.975	594	3.281		
	Total	1953.726	598			

Note. Dependent Variable: VAS Repeat; Selecting only cases for which Health Issue = Arthritic Pain; Predictors: (Constant), Gender = Female, VisitType = Telemedicine, VAS, Age.

Table 16

Regression: Correlations Arthritic Pain

		VAS Repeat	Age	VAS	VisitType = Telemedicine	Gender = Female
Pearson Correlation	VAS Repeat	1.000	-.006	.013	-.025	-.041
	Age	-.006	1.000	.060	-.152	.035
	VAS	.013	.060	1.000	-.011	-.052
	VisitType = Telemedicine	-.025	-.152	-.011	1.000	.027
	Gender = Female	-.041	.035	-.052	.027	1.000
Sig. (1-tailed)	VAS Repeat	.	.445	.377	.273	.157
	Age	.445	.	.071	.000	.198
	VAS	.377	.071	.	.397	.100
	VisitType = Telemedicine	.273	.000	.397	.	.252
	Gender = Female	.157	.198	.100	.252	.

Note. Selecting only cases for which Health Issue = Arthritic Pain

Table 17

Regression: Model Summary Arthritic Pain

	R				Durbin-Watson
Model	Health Issue = Arthritic Pain (Selected)	R^2	Adjusted R^2	Std. Error of the Estimate	Health Issue = Arthritic Pain (Selected)
1	.049	.002	-.004	1.811	2.154

Note. Predictors: (Constant), Gender = Female, VisitType = Telemedicine, VAS, Age.

Statistics are based only on cases for which Health Issue = Arthritic Pain. Dependent Variable: VAS Repeat.

Table 18

Regression: Parameter Estimates Arthritic Pain

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	*SE*	Beta	*t*	Sig.
1	(Constant)	6.343	.387		16.386	< .001
	Age	-.001	.005	-.009	-.209	.834
	VAS	.011	.040	.011	.267	.790
	VisitType = Telemedicine	-.090	.151	-.025	-.599	.549
	Gender = Female	-.143	.149	-.040	-.963	.336

Note. Dependent Variable: VAS Repeat. Selecting only cases for which Health Issue = Arthritic Pain.

Tables 19-23 are the outputs of a multiple linear regression conducted to see if age, gender, original pain score (VAS), visit type, gender, and back pain levels predicted the VAS repeat of back pain patients. Significance was not met, p = 0.717 (Table 20). No further analysis was conducted as statistical significance was not met.

Table 19

Regression: Descriptive Statistics Back Pain

	M	*SD*	*N*
VAS Repeat	6.32	1.870	900
Age	43.05	15.764	900
VAS	7.47	1.855	900
VisitType = Telemedicine	.4844	.50004	900
Gender = Female	.4356	.49611	900

Note. Selecting only cases for which Health Issue = Back Pain.

Table 20

Regression: ANOVA Table Back Pain

Model		*SS*	*df*	*MS*	*F*	Sig.
1	Regression	7.372	4	1.843	.526	.717
	Residual	3137.890	895	3.506		
	Total	3145.262	899			

Note. Dependent Variable: VAS Repeat

Selecting only cases for which Health Issue = Back Pain

Predictors: (Constant), Gender = Female, VisitType = Telemedicine, VAS, Age

Table 21

Regression: Correlations Back Pain

		VAS Repeat	Age	VAS	VisitType = Telemedicine	Gender = Female
Pearson Correlation	VAS Repeat	1.000	-.031	-.036	.011	-.005
	Age	-.031	1.000	-.024	-.182	.041
	VAS	-.036	-.024	1.000	.036	-.007
	VisitType = Telemedicine	.011	-.182	.036	1.000	-.022
	Gender = Female	-.005	.041	-.007	-.022	1.000
Sig. (1-tailed)	VAS Repeat	.	.179	.141	.367	.440
	Age	.179	.	.240	.000	.111
	VAS	.141	.240	.	.140	.421
	VisitType = Telemedicine	.367	.000	.140	.	.255
	Gender = Female	.440	.111	.421	.255	.

Note. Selecting only cases for which Health Issue = Back Pain

Table 22

Regression: Model Summary Back Pain

	R				Durbin-Watson
Model	Health Issue = Back Pain (Selected)	R Square	Adjusted R Square	Std. Error of the Estimate	Health Issue = Back Pain (Selected)
1	.048	.002	-.002	1.872	2.073

Note. Predictors: (Constant), Gender = Female, VisitType = Telemedicine, VAS, Age

Statistics are based only on cases for which Health Issue = Back Pain.

Dependent Variable: VAS Repeat

Table 23

Regression: Parameter Estimates Back Pain

Model		Unstandardized Coefficients		Standardized Coefficients	*t*	Sig.
		B	*SE*	Beta		
1	(Constant)	6.749	.329		20.540	<.001
	Age	-.004	.004	-.030	-.884	.377
	VAS	-.037	.034	-.037	-1.104	.270
	VisitType = Telemedicine	.027	.127	.007	.210	.834
	Gender = Female	-.015	.126	-.004	-.116	.908

Note. Dependent Variable: VAS Repeat

Selecting only cases for which Health Issue = Back Pain

Tables 24-28 are the outputs of a multiple linear regression conducted on all pain conditions which allowed for comparisons of pain across conditions. Significance was not met, $p = .925$ (see Table 25). No further analysis was conducted as statistical significance was not met.

Table 24

Descriptive Statistics All Pain Conditions

Variables	*M*	*SD*	*N*
VAS Repeat	6.30	1.887	2302
Age	43.77	15.492	2302
VAS	7.44	1.915	2302
VisitType = Telemedicine	.4770	.49958	2302
Gender = Female	.4492	.49752	2302
Medical Condition = Migraines	.1021	.30283	2302
Medical Condition = Cancer Pain	.0517	.22146	2302
Medical Condition = Arthritic Pain	.2602	.43884	2302
Medical Condition = Back Pain	.3910	.48807	2302

Table 25

Regression: ANOVA Table All Pain Conditions

Model		*SS*	*df*	*MS*	*F*	Sig.
1	Regression	11.218	8	1.402	.393	.925
	Residual	8179.543	2293	3.567		
	Total	8190.761	2301			

Note. Dependent Variable: VAS Repeat; Predictors: (Constant), VAS, Medical Condition = Migraines, Gender = Female, VisitType = Telemedicine, Medical Condition = Cancer Pain, Age, Medical Condition = Arthritic Pain, Medical Condition = Back Pain.

Table 26

Regression: Correlations All Pain Conditions

	Variables	VAS	VAS Repeat	Age	VisitType = Telemedicine	Gender = Female	Condition = Migraines	Condition = Cancer Pain	Condition = Arthritis	Condition = Back Pain
Pearson Correlation	VAS Repeat	.001	1.000	-.004	.007	-.012	.012	-.031	-.009	.012
	Age	.013	-.004	1.000	-.136	.025	-.067	.034	.093	-.037
	VisitType = Telemedicine	.036	.007	-.136	1.000	-.009	.023	.056	-.033	.012
	Gender = Female	-.012	-.012	.025	-.009	1.000	.004	-.010	.014	-.022
	Condition = Migraines	.000	.012	-.067	.023	.004	1.000	-.079	-.200	-.270
	Condition = Cancer Pain	-.017	-.031	.034	.056	-.010	-.079	1.000	-.138	-.187
	Condition = Arthritic Pain	.005	-.009	.093	-.033	.014	-.200	-.138	1.000	-.475
	Condition = Back Pain	.009	.012	-.037	.012	-.022	-.270	-.187	-.475	1.000
	VAS	1.000	.001	.013	.036	-.012	.000	-.017	.005	.009
Sig. (1-tailed)	VAS Repeat	.476	.	.415	.372	.280	.290	.072	.335	.289
	Age	.261	.415	.	.000	.111	.001	.053	.000	.037
	VisitType = Telemedicine	.044	.372	.000	.	.332	.138	.004	.056	.283
	Gender = Female	.277	.280	.111	.332	.	.421	.321	.254	.146
	Condition = Migraines	.495	.290	.001	.138	.421	.	.000	.000	.000
	Condition = Cancer Pain	.204	.072	.053	.004	.321	.000	.	.000	.000
	Condition = Arthritic Pain	.401	.335	.000	.056	.254	.000	.000	.	.000
	Condition = Back Pain	.332	.289	.037	.283	.146	.000	.000	.000	.
	VAS	.	.476	.261	.007	-.012	.012	-.031	-.009	.012

Table 27

Regression: Model Summary All Pain Conditions

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
	Health Issue = Back Pain (Selected)				Health Issue = Back Pain (Selected)
1	.037	.001	-.002	1.889	2.040

Note. Predictors: (Constant), VAS, Medical Condition = Migraines, Gender = Female, VisitType = Telemedicine, Medical Condition = Cancer Pain, Age, Medical Condition = Arthritic Pain, Medical Condition = Back Pain; Dependent Variable: VAS Repeat.

Table 28

Regression: Parameter Estimates All Pain Conditions

Model		Unstandardized Coefficients		Standardized Coefficients	*t*	Sig.
		B	*SE*	Beta		
1	(Constant)	6.320	.215		29.414	< .001
	Age	-6.252E-5	.003	-.001	-.024	.981
	VisitType = Telemedicine	.030	.080	.008	.370	.711
	Gender = Female	-.046	.079	-.012	-.584	.559
	Medical condition = Migraines	.048	.152	.008	.313	.755
	Medical condition = Cancer pain	-.267	.195	-.031	-1.367	.172
	Medical condition = Arthritic pain	-.043	.118	-.010	-.363	.717
	Medical condition = Back pain	.010	.109	.003	.095	.925
	VAS	.000	.021	.000	.015	.988

Note. Dependent Variable: VAS Repeat.

Summary

This study examined the relationship between telehealth technology and traditional office visits when comparing pain management levels in patients dealing with five individual pain types (arthritic, back, migraine, general, and cancer) at a medical cannabis practice during the COVID-19 pandemic. The initial study design revolved around five research questions; however, sample size effects decreased the study to two main research questions involving the pain types of arthritic pain and back pain.

RQ1: What is the relationship between telehealth technology and traditional office visits when comparing pain management levels in patients dealing with arthritic pain during the pandemic?

$H_0$1 – There is no statistically significant difference in pain management levels in arthritic patients.

$H_1$1 – There is a statistically significant difference in pain management levels in arthritic patients.

RQ2: What is the relationship between telehealth technology and traditional office visits when comparing pain management levels in patients dealing with back pain during the pandemic?

$H_0$2 – There is no statistically significant difference in pain management levels in back pain patients.

$H_1$2 – There is a statistically significant difference in pain management in back pain patients.

Research question one utilized multiple linear regression analysis and confirmed the null hypothesis that there was no statistically significant difference in pain management levels (repeat VAS) between traditional office visits and telehealth patients experiencing arthritic pain. Age, gender, original pain score (VAS), visit type, and arthritic pain did not predict the VAS repeat of arthritic patients. Significance was not met with a $p = 0.836$.

Research question two utilized multiple linear regression analysis and confirmed the null hypothesis that there was no statistically significant difference in pain management levels (repeat VAS) between traditional office visits and telehealth patients experiencing back pain. Age, gender, original pain score (VAS), visit type, and back pain did not predict the VAS repeat of patients. Significance was not met with a p-value = 0.717.

A final omnibus multiple linear regression analysis was conducted to ensure all pain conditions were evaluated in a single model including all patients ($n = 2{,}302$). This model was not statistically significant, with a p-value = 0.925.

In summary, the results of this study confirmed the null hypotheses of the two analyzed pain conditions.

$H_0 1$ – There is no statistically significant relationship between telehealth technology and traditional office visits when comparing pain management levels in arthritic patients.

$H_0$2 – There is no statistically significant relationship between telehealth technology and traditional office visits when comparing pain management levels in back pain patients.

The data did indicate that telehealth and traditional office visits are equally effective visit types for pain patients in this single medical cannabis clinic.

Chapter 5: Results

The purpose of this study was to investigate the relationship between visit type and pain management levels in five separate pain conditions, analyzing VAS pain scale scores during the COVID-19 pandemic. The quasi-experimental quantitative study was conducted to expand nonopioid health service treatment options by comparing the relationship between telemedicine visits and traditional office visits on treating pain in a medical cannabis clinic during a pandemic. Specifically, in this study, I considered the independent variable of visit type (telemedicine versus traditional office visits) and the dependent variables of pain in several medical conditions (general pain, migraines, cancer, arthritis, and back pain), age, gender, and VAS score.

The limited number of alternative medications for chronic pain that are devoid of serious side effects limit the ability of health care providers to treat chronic pain effectively (Volkow, 2018). Chronic pain services that minimize the risk of abuse, utilize nonopioid analgesics, and are more accessible to all patients is a significant health services need (Kaye et al., 2017). Compounds that target the ECS are a potential solution, with evidence suggesting medications that target the ECS are effective in treating pain and improving quality of life without risk of abuse (VanDolah et al., 2019).

The theoretical framework applied to this study was the Donabedian model, a tripartite approach created by Donabedian (1988), assessing health care quality through a structure, process, outcome model. The utilization of a known quality model and the results of previous studies indicated that the Donabedian model could be used as a

pandemic response tool in assessing patient safety and outcome. With structure held constant, processes were assessed to determine patient functional outcomes.

Interpretation of Findings

The findings associated with this research study aligned with previous literature reviews within the fields of delivery of care, pain management, and the utilization of telemedicine during the COVID-19 pandemic. The results of this study confirmed the null hypotheses of the two analyzed pain conditions (arthritic and back pain). There is no statistically significant relationship between telehealth technology and traditional office visits when comparing pain management levels in arthritic patients and back pain patients. The data indicated that telehealth and traditional office visits were equally effective visit types for pain patients which aligned with previous research conducted by Glynn et al. (2021), who studied chronic pain care via telehealth to rural patients at VA clinics and concluded that telehealth was a successful tool in delivering treatment and improving access to care. Previous research by Puntillo et al. (2020) lacked evidence on the efficacy of telemedicine in treating chronic pain, data from this research indicated telemedicine was as effective as traditional office visits and should be further explored with larger sample sizes.

Ghai et al. (2020) hypothesized that telemedicine should be considered for chronic pain conditions during the COVID-19 pandemic to provide essential health care services, this study would support the hypothesis and should be further explored in other clinics and treatment facilities. In the absence of face-to-face contact, telehealth is

recommended as a first line of care for those dealing with chronic pain within this small cannabis clinic.

The quantitative outcome of this study revealed all significance values were greater than .05. There was no statistical relationship between telehealth technology and traditional office visits when comparing pain management levels. The data set contained no outliers, multicollinearity was not relevant, Durbin-Watson values met the assumption of independent errors, and the data were normally distributed and met the assumptions of homogeneity and linearity. Two-way tests analyzed the difference between the means of repeat VAS for each categorical independent variable and correlations of repeat VAS with each continuous independent variable; all significance values were greater than .05 indicating no statistical relationship between any of the variable sets. The null hypothesis for all the Levene's tests were rejected.

Limitations of the Study

This study utilized a single site which was the most significant limitation to the research, impacting external validity an advantage of quasi-experimental design. The completeness of the data set, inequal telehealth to traditional patients and adequate sample sizes per pain condition were also limitations to the research. This study utilized a retrospective quasi-experimental design, creating study limitations, including unmeasured confounders, response bias, and a lack of randomization. The subjective nature of pain from person to person and the use of self-report methods could raise questions as to the validity of the data as well.

Recommendations

Recommendations for future research would include strategies to eliminate the limitations within the completed study design. Utilizing a multi-site study design would provide access to a larger and more diverse sample set while allowing for more generalizable data; an important component to influencing healthcare policy. Expanding to a multi-site study design and study replication by independent investigators would help to restore the weak external validity. Expanding to a wider variety of medical conditions would increase sample sizes as well and help to understand if telehealth is as impactful as traditional office visits in addressing other health conditions. The form of telehealth was not tracked in this study and with varying accessibility to technologies, it would be interesting to study what type of telemedicine is most impactful. Dosages and route of administration were not studied, another potential area to research as each state's laws will dictate what medicines and dosages are legal for their patients. A follow-up study to understand the adoption of telehealth practices post COVID-19 at the CED clinic could be an interesting analysis. If the health outcomes are the same independent of visit type, medical clinics outreach should expand, improving access to care during a pandemic.

Implications

The COVID-19 pandemic drastically impacted a major objective of public healthcare, access to health services. A synthesis of data over the past 2 years concluded there was a general reduction in services, new barriers to access were created, and current system flaws were further exacerbated; however, telemedicine surged as a tool to maintain care and helped assess, diagnose, triage, and treat patients (Pujolar et al., 2022).

In areas without telemedicine, the pandemic has further affected access to treatment services for chronic conditions (Núñez et al., 2021). Based on this research, further expansion of telemedicine capabilities within medical cannabis clinics and other health care service centers should be explored. Telemedicine capabilities provide high satisfaction to patients, improve access to treatment options, and can be used to address chronic conditions, mental health problems, and several high-risk patient segments during a pandemic (Núñez et al., 2021). The utilization of telemedicine could reduce barriers to entry for health care service centers, creating a larger network of accessible treatment options for those most impacted during a pandemic.

Conclusion

In conclusion, this study provided insight into the effectiveness of telemedicine practices at a single medical cannabis clinic in Massachusetts. Before this study, there was no research on the impact of telemedicine versus traditional office visits in treating patients experiencing pain. The findings of this study showed no significant improvements in overall pain as measured by VAS but did indicate that telemedicine was as effective as traditional office visits for patients experiencing pain. Accessibility to health care services continues to be a highly debated and studied research topic, which are further intensified by a pandemic. Reinforcing telemedicine strategies across multiple health service organizations while establishing and formalizing telemedicine processes which improve access to healthcare during a pandemic are paramount in mitigating the spread of the pandemic and ensuring continuity of treatment for patients suffering from chronic conditions.

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