Scoping Review

The Use of Telemedicine in Outpatient Pain Management: A Scoping Review

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Background: Telemedicine is an increasingly important tool in outpatient pain management. Telemedicine can be implemented through various strategies and a multitude of approaches have been described in existing literature.

Objectives: This scoping review aims to survey how telemedicine has been approached in published literature, providing insight for continued implementation.

Study Design: Scoping review.

Setting: Outpatient pain management.

Methods: Ovid MEDLINE and Embase databases were queried. Two board-certified pain management physicians screened search results for relevant publications based on predetermined criteria. Included publications focused on outpatient pain management via live video or telephone and reported empirical outcomes. Publications were excluded that focused on acute pain, progressive muscle relaxation, physical therapy, or psychiatry, including cognitive behavioral therapy, or that primarily described educational modules, apps, mobile tracking, or automated calls. Nonfull publications (abstracts) and articles not available in English were also excluded. A third reviewer performed full-text screening, extracting variables of interest. Systematic reviews and meta-analyses were excluded from final selection.

Results: Text and abstract screening of 3,302 results yielded 88 publications. Upon full-text screening, 64 additional publications were excluded, yielding 24 publications. High-quality randomized controlled trials (RCTs) were described in 5 (21%) publications, pilot RCTs in 4 (17%), prospective studies in 1 (4%), retrospective studies in 5 (21%), survey-based studies in 7 (29%), and other types of studies in 2 (8%). Cancer pain was the focus of 3 (13%) studies, headache/facial pain the focus of 4 (17%), musculoskeletal the focus of 3 (13%), and unspecified chronic pain the focus of 14 (58%). Patient experiences were the focus of 18 (75%) publications, provider experiences the focus of 2 (8%), and both patient and provider experiences the focus of 4 (17%). Outcome improvement measures were studied in 17 (71%) publications, process improvement measures in 5 (21%), and both types of measures in 2 (8%). Standard visits without on-site support were described in 4 (17%) publications, while standard visits with on-site support were described in 9 (38%). The remaining 11 (46%) described structured/integrated pain management programs. Positive pain-related outcomes were reported in 9 (38%) studies. Increased access or decreased barriers to care were reported in 9 (38%). Patient satisfaction was reported in 12 (50%) publications, with 10 (42%) describing positive results.

Limitations: This scoping review focused on telemedicine delivered via telephone or live video communication, excluding a substantial body of literature focused on virtual courses, modules, and other telehealth programs not involving live communication.

Conclusions: Current literature describes telemedicine implementation with various levels of technological and logistical support. Models of telemedicine represented in current literature include: standard visits with on-site support, standard visits without on-site support, and structured/integrated pain management programs. Presently, no literature has directly compared outcomes

from these different approaches. Choice of model will depend on the specific goals and available resources. Patient satisfaction was studied most frequently and generally demonstrated positive results. Though current literature is heterogeneous and lacks RCTs, it consistently demonstrates benefits of telemedicine to patient satisfaction, pain, and access to care.

Key words: Chronic pain, telemedicine, telehealth, pandemic, health care equity, disability, health care resources

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The COVID-19 pandemic impacted multiple aspects of health care, including patients' access to medical care in the outpatient setting. As infection prevention became a priority, telemedicine emerged as a crucial tool for providing outpatient care to patients with chronic health conditions, without increasing their risk of exposure. Telemedicine is defined by the Centers for Medicare and Medicaid Services as real-time, 2-way communication between patients and their providers at different physical sites (1). As smartphones, personal computers, and other devices have become increasingly common, real-time communication between patients and providers through videoconferencing, telephone, and specialized applications has become more prevalent. Likewise, similar telemedicine approaches can facilitate communication between providers to collaborate on patient care from distant locations.

As in other outpatient specialties, chronic pain management has experienced an accelerated implementation of telemedicine (2). Not surprisingly, this has brought to light that telemedicine offers multiple benefits beyond a pandemic setting. Advantages include decreased transportation costs, increased access to specialists, and continued follow-up with primary care physicians (3). Lack of access to chronic pain management physicians can lead to inadequately treated chronic pain, which can have negative impacts on patients, such as decreased activities of daily living and low work efficiency, which has significant downstream economic effects (4). Chronic pain treatment is often complex and requires a well-integrated, multidisciplinary approach with appropriate follow-up care. Physicians often utilize pharmacological interventions, physical therapy (PT), and interventional techniques to aid in managing chronic pain in patients (5).

It is prudent to assess how telemedicine has been implemented in the treatment of chronic pain, considering how vital telemedicine has recently become to patients and their health care providers. Because telemedicine is a broad term that can be applied to various models of care, it is essential to survey and analyze the approaches to telemedicine in chronic pain management that have been described in the existing literature. This scoping review aims to empirically describe the existing literature regarding telemedicine use in chronic pain management to provide possible guidance for sustained and improved implementation in the future.

Methods

This review was informed by recommendations provided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for scoping reviews.

Literature Search

A comprehensive search strategy using keywords and index terms was executed in the Ovid MEDLINE and Ovid Embase databases on October 6, 2021. The search was designed to yield all articles that address the use of telemedicine in chronic pain management. No limits were set on date, and all non-English publications and conference abstracts were excluded. The complete search strategy is available in Appendix A.

Study Selection, Risk of Bias, and Data Extraction

All search results were uploaded to the Covidence™ software (Veritas Health Innovation, Melbourne, Australia) and screened for inclusion by 2 board-certified pain management physicians. Screening was executed in parallel and independently by each physician to find all publications that studied the use of telemedicine in chronic pain management. A list of inclusion and exclusion criteria was established prior to initiation of publication screening. Studies were included if they met the following inclusion criteria:

1) The publication focuses on pain management.
2) Telemedicine in the form of live video or telephone-based encounters is the primary focus of the study.
3) The study focuses on empirical outcomes.

Publications that were focused on acute pain,

progressive muscle relaxation, PT, or psychiatry, including cognitive behavioral therapy, were excluded. Telehealth encounters delivered primarily in the form of educational modules, apps, mobile tracking, or automated calls were excluded. Editorials, reviews, opinions, and all publications for which rigorous empirical study was not the focus were also excluded. Systematic reviews and meta-analyses were included during text and abstract screening but excluded during the full-text reading stage.

Conflicts that occurred during the independent publication review were screened again by the same reviewers and if there was no resolution, the publication was eliminated entirely. After the screening was completed, a third reviewer read through the full publications for all included publications with the goal of documenting specific qualitative and quantitative variables of interest. During the charting process, progress was discussed among authors, and data collection forms were adapted to capture emerging trends. The variables of interest were: the telemedicine platform, the type of telemedicine intervention, level of resources required, the study design, the sample size, the type of pain studied, whether the study mentioned or analyzed cost effectiveness/cost reduction, whether the study focused on the patient experience or the provider experience, whether the study focused on outcome measures or process measures, and whether the study reported positive outcomes related to pain, patient satisfaction, access to care, and cost-effectiveness. Publications were summarized by characteristics of the telemedicine intervention, study design, and findings. Methods of bias assessment were not implemented in this study during data extraction, as strict bias assessment is not feasible when conducting a scoping review.

Results

The initial keyword search resulted in 3,302 publications. Text and abstract screening were performed by 2 board-certified pain management physicians, yielding 88 publications for full-text screening. During full-text screening, an additional 64 publications were excluded, yielding a final set of 24 publications (Fig. 1). Characteristics of publications, including study design, telemedicine platform, and intervention type are described in Table 1. Study findings related to satisfaction, pain outcomes, access to care, and cost savings are summarized in Table 2.

Among these 24 publications, 5 (21%) were high-quality randomized controlled trials (RCTs) powered for statistical significance, 4 (17%) were described as pilot or feasibility RCTs, 1 (4%) was a prospective observational study, 5 (21%) were retrospective observational studies, 7 (29%) were survey-based studies, and 2 (8%) were other types of studies. Of the high-quality RCTs powered for statistical significance, the average number of patients was 244.2, with a total of 1,221 patients in all the studies.

Eight (33%) of these studies utilized a telephone as the primary telemedicine platform. Fourteen (58%) publications utilized videoconference as the primary telemedicine platform. One (4%) of these studies utilized both telephone and videoconference, and one (4%) study did not specify the mode of live communication.

These publications focused on a variety of types of pain. Three (13%) studies focused on cancer pain, 4 (17%) studies focused on headache or facial pain, 3 (13%) studies focused on musculoskeletal or orthopedic pain, and 14 (58%) studies did not specify a specific type of pain or focused on various types of pain.

Among the 24 publications, 18 (75%) focused on the patient experience, 2 (8%) focused on the provider experience, and 4 (17%) analyzed both the patient and provider experience. Seventeen (71%) of the pub-

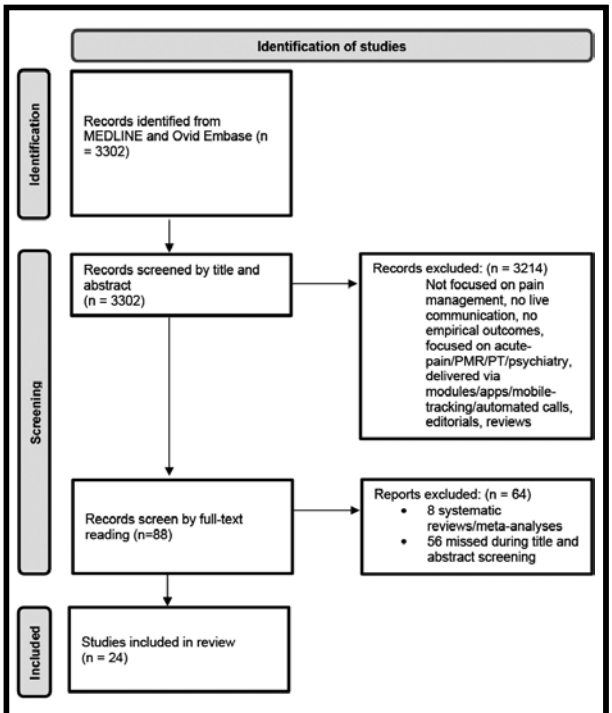

Fig. 1. *Flow chart describing the study selection.*

Table 1. *Summary of included studies.*

Publication	Telehealth Mechanism	Intervention Category	Resource Involvement	Study Design	Sample Size (n)	Experience: Patient Experience, Provider Experience or Both	Type of Improvement: Outcome or Process	Pain Category
Byrne 2020, The use of telepain for chronic pain in the US Armed Forces - Patient experience from Walter Reed National Military Medical Center	Videoconference	Telemedicine-visit with pain management specialist or equivalent (e.g., neurologist)	Standard visits or follow-up with on-site support	Survey	66	Patient experience	Outcome	Not specified or various
Chen 2022, Telehealth and rural-urban differences in receipt of pain care in the Veterans Health Administration	Videoconference	Patient education, monitoring, health coaching, nonphysician follow-up or other interdisciplinary care	Standard visits or follow-up with on-site support	Retrospective observational study	33,169	Patient experience	Process	Not specified or various
Crawford 2021, Interventional procedure plans generated by telemedicine visits in spine patients are rarely changed after in-person evaluation	Videoconference and telephone	Telemedicine-visit with pain management specialist or equivalent (e.g., neurologist)	Standard visits or follow-up without on-site support	Retrospective observational study	87	Both	Process	Musculoskeletal or orthopedic pain
Desko 2014, Evaluation of a clinical video telehealth pain management clinic	Videoconference	Telemedicine-visit with pain management specialist or equivalent (e.g., neurologist)	Standard visits or follow-up with on-site support	Survey	21	Patient experience	Outcome	Not specified or various
Dias 2021, Headache teleconsultation in the era of COVID-19 - Patients' evaluation and future directions	Telephone	Telemedicine-visit with pain management specialist or equivalent (e.g., neurologist)	Standard visits or follow-up without on-site support	Survey	83	Patient experience	Outcome	Headache or facial pain
Elliott 2007, Videoconferencing for a veteran's pain management follow-up clinic	Videoconference	Telemedicine visit with pain management specialist or equivalent (e.g., neurologist)	Standard visits or follow-up with on-site support	Survey	36	Both	Outcome	Not specified or various

Table 1 cont. *Summary of included studies.*

Publication	Telehealth Mechanism	Intervention Category	Resource Involvement	Study Design	Sample Size (n)	Experience: Patient Experience, Provider Experience or Both	Type of Improvement: Outcome or Process	Pain Category
Gammaitoni 2000, Palliative pharmaceutical care - A randomized, prospective study of telephone-based prescription and medication counseling services for treating chronic pain	Telephone	Provider-to-provider e-consultation	Structured or integrated pain management program involving telemedicine intervention	Pilot or feasibility study	74	Patient experience	Both	Not specified or various
Gersch 2021, Clinical effectiveness of an outpatient multidisciplinary chronic pain management telementoring service	Videoconference	Provider-to-provider e-consultation	Structured or integrated pain management program involving telemedicine intervention	Retrospective observational study	1,424	Patient experience	Outcome	Not specified or various
Hanna 2016, Development and patient satisfaction of a new telemedicine service for pain management at Massachusetts General Hospital to the island of Martha's Vineyard	Videoconference	Telemedicine visit with pain management specialist or equivalent (e.g., neurologist)	Standard visits or follow-up with on-site support	Survey	49	Patient experience	Outcome	Not specified or various
Haozous 2012, Role of telehealth/videoconferencing in managing cancer pain in rural American Indian communities	Videoconference	Provider-to-provider e-consultation	Structured or integrated pain management program involving telemedicine intervention	Survey	52	Provider experience	Outcome	Cancer pain
Harnik 2021, Telemedicine for chronic pain treatment during the COVID-19 pandemic - Do pain intensity and anxiousness correlate with patient acceptance?	Telephone	Telemedicine visit with pain management specialist or equivalent (e.g., neurologist)	Standard visits or follow-up without on-site support	Survey	61	Patient experience	Outcome	Not specified or various
Helstrom 2018, Telephone-Based management of chronic pain in older adults in an integrated care program	Telephone	Patient education, monitoring, health coaching, nonphysician follow-up or other interdisciplinary care	Structured or integrated pain management program involving telemedicine intervention	Pilot or feasibility study	1,708 for analysis of patient characteristics; 160 for intervention	Patient experience	Outcome	Not specified or various

Table 1 cont. *Summary of included studies.*

Publication	Telehealth Mechanism	Intervention Category	Resource Involvement	Study Design	Sample Size (n)	Experience: Patient Experience, Provider Experience or Both	Type of Improvement: Outcome or Process	Pain Category
Kroenke 2010, Effect of telecare management on pain and depression in patients with cancer - A randomized trial	Telephone	Patient education, monitoring, health coaching, nonphysician follow-up or other interdisciplinary care	Structured or integrated pain management program involving telemedicine intervention	High-quality RCT powered for statistical significance	405	Patient experience	Outcome	Cancer pain
Matthias 2020, Patients'experiences with telecare for chronic pain and mood symptoms - A qualitative study	Telephone	Patient education, monitoring, health coaching, nonphysician follow-up or other interdisciplinary care	Structured or integrated pain management program involving telemedicine intervention	Qualitative study	25	Patient experience	Outcome	Musculoskeletal or orthopedic pain
Müller 2017, A randomized trial of telemedicine efficacy and safety for nonacute headaches	Videoconference	Telemedicine visit with pain management specialist or equivalent (e.g., neurologist)	Standard visits or follow-up with on-site support	High quality RCT powered for statistical significance	402	Patient experience	Outcome	Headache or facial pain
Müller 2017, Telemedicine in the management of non-acute headaches - A prospective, open-labelled non-inferiority, randomised clinical trial	Videoconference	Telemedicine visit with pain management specialist or equivalent (e.g., neurologist)	Standard visits or follow-up with on-site support	High-quality RCT powered for statistical significance	348	Patient experience	Outcome	Headache or facial pain
Peng 2006, Use of telemedicine in chronic pain consultation - A pilot study	Videoconference	Telemedicine visit with pain management specialist or equivalent (e.g., neurologist)	Standard visits or follow-up with on-site support	Pilot or feasibility study	8 patients 11 visits	Both	Both	Not specified or various
Pronovost 2009, Telemedicine in the management of chronic pain - A cost analysis study	Videoconference	Telemedicine visit with pain management specialist or equivalent (e.g., neurologist)	Standard visits or follow-up with on-site support	High-quality RCT powered for statistical significance	26	Patient experience	Outcome	Not specified or various
René 1992, Reduction of joint pain in patients with knee osteoarthritis who have received monthly telephone calls from lay personnel and whose medical treatment regimens have remained stable	Telephone	Patient education, monitoring, health coaching, nonphysician follow-up or other interdisciplinary care	Standard visits or follow-up without on-site support	High-quality RCT powered for statistical significance (secondary analysis)	40	Patient experience	Outcome	Musculoskeletal or orthopedic pain

Table 1 cont. *Summary of included studies.*

Publication	Telehealth Mechanism	Intervention Category	Resource Involvement	Study Design	Sample Size (n)	Experience: Patient Experience, Provider Experience or Both	Type of Improvement: Outcome or Process	Pain Category
Sangalli 2022, Telehealth increases access to brief behavioral interventions in an orofacial pain clinic during COVID-19 pandemic - A retrospective study	Not specified	Patient education, monitoring, health coaching, nonphysician follow-up or other interdisciplinary care	Structured or integrated pain management program involving telemedicine intervention	Retrospective observational study	248 in 2019 and 252 in 2020	Patient experience	Process	Headache or facial pain
Scriven 2019, Evaluation of a multisite telehealth group model for persistent pain management for rural/remote participants	Videoconference	Patient education, monitoring, health coaching, nonphysician follow-up or other interdisciplinary care	Structured or integrated pain management program involving telemedicine intervention	Prospective Descriptive Study	28	Patient experience	Outcome	Not specified or various
Theodore 2015, Transaction cost analysis of in-clinic versus telehealth consultations for chronic pain - Preliminary evidence for rapid and affordable access to interdisciplinary collaborative consultation	Videoconference	Provider-to-provider e-consultation	Structured or integrated pain management program involving telemedicine intervention	Retrospective descriptive study (analysis of health care transactions)	2 transactions	Provider experience	Process	Not specified or various
Williams 2022, Rapid design and implementation of a virtual pain management programme due to COVID-19 - A quality improvement initiative	Videoconference	Patient education, monitoring, health coaching, nonphysician follow-up or other interdisciplinary care	Structured or integrated pain management program involving telemedicine intervention	Quality improvement	14	Both	Process	Not specified or various
Zou 2020, Telephone follow-up design and practice for advanced cancer pain patients	Telephone	Patient education, monitoring, health coaching, nonphysician follow-up or other interdisciplinary care	Structured or integrated pain management program involving telemedicine intervention	Pilot or feasibility study	40	Patient experience	Outcome	Cancer pain

Table 2. *Main findings of included studies (omitted cells not reported).*

Publication	Summary of Conclusion	Patient Satisfaction	Pain-related clinical outcomes	Utilization/access	Cost benefit for health system
Byrne 2020, The use of telepain for chronic pain in the US armed forces - Patient experience from Walter Reed National Military Medical Center	Telemedicine program had positive impacts on pain and patient convenience/access to care	High satisfaction; no control	Most patients reported an improvement of pain on survey	Increased access to care and reduction in travel time	-
Chen 2022, Telehealth and rural-urban differences in receipt of pain care in the Veterans Health Administration	Telemedicine was associated with increased patient utilization of pain management care	-	-	Increased access and utilization	-
Crawford 2021, Interventional procedure plans generated by telemedicine visits in spine patients are rarely changed after in-person evaluation	Telemedicine visits were useful for planning interventional spine procedures	-	-	-	-
Desko 2014, Evaluation of a clinical video telehealth pain management clinic	Telemedicine had high-patient satisfaction and resulted in increased savings to institution and reduced travel for patients	High satisfaction; no control	-	Reduction in patient cost and distance traveled	Yes
Dias 2021, Headache teleconsultation in the era of COVID-19 - Patients' evaluation and future directions	Patients were satisfied with telemedicine intervention	High satisfaction; no control	-	Reduction in patient cost, distance traveled, and time to first appointment	-
Elliott 2007, Videoconferencing for a veteran's pain management follow-up clinic	Telemedicine was found cost effective and clinically acceptable	High satisfaction; no control	-	Reduction in patient cost and distance traveled	Yes
Gammaitoni 2000, Palliative pharmaceutical care - A randomized, prospective study of telephone-based prescription and medication counseling services for treating chronic pain	Telemedicine pharmaceutical care was associated with improvements in certain aspects of patient satisfaction	Mixed; satisfaction better than usual care control in some metrics	Most pain outcomes not significantly different in intervention group vs usual care control	-	-
Gersch 2021, Clinical effectiveness of an outpatient multidisciplinary chronic pain management telementoring service	Telemedicine intervention was associated with reduced opioid use	-	Reduction in opioid use vs usual care control	-	-
Hanna 2016, Development and patient satisfaction of a new telemedicine service for pain management at Massachusetts General Hospital to the island of Martha's Vineyard	Telemedicine intervention had high patient satisfaction	High satisfaction; no control	-	Reduction in patient cost and distance traveled	-
Haozous 2012, Role of telehealth/videoconferencing in managing cancer pain in rural American Indian communities	E-consult program was feasible and effective at increasing provider competence	-	-	-	-
Harnik 2021, Telemedicine for chronic pain treatment during the COVID-19 pandemic - Do pain intensity and anxiousness correlate with patient acceptance?	Telemedicine had good acceptance overall, but pain and anxiousness were associated with lower levels of acceptance	Mixed; average patient acceptance was 6.25/10	-	-	-
Helstrom 2018, Telephone-Based management of chronic pain in older adults in an integrated care program	Telemedicine intervention was feasible and acceptable to patients	-	Decrease in pain interference compared with monitoring only control	-	-

Table 2 cont. *Main findings of included studies (omitted cells not reported).*

Publication	Summary of Conclusion	Patient Satisfaction	Pain-related clinical outcomes	Utilization/access	Cost benefit for health system
Kroenke 2010, Effect of telecare management on pain and depression in patients with cancer - A randomized trial	Telemedicine monitoring resulted in improved pain and depression	-	Decrease in pain metrics compared with usual care control	-	-
Matthias 2020, Patients' experiences with telecare for chronic pain and mood symptoms - A qualitative study	Patients who received telemedicine nurse follow-up reported benefits of motivational and informational support	Qualitative study (no quantitative result)	Qualitative study (no quantitative result)	Qualitative study (no quantitative result)	Qualitative study (no quantitative result)
Müller 2017, A randomized trial of telemedicine efficacy and safety for nonacute headaches	Telemedicine intervention was equally safe and effective as in-person intervention	-	Noninferior to in-person control	-	-
Müller 2017, Telemedicine in the management of non-acute headaches - A prospective, open-labelled non-inferiority, randomised clinical trial	Telemedicine intervention was associated with satisfaction and effectiveness noninferior to in-person control	Noninferior to in-person control	Noninferior to in-person control	-	-
Peng 2006, Use of telemedicine in chronic pain consultation - A pilot study	Telemedicine intervention had high patient and provider satisfaction and saved time and cost for patients	High satisfaction; no control	-	Reduction in patient cost and time spent obtaining care	-
Pronovost 2009, Telemedicine in the management of chronic pain - A cost analysis study	Telemedicine is cost effective	Superior to in-person control	Non-inferior to in-person control	Reduction in patient cost	Favorable cost effectiveness for patient and institution together
René 1992, Reduction of joint pain in patients with knee osteoarthritis who have received monthly telephone calls from lay personnel and whose medical treatment regimens have remained stable	Telemedicine intervention was effective for reducing pain	-	Superior to usual care control	-	-
Sangalli 2022, Telehealth increases access to brief behavioral interventions in orofacial pain clinic during COVID-19 pandemic - A retrospective study	Telemedicine intervention was feasible and associated with higher levels of utilization	-	-	Greater utilization in telehealth group vs in-person control	-
Scriven 2019, Evaluation of a multisite telehealth group model for persistent pain management for rural remote participants	Telemedicine intervention had high satisfaction and was associated with some clinical benefit	High satisfaction; no control	Significant improvement in some metrics, no control	-	-
Theodore 2015, Transaction cost analysis of in-clinic versus telehealth consultations for chronic pain - Preliminary evidence for rapid and affordable access to interdisciplinary collaborative consultation	Telemedicine transaction was not significantly more cost effective than in-person transaction, but took much less time	-	-	-	No, similar cost to in-person, but in-person took longer per transaction
Williams 2022, Rapid design and implementation of a virtual pain management programme due to COVID-19 - A quality improvement initiative	This report outlines the rapid implementation of a telemedicine program	-	-	-	-
Zou 2020, Telephone follow-up design and practice for advanced cancer pain patients	Telemedicine intervention had high patient satisfaction	High satisfaction; no control	-	-	-

lications studied outcome measures, 5 (21%) studied process measures, and 2 (8%) focused on both types of improvement measures. Sixteen (67%) mentioned cost reduction or cost effectiveness, but only 4 (17%) studies provided a quantitative assessment of cost reduction or effectiveness for the health system or provider. Of these papers, 2 (8%) reported cost effectiveness in positive terms, 1 (4%) study found no cost benefit, but a benefit to transaction time, and 1 (4%) described a cost savings benefit to the health system and patient together.

These publications described telemedicine models requiring different levels of on-site technological and clinical support to patients. Ten (42%) papers described interventions in which the patient accessed telehealth from home, while 14 (58%) publications described interventions in which the patient received some level of on-site technological or clinical support. Of interventions that most resemble traditional visits or follow-up carried out via telemedicine, 4 (17%) interventions could be categorized as standard visits or follow-up without on-site clinician or technological support, and 9 (38%) interventions as standard visits or follow-up with on-site clinician or technological support. The remaining 11 (46%) publications described structured or integrated pain management programs involving telemedicine intervention with or without on-site support.

The retrieved publications were heterogeneous and reported a wide variety of findings. Nine (38%) of the studies reported positive pain-related outcomes through a telemedicine intervention. Nine (38%) papers described an increase in access to or utilization of pain management care or a decrease in barriers to care through telemedicine intervention. Of the 12 (50%) papers that reported patient satisfaction, 10 (42%) described patient satisfaction in positive terms. Two (8%) of these papers were controlled trials in which the telemedicine intervention group reported equal or better satisfaction than the nontelemedicine control group. COVID-19 was mentioned in 6 (25%) of the publications; however, it was mentioned in every paper published in 2021. Of included publications, 12 (50%) were publicly funded, 2 (8%) were privately funded, 3 (13%) were nonfunded, and 7 (29%) did not clearly report information about funding.

Pain-Related Outcomes

Some publications support the idea that telemedicine is noninferior to in-person care. An RCT (n = 402) studying telemedicine used for headache pain consultations found that the telemedicine consultations were noninferior to a traditional care control, with no difference in Visual Analog Scale score reduction at 12 months (-1.9 vs -1.5, 95% CI: -0.29 to 0.94) (6). This same group published an article reporting similar results from the same trial at 3 months of follow-up, and reported similar positive results in both urban and rural populations (7). Another RCT (n = 26) focused on comparing the cost-effectiveness of telemedicine vs in-person consultations determined pain scores were not changed between telemedicine and in-person care groups at 2-month follow-up, but did not provide supporting data for this observation (8).

Other RCTs did not directly compare a telemedicine intervention to an in-person control, and rather evaluated a telemedicine monitoring or management program that could be used alongside usual care. These programs typically involve the use of telemedicine to collect clinical information, engage in patient education, or provide feedback, guidance, and emotional support. Generally, these studies found favorable impacts on pain-related outcomes with telemedicine management or monitoring. For instance, one feasibility trial (n = 160) found that patients in a telephone care management group were more likely to see pain interference reduced by 2+ points on a 10-point scale (odds ratio [OR] = 3.06, 95% CI: 1.19-7.89) (9). Another RCT (n = 274) demonstrated that patients in a care monitoring group had improved Brief Pain Inventory (BPI) scores compared with a usual care group at 3 (3.30 vs 4.52, $P < 0.001$), 6 (3.55 vs 4.38, $P < 0.001$), and 12 (3.62 vs 4.33, $P < 0.001$) months. Effect sizes were 0.67 (95% CI: 0.33-1.02), 0.46 (95% CI: 0.11-0.81), and 0.39 (95% CI: 0.01-0.77) at 3, 6, and 12 months, respectively (10). A final RCT (n = 40) found that a group receiving telephone monitoring had decreased Arthritis Impact Measurement Scales pain scores compared with a usual care control (effect size = 0.63, $P < 0.01$) (11).

One retrospective study evaluated a provider-to-provider e-consult program compared with a usual care control group and found that the intervention group had decreased morphine milligram equivalent (MME) consumption after 6 months compared with the control group, which showed an increase (-7.4 mg/d vs + 1.5 mg/d, $P = 0.001$) (12). After 12 months, the observation group showed a greater decrease in MME consumption than the control group (-15.1 mg/d vs -2.8 mg/d, $P < 0.001$) (12).

The remaining 2 studies that reported positive pain-related outcomes both did not have robust controls. One survey-based study evaluating telemedicine consultations (n = 66) found that 80.3% of surveys

reported a decrease in pain with telemedicine intervention (13). Another prospective observational study (n = 28), evaluating a multidisciplinary pain management program, found that after a pain management program patients had significantly decreased their chronic pain acceptance questionnaire scores compared with preprogram measurements (55.85 vs 63.50, $P = 0.01$) (14). There was no significant difference in BPI scores pre- and postprogram (14).

Only 1 publication investigated pain-related outcomes but did not describe positive results. This RCT (n = 74) investigating a telephone-based medication and pharmaceutical counseling program found that most pain-related outcomes, including worst pain, average pain, and current pain, as well as various measures of pain interference with life activities, showed no significant changes with intervention (15).

Access and Utilization

Only 1 RCT (n = 26) reported results related to access and utilization, finding that patients who engaged in telemedicine care instead of traveling to an in-person consultation spent less money receiving care via telemedicine vs in-person ($133 vs $442, $P < 0.001$), largely due to a reduction in cost of travel (8). Another pilot study (n = 11) determined that patients spent less time and money (0.9 hours/$3 vs 8 hours/$80, $P < 0.005$) in telemedicine consultation compared with in-person care received at prior in-person appointments (16).

Two retrospective studies, which also reported results related to access and utilization, additionally reported positive results. One retrospective review of 33,169 patients found that utilization of pain specialty services increased from 11.1% to 16.2% (OR: 1.37, 95% CI: 1.26-1.49) with the implementation of a telemedicine hub-and-spoke program (17). Another retrospective study involving a physical self-regulation program for orofacial pain found that compared with in-person care, telehealth was associated with greater odds of initiating (OR = 6.21, 95% CI: 2.449-15.435) and completing (OR = 5.69, 95% CI 2.352-13.794) physical self-regulation program (18).

The remainder of studies reporting results related to access and utilization were based on patient surveys. Generally, these studies demonstrated that patients saw telemedicine as having benefits related to reduced travel and costs, with one study reporting that of 66 patients, 98.5% reported increased access to care, and 96.9% reported decreased travel (13). Another (n = 36) found that patients saved an average one-way distance of 65 miles (range: 24-89 miles), and an average of 126 minutes (range: 80-235 minutes) (19). Similar results were also reported with the analysis of 110 visits of 39 patients, where 74.8 miles of travel were saved with telemedicine intervention (20).

Patient Satisfaction

Two RCTs that compared patient satisfaction in telemedicine consultations vs in-person consultations both found that patients were highly satisfied with telemedicine. One RCT (n = 348) found that there was no significant difference in the percentage of patients satisfied between telemedicine vs in-person consultations (88.8% vs 92.3%, $P = 0.35$) (7). The other RCT (n = 26) comparing in-person vs telemedicine consultations found that patients in a telemedicine group were more likely to strongly agree that they were satisfied with the format of the consultation than an in-person control (56% vs 24%, $P < 0.05$) (8).

Another RCT (n = 74) investigating a telemedicine pharmaceutical care model investigated patient satisfaction on a variety of dimensions, with increased satisfaction in areas, such as pharmacy service and medication delivery, but no change to satisfaction with regards to the whole program and several other dimensions of satisfaction (15).

In general, survey-based studies also found a high degree of patient satisfaction, though most of these studies were uncontrolled. For instance, one study reported that in 66 patient surveys, 83.3% reported being satisfied or very satisfied with a telemedicine consultation (13). Most other survey-based studies found similar results. In contrast, one study (n = 61) evaluating telemedicine care provided in lieu of in-person care during the COVID-19 pandemic found that patient (n = 61) acceptance of telemedicine was moderate with high variability in responses (average 6.25/10, median: 7/10, IQR 2-10) (21). Authors found that higher acceptance correlated with lower pain intensity, less fear relating to COVID-19 ($r = -0.40$, $P < 0.001$), and less worrying ($r = -0.42$, $P < 0.001$) (21).

Discussion

These results indicate that only a small number of high-quality RCTs have been performed to evaluate the effectiveness of telemedicine in pain management. Of the 24 publications included, only 5 were high-quality RCTs powered for statistical significance with 1,221 study patients in total. However, not all of these studies investigated the same types of interventions, with

3 involving pain management visits conducted via telehealth (6-8), and 2 involving nonphysician follow-up monitoring, education, or other interdisciplinary care (9,10). Furthermore, of the 3 studies involving pain management visits conducted via telehealth, 2 of these studies were published by the same group, related to the same RCT, and focused specifically on headache treatment by neurologists (6,7), and the third was published over a decade ago and focused largely on cost analysis (8). Evidently, there is a lack of high-quality evidence regarding the efficacy of telemedicine for carrying out typical pain management visits. Given that in a post-COVID-19 environment, many more traditional pain management visits are being conducted via telehealth, it is more important than ever to further investigate the efficacy of these interventions.

Many of the retrieved publications focused primarily on patient satisfaction with telemedicine. These studies often took the form of surveys, and many did not involve a control group. These studies support the notion that telemedicine pain management is subjectively beneficial for patients. Somewhat fewer papers investigated other types of outcomes. Areas that were typically investigated were pain reduction, care utilization/accessibility, and cost to patients. While not all studies involved adequate controls, the retrieved publications generally did describe positive outcomes regarding these measures.

Another category of publications that are represented in the literature are studies involving the use of telemedicine for provider-to-provider communication. These interactions were generally virtual consultations between primary care providers and pain management specialists; however, one publication involved virtual consultations with specialized pharmacists (15). This model of care is largely being studied in communities where pain management care is undersupplied, such as rural communities (12,22). Of note, there were several studies related to this topic that were not included in this review as their primary focus was on clinician education on pain management, not patient care via e-consults.

Despite the lack of RCTs investigating this subject, the retrieved publications present a consistently favorable, albeit heterogeneous impression of the utility of telemedicine for outpatient pain management. While many providers may see this current evidence as adequate for adopting telemedicine into the practice, a more robust investigation into the impact of telemedicine on outcomes and patient access will help providers better identify patients for which telemedicine is most appropriate. Additional research will also provide context for shaping policy related to the reimbursement of telemedicine services by insurance carriers. Presently, reimbursement for telemedicine coverage varies based on evolving state laws and individual payers (23). Increased understanding of the cost-effectiveness and clinical outcomes of telemedicine pain care will facilitate policy choices in this area.

This scoping review has limitations. In order to focus on publications most relevant to the practice of a typical pain management physician, we excluded telehealth interventions not primarily in the form of live communication via telephone or videoconference. During our screening, we discovered that much of the related literature that was excluded from this review involved telehealth courses delivered mostly via online modules, apps, or other nonlive communication. While this review's narrower scope provides clearer insight into how individual pain management specialists may approach telemedicine, it should be noted that a broader literature exists on other forms of telehealth for aiding in pain management. Furthermore, COVID-19 has highlighted the importance of adapting more traditional pain management services to a telemedicine model.

Guidance for Telemedicine Implementation

The current literature models several approaches to telemedicine implementation. The 3 major approaches that we observe are:

1) Standard visits or follow-ups carried out via telemedicine without on-site clinical or technological support to patients.
2) Standard visits or follow-ups carried out via telemedicine with on-site clinical or technological support to patients.
3) Structured or integrated pain management programs involving a telemedicine intervention with or without on-site support.

In the case of this first approach, little technological infrastructure is required as patients and clinicians may connect with tools already available to them, such as telephone or video-conferencing platforms that are commonly available on smartphones and computers. While this approach was only utilized in 4 (17%) of the studies, it may be easier to implement with a lower infrastructure requirement and may be most appropriate when infection prevention is the main reason for the telehealth visit.

Another approach is to bring the patient to a satellite site where clinician or technological support is available. This "hub-and-spoke" approach has certain advantages in that it allows for nursing staff to assist the clinician with tasks that can only be performed in person, such as examinations and measurements. Additionally, this model bypasses the need for patients to have the knowledge and resources to utilize telemedicine technologies. However, this program still requires the patients to come to a clinical site, and therefore does not provide the same convenience and infection prevention benefits as a telemedicine visit from the patient's own home. This approach is frequently associated with connecting patients to specialty services when those services are located a large distance away, as in the case of rural communities, or otherwise difficult or costly to access (6-8,13,16,17,19,20,24).

Lastly, several studies describe the use of more structured telemedicine programs. Some of these involve e-consultation networks that often involve a clinician education component (12,15,22,25). Other programs involve multidisciplinary care and educational sessions provided to patients (9,14,18,26). Others involve some sort of monitoring system, using telemedicine to follow-up with patients over time (10,27,28). These types of programs may involve a greater administrative and technological burden, but can also allow for innovative telemedicine approaches.

These 3 approaches require 3 different levels of logistical and infrastructural investment. While a larger group or health system may consider establishing an integrated telemedicine pain program or a "hub-and-spoke" program, a smaller group may opt to carry out telemedicine in a simpler format, connecting patients and clinicians directly via teleconference or phone without additional components. None of the publications retrieved compared any of these methods, so it is unclear whether any particular format is superior.

Conclusions

The current body of literature on this topic suggests that patients are generally satisfied by telemedicine interventions for pain management, but comparatively fewer studies have thoroughly investigated pain-related outcomes of telemedicine interventions. Telemedicine interventions can be set up in a variety of ways, each with advantages and disadvantages that must be considered.

In the wake of COVID-19, telemedicine will take on a newfound importance in health care. This study represents an investigation of the existing literature on telemedicine in pain management throughout the last several decades and through the initial period of the COVID-19 pandemic. This review indicates that this is an area with little existing research, and high-quality RCTs investigating the efficacy of these telemedicine interventions represent a minority of this literature.

In total, while there is a lack of high-quality RCTs examining the utility of telemedicine for outpatient pain management, the research that does exist shows generally positive results related to pain outcomes, accessibility and utilization, and patient satisfaction. When in-person care is impractical, as in the setting of a pandemic or long travel times, telemedicine can be a useful alternative that is supported by a modest, but consistent, body of literature. While further research is necessary to better understand the advantages and disadvantages of telemedicine in outpatient pain management, it is already evident that telemedicine has been successfully implemented with a high degree of patient satisfaction and acceptance. The current literature has established a valuable foundation for continued implementation and outcomes research.

Supplemental material is available at www.painphysicianjournal.com

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Appendix A

1 exp telehealth/ 63411
2 (telehealth or telemedicine or teleconsultation).tw,kw. 31942
3 (e-health or ehealth or mhealth).tw,kw. 14579
4 ((online or internet or phone or tele* or skype or video or remote or mobile) adj2 (health or medicine or intervention* or call or consult or consultation or evaluation or model or care or visit or monitor or monitoring or "pain management" or "pain practice" or assessment or evaluation)).tw,kw. 66108
5 1 or 2 or 3 or 4 122995
6 exp anesthesiology/ 24202
7 exp anesthesiologist/ 8321
8 (Anesthesiology or Anesthesiologist*).tw,kw. 46266
9 (Anesthesia or Anesthetic or anesthetization or Anesthesia).tw,kw. 273569
10 exp analgesia/ 188449
11 chronic pain/ 67409
12 (pain adj2 (chronic or back or management or knee or neck)).mp. 281762
13 6 or 7 or 8 or 9 or 10 or 11 or 12 705315
14 5 and 13 2780
15 limit 14 to (conference abstract or conference paper or "conference review") 860
16 14 not 15 1920
17 limit 16 to english language 1812