Behavioral Health, Telemedicine, and Opportunities for Improving Access

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Abstract

Purpose of Review The purpose of this review is to summarize advances in behavioral treatments for pain and headache disorders, as well as recent innovations in telemedicine for behavioral treatments.

Recent Findings Research for behavioral treatments continues to support their use as part of a multidisciplinary approach to comprehensive management for pain and headache conditions. Behavioral treatments incorporate both behavioral change and cognitive interventions and have been shown to improve outcomes beyond that of medical management alone. The onset of the COVID-19 public health emergency necessitated the rapid uptake of nontraditional modalities for behavioral treatments, particularly telemedicine. Telemedicine has long been considered the answer to several barriers to accessing behavioral treatments, and as a result of COVID-19 significant progress has been made evaluating a variety of telemedicine modalities including synchronous, asynchronous, and mobile health applications. Researchers are encouraged to continue investigating how best to leverage these modalities to improve access to behavioral treatments and to continue evaluating the efficacy of telemedicine compared to traditional in-person care.

Summary Comprehensive pain and headache management should include behavioral treatments to address a variety of behavior change and cognitive targets. Policy changes and advances in telemedicine for behavioral treatments provide the opportunity to address historical barriers limiting access.

Keywords Behavior · Treatment · Telemedicine · Access · Migraine · Pain

Introduction

Behavioral management is a critical component of a multidisciplinary approach to pain and headache. Although an important component of care, several barriers limit engagement with behavioral treatments, particularly relating to finances and accessibility. Telemedicine, the use of electronic technologies to provide remote healthcare, has long been considered a strategy well-positioned to address many barriers to care. As a result of the COVID-19 pandemic, telemedicine became a critical aspect of delivering care while adhering to best-practice guidelines for mitigating COVID-19 transmission. The necessity for the transition to telemedicine afforded unique opportunities to evaluate a variety of relatively understudied treatment modalities for behavioral pain and headache treatments.

This paper aims to provide an update of new research in behavioral treatments for pain and headache disorders, review historical barriers to accessing behavioral treatments and how COVID-era policy changes as telemedicine has
served to address those barriers, and finally provide an overview of recent innovations in telemedicine-based behavioral treatments for pain and headache disorders.

**Advances in Behavioral Management of Pain and Headache Disorders**

Behavioral pain and headache treatments typically include multiple behavior change and cognitive restructuring interventions to improve coping with pain and have demonstrated efficacy in reducing pain-related interference and enhancing quality of life [1, 2, 3, 4, 5]. Behavior change interventions, such as reducing activity restriction, increasing pleasurable activities, and increasing social engagement, can “turn the dial down” on the pain experience and improve physical rehabilitation efforts. Cognitive factors, such as fear and avoidance of pain and pain catastrophizing, have demonstrated strong relationships with pain interference and quality of life [6–8]. Interventions that focus on identifying and restructuring maladaptive pain cognitions have demonstrated efficacy in improving pain-related quality of life [9–12]. Incorporating behavioral management of chronic pain and headache disorders improves outcomes beyond medical management alone [13–15]. Recent clinical trials have demonstrated that cognitive behavioral treatments address important comorbidities of pain and headache, such as sleep [16, 17] and depression [18, 19], and positively affect pain and headache outcomes. Mindfulness-based interventions have also demonstrated promise to reduce pain-related interference and improve quality of life in people living with chronic pain and headache disorders [20, 21].

Stepped care approaches are recommended to improve pain and headache management while managing limited resources across a health system [22–26]. In a stepped care approach, patients begin their healthcare journey in the lowest level of care available for their disease (often primary care) and are then given optimized care available in each care setting before moving to the next step of more specialized care. Given the pervasive impact, most people with chronic pain and headache disorders could likely benefit from screening and education about the role of lifestyle behavior in these disorders. Patients who screen positive for having suboptimal lifestyle factors or maladaptive pain behaviors or cognitions should be offered provider-based interventions such as motivational interviewing and goal-setting to promote healthy lifestyle changes. Patients for whom the first level of care does not provide meaningful improvements in the pain or headache management, or for whom mental health comorbidities are interfering with pain or headache management goals, should be referred to a behavioral health professional for assessment of behavioral and cognitive targets for intervention to improve pain or headache management.

Despite the considerable promise to reduce pain-related interference and improve quality of life of people living with chronic pain and headache disorders, behavioral treatments are underutilized. Reducing barriers to accessing behavioral treatments for chronic pain and headache disorders is therefore a high priority.

**Addressing Barriers to Behavioral Treatments: Telemedicine and COVID-19**

Telemedicine, the use electronic technologies to provide remote healthcare, has long been heralded as a solution to numerous healthcare barriers, including those regarding access and engagement. Despite technological advances, adoption of telemedicine lagged behind for a variety of reasons, including provider and patient skepticism, inability to integrate with traditional healthcare, ethical concerns, licensing issues, reimbursement, and policy [27, 28]. Further, a 2019 report on telemedicine reviewing seven state Medicaid programs noted that technology barriers, such as unreliable internet services, prevent telemedicine from reaching the very populations considered to benefit the most from such services (e.g., rural individuals) [29]. Facing considerable inertia, telemedicine services were accessed by less than 10% of individuals as recently as a 2019. A notable exception to the slow uptake of telemedicine services was the Veterans Healthcare Administration (VHA) [30]. Representing the largest healthcare system in the USA and serving approximately six million veterans yearly [31], telemedicine was utilized with approximately 15% of patients with a primary focus on expanding coverage for rural veterans [30].

The onset of the current public health emergency (PHE) as a result of the 2019 coronavirus (COVID-19) necessitated a rapid shift in healthcare strategies. Beginning in March 2020, the Centers for Medicare and Medicaid Services (CMS), alongside private insurers, began reimbursing under broader telemedicine circumstances, and notably, at the same rate as in-person visits [32]. Policy shifts from the Department of Human & Health Services relaxed HIPPA-related restrictions on the use of remote communication strategies and interstate care [32]. The initial impact of COVID-19 and subsequent policy changes saw telemedicine sharply increase to account for as high as 30–50% of all health care encounters [33, 34]. The CMS released a brief shortly after COVID-related policy changes went into effect, noting that telemedicine services rose from 15,000 patients/week prior to COVID, to nearly 1.7 million/week in April 2020.

Many federal policies remain conditional on the COVID-19 PHE, most recently extended in April 2022 [35], though many states have legislated permanent revisions such as equal...
reimbursement rates between in-person and online visits. Additionally, many states have begun to develop various interstate licensure agreements, such as the Interstate Medical Licensure Compact, which has seen related legislature passed or pending in twelve states since the onset of COVID-19 [36]. Similarly, state legislation for interstate psychology practice, under the Psychology Interjurisdictional Compact, has nearly doubled over the last two years [37].

Broader state- and federal-level adoption of these policies following COVID-19 will likely require extensive clinical trials across a variety of medical and mental health conditions, particularly for challenging presentations such as chronic pain and headache [38]. In the meantime, COVID-19 has provided the impetus for radical uptake of telemedicine and provided numerous insights into the barriers it is poised to address.

### Mitigating Barriers and Improving Access to Care

Several barriers prevent people with chronic pain and headache from receiving in-person behavioral treatments. However, using a variety of telemedicine modalities may mitigate these barriers. Reimbursement for behavioral pain and headache treatments remains suboptimal, serving as an additional disincentive to participate in behavioral treatments, particularly when compared to the higher reimbursement for medical pain and headache treatment strategies. Consequently, many people report that they are unwilling to pay out-of-pocket for treatment [39]. Not only can treatment be expensive, but patients must often miss work to travel to and attend appointments, which may result in lost income or the use of accrued leave from work. Additionally, patients with children or other dependents may need to secure additional caretakers so that they can attend an appointment. Given that telemedicine allows patients the flexibility to receive behavioral treatments for pain and headache from any location, telemedicine may offset some of the costs associated with attending in-person appointments.

Time constraints may also limit in-person care. For example, medical office hours often align with typical work hours which are not always convenient for those working nightshifts. Asynchronous or self-led treatment modalities that leverage mHealth may be a particularly attractive alternative to in-person care.

Access to behavioral providers with specialization in behavioral pain or headache treatments can be challenging, particularly in rural settings [40]. Therefore, patients may face limited options in behavioral treatment providers, resulting in limited behavioral treatment strategies that may not adequately address their specific treatment needs [41, 42]. Recent studies have observed greater use of telemedicine for patients who receive specialty pain services in rural populations (12%) compared to urban patients (3%) [43]. Additionally, people with mobility limitations may require accessible transit options to attend in-person medical appointments. Moreover, given the unpredictable nature of pain and headache attacks, transportation may be uncomfortable, and attending in-person appointments may exacerbate pain [44••]. Therefore, telemedicine delivery of behavioral treatments for pain and headache can afford patients the ability to receive high-quality care without physically needing to travel to a medical facility.

Societal and cultural concepts related to seeking psychological care may also interfere with seeking in-person behavioral care for chronic pain and headache disorders [45]. For example, patients may believe that a referral to a psychologist indicates their medical provider does not believe their pain is “real,” or that a referral to a pain psychologist is for a mental health concern rather than pain management. One qualitative study stemming from a telerehabilitation RCT found that telemedicine may place patients at ease, facilitating disclosure and allowing patients to speak more freely, ultimately improving treatment outcomes [46]. Despite beliefs that telemedicine decreases personal connection, this data suggests that modalities without face-to-face components may increase patient comfort resulting in increased patient honesty and disclosure.

Telemedicine can be empowering for patients by removing many of the aforementioned barriers. When patients can choose where, when, and how they receive treatment, they feel a sense of control. A recent systematic review of 21 qualitative studies (N = 429) covering the full range of telemedicine modalities indicates their medical provider does not believe their pain is “real,” or that a referral to a pain psychologist is for a mental health concern rather than pain management. One qualitative study stemming from a telerehabilitation RCT found that telemedicine may place patients at ease, facilitating disclosure and allowing patients to speak more freely, ultimately improving treatment outcomes [46]. Despite beliefs that telemedicine decreases personal connection, this data suggests that modalities without face-to-face components may increase patient comfort resulting in increased patient honesty and disclosure.

Even in its infancy, telemedicine has become a preferred method of care for many people living with chronic pain and headache. Studies of early telemedicine adoption have consistently shown that patients view this modality as acceptable, with similar or greater rates of satisfaction and treatment compliance compared to in-person care, and prefer a fully virtual or blended care model moving forward [48–50]. In addition to being well received by patients, behavioral treatments delivered through a variety of telemedicine models have demonstrated early promise for reducing pain intensity, and pain and headache-related disability [51–59].

### Modes of Care Delivery

Technological advances for patients and healthcare systems and recognition of the benefit of such tools have led to several novel technology modalities affording synchronous, asynchronous, or hybrid care [60].
Synchronous Care Delivery

Synchronous healthcare delivery entails two-way interactions between patients and providers in real time, with video or phone-based care most commonly used. Synchronous care provides the closest fidelity to traditional, in-person treatments while offering the benefits of telemedicine. Several studies have examined the delivery of behavioral treatments for pain or headache using synchronous care. For example, Rutledge and colleagues conducted a randomized controlled trial examining the synchronous, virtual delivery of cognitive behavioral therapy and supportive psychotherapy for 61 people with chronic back pain [54]. Participants in both groups reported significant improvements in disability and pain intensity, showing that providers can effectively deliver behavioral treatments for pain via telemicine.

While cognitive behavioral therapy is one of the most commonly studied behavioral treatments for pain and headache, third-wave interventions, such as Acceptance and Commitment Therapy for Chronic Pain (ACT), continue to gain attention. ACT highlights acceptance, mindfulness, and psychological flexibility to help patients live a valued-based life despite their chronic pain. Herbert and colleagues conducted a randomized noninferiority trial comparing the delivery of an 8-week ACT treatment intervention either in person or via video with 128 Veterans with chronic pain [55]. Participants were randomized to receive eight individual ACT sessions either in person or via videoconferencing. Outcomes included pain interference and pain intensity, among other mental health comorbidities. In-person delivery of ACT was noninferior to delivery via video, therefore concluding that the treatment provision of ACT video is both acceptable and effective for people living with chronic pain.

Asynchronous Care Delivery

While synchronous healthcare entails interactions between patients and providers in real time, asynchronous care can occur at any time. Leveraging the accessibility of technology, asynchronous models may be particularly beneficial for individuals with inflexible work or caregiving schedules. There are several formats for providing asynchronous care, including secure messaging, emailing, or interactive voice response technology. Heapy and colleagues conducted a noninferiority randomized trial comparing synchronous and asynchronous delivery of a 10-week cognitive-behavioral therapy for chronic pain protocol with 125 Veterans diagnosed with chronic low-back pain [61]. Participants were randomized to receive CBT-CP in person or via interactive voice response technology (IVR-CBT-CP). Those randomized to the IVR-CBT-CP group received asynchronous care with a self-directed treatment workbook and daily IVR calls to gather data about skill practice and pain outcomes and weekly prerecorded therapist feedback. Participants in the CBT-CP group received synchronous care via one-on-one in-person treatment with a therapist. The authors found that the average pain intensity from baseline to 3 months post-treatment was similar between the groups (−0.77 IVR-CBT-CP vs. −0.84 CBT-CP). Additionally, participants across both treatment groups reported benefits for sleep quality and quality of life. The authors concluded that IVR technology, as a mode of asynchronous care delivery, is an attractive option since it is convenient for patients and could increase access to much-needed behavioral treatments for people living with chronic pain. Interestingly, in a secondary analysis of this trial, patients who received IVR-CBT-CP remained in treatment longer than those in the CBT-CP group, suggesting that IVR delivery of CBT-CP is an effective and acceptable method of treatment delivery for pain [62].

More recently, Heapy and colleagues conducted a randomized hybrid type I pragmatic superiority trial comparing CBT-CP and IVR CBT-CP with 764 Veterans with chronic musculoskeletal pain [63]. They anticipate several benefits of utilizing IVR as a method of asynchronous delivery. It is much less burdensome for patients and providers, allowing for shorter appointment times, and more flexibility for patients and providers, as patients can access treatment at a most convenient time.

Leveraging asynchronous tools may be beneficial in allowing patients to receive care outside of the clinic walls, increasing access, and being more convenient for patients, though there are concerns regarding fully asynchronous care. Providers may feel uncomfortable with the lack of “face-to-face,” real-time contact, and patient interactions over email or IVR may be substantively different than in traditional settings. Hybrid telemedicine models combine aspects of synchronous and asynchronous care, offering largely web-based programs with less frequent and shorter-duration patient-provider interactions. Dear and colleagues conducted a randomized control trial of one such models, investigating an 8-week web-based, clinician-guided cognitive behavioral therapy program for chronic pain among 60 participants [64]. Sustained improvements in pain and affective distress were observed by the treatment group, and the program was exceptionally well received by patients. Notably, providers spent an average of 82 min per patient across the 8 weeks, compared to 240–480 h that would typically accompany 30–60-min weekly sessions over 8 weeks. This program has been subsequently investigated in larger-scale trials with varying degrees of clinician support or use in specific pain disorders such as fibromyalgia, with similar outcomes reported [59, 65].

Although these models show significant promise, future research examining how best to incorporate asynchronous...
and synchronous care in tandem is needed, particularly in the context of headache disorders.

**Mobile Health and Internet-Based Care Delivery**

Mobile health (mHealth) is another method of providing treatment. The World Health Organization defines mHealth as “medical and public health practice supported by mobile devices, such as mobile phones, patient monitoring devices, personal digital assistants (PDAs), and other wireless devices” [66]. Phone-based apps are increasingly popular and can serve a multitude of purposes. For example, electronic headache phone applications are commonly used for data collection, allowing patients to track headache frequency, symptoms, and potential headache triggers. In addition to monitoring headache and associated symptoms, phone-based applications can also be used to deliver behavioral treatment [67]. Smartphone apps have also been used to deliver components of behavioral interventions for headache. For example, a pilot trial with 139 people with migraine reported that delivery of progressive muscle relaxation resulted in decreased headache-related disability [57]. Self-guided programs have also been shown to be effective for pain. For example, in a study of 58 people with chronic low-back pain, the use of an internet-based delivery of cognitive behavioral therapy for pain resulted in a reduction of pain interference and improvements in psychiatric symptoms of anxiety and depression [56]. The authors concluded that internet delivery of cognitive behavioral therapy for pain was feasible and acceptable.

Mobile health modalities are particularly well suited to address many of the barriers previously described due to the rapid proliferation of mobile devices over the last two decades, and continued research investigating how best to leverage the technology in the context of pain and headache disorders is needed.

**Summary**

Behavioral management of pain and headache disorders is an important component of a multidisciplinary treatment plan, though it has been historically impeded by a multitude of financial, accessibility, and social barriers. With the onset of the COVID-19 public health emergency and related policy changes, telemedicine quickly became the default modality for behavioral treatments. Although circumstances necessitated the shift, care should be emphasized when considering telemedicine modalities as efficacious or preferred to traditional in-person. Early research shows promise for a variety of telemedicine models for behavioral management of pain and headache, and undoubtedly more will emerge as a result of COVID-19. Future research investigating how best to utilize different methods is needed, as well as identifying who benefits most from such programs. Additional noninferiority trials comparing telemedicine to in-person care will be necessary to guide best practice guidelines, though even an attenuated effect will carry significant implications for expanding behavioral pain and headache services.

**Compliance with Ethical Standards**

**Conflict of Interest** Daniel G. Rogers, Katie Santamaria, and Amy S. Grinberg, have nothing to disclose. Elizabeth K. Seng, reports personal fees from GlaxoSmithKline, personal fees from Click Therapeutics, and personal fees from AbbVie, outside the submitted work.

**References**

Papers of particular interest, published recently, have been highlighted as:

- Of importance
- Of major importance

1. Vambhejm SM, Kyllø TM, Hegland S, Bystad M. Relaxation techniques as an intervention for chronic pain: a systematic review of randomized controlled trials. Helijyon. 2021;7(8):e07837. https://doi.org/10.1016/j.helijyon.2021.e07837.
2. Petrucci G, Papalia GF, Russo F, Vadala G, Piredda M, De Marinis MG, et al. Psychological approaches for the integrative care of chronic low back pain: a systematic review and meta-analysis. Int J Environ Res Public Health. 2021;19(1). https://doi.org/10.3390/ijerph19010060.
3. Cheng JOS, Cheng ST. Effectiveness of physical and cognitive-behavioural intervention programmes for chronic musculoskeletal pain in adults: a systematic review and meta-analysis of randomised controlled trials. PLoS One. 2019;14(10):e0223367. https://doi.org/10.1371/journal.pone.0223367. Review of behavioral treatments for chronic pain.
4. Dudeney J, Sharpe L, McDonald S, Menzies RE, McGuire B. Are psychological interventions efficacious for adults with migraine? A systematic review and meta-analysis Headache. 2022;62(4):405–19. https://doi.org/10.1111/head.14260.
5. Lee HJ, Lee JH, Cho EY, Kim SM, Yoon S. Efficacy of psychological treatment for headache disorder: a systematic review and meta-analysis. J Headache Pain. 2019;20(1):17. https://doi.org/10.1186/s10194-019-0965-4.
6. Rogers DG, Protti TA, Smitherman TA. Fear, avoidance, and disability in headache disorders. Curr Pain Headache Rep. 2020;24(7):33. https://doi.org/10.1007/s11916-020-00865-9.
7. Markfield T, Pauli P. Fear of pain and pain intensity: meta-analysis and systematic review. Psychol Bull. 2020;146(5):411–50. https://doi.org/10.1037/bul0000228.
8. Martinez-Calderon J, Flores-Cortes M, Morales-Asencio JM, Luque-Suarez A. Pain-related fear, pain intensity and function in individuals with chronic musculoskeletal pain: a systematic review and meta-Analysis. J Pain. 2019;20(12):1394–415. https://doi.org/10.1016/j.jpain.2019.04.009.
9. Yang J, Lo WLA, Zheng F, Cheng X, Yu Q, Wang C. Evaluation of cognitive behavioral therapy on improving pain, fear avoidance, and self-efficacy in patients with chronic low back pain: a systematic review and meta-analysis. Pain Res Manag. 2022:2022:4276175. https://doi.org/10.1155/2022/4276175.
10. Vergeld V, Martin Ginis KA, Jenks AD. Psychological interventions for reducing fear avoidance beliefs among people with chronic back pain. Rehabil Psychol. 2021;66(4):386–403. https://doi.org/10.1037/rep0000394.

11. Thorn BE, Pence LB, Ward LC, Kilgo G, Clements KL, Cross TH, et al. A randomized clinical trial of targeted cognitive behavioral therapy to reduce catastrophizing in chronic headache sufferers. J Pain. 2007;8(12):938–49. https://doi.org/10.1016/j.jpain.2007.06.010.

12. Martin PR, Reece J, MacKenzie S, Bandarian-Baloouch S, Brunelli A, Goadsby PJ. Integrating headache trigger management strategies into cognitive-behavioral therapy: a randomized controlled trial. Health Psychol. 2021;40(10):674–85. https://doi.org/10.1037/hea0001115.

13. Holroyd KA, Cottrell CK, O’Donnell FJ, Cordingly GE, Drew JB, Carlson BW, et al. Effect of preventive (beta blocker) treatment, behavioural migraine management, or their combination on outcomes of optimised acute treatment in frequent migraine: randomised controlled trial. BMJ. 2010;341:c4871. https://doi.org/10.1136/bmj.c4871.

14. Holroyd KA, O’Donnell FJ, Stensland M, Lipchik GL, Cordingly GE, Carlson BW. Management of chronic tension-type headache with tricyclic antidepressant medication, stress management therapy, and their combination: a randomized controlled trial. JAMA. 2001;285(17):2208–15. https://doi.org/10.1001/jama.285.17.2208.

15. DeBar L, Mayhew M, Benes L, Deyo RA, Elder CR, et al. A primary care-based cognitive behavioral therapy intervention for long-term opioid users with chronic pain: a randomised pragmatic trial. Ann Intern Med. 2022;175(1):46–55. https://doi.org/10.7326/M21-1436.

16. Selvanathan J, Pham C, Nagappa M, Peng PWH, Englesakk M, Espie CA, et al. Cognitive behavioral therapy for insomnia in patients with chronic pain - a systematic review and meta-analysis of randomized controlled trials. Sleep Med Rev. 2021;60:101460. https://doi.org/10.1016/j.smrv.2021.101460.

17. Smitherman TA, Kuka AJ, Calhoun AH, Walters ABP, Davis-Martin RE, Ambrose CE, et al. Cognitive-behavioral therapy for insomnia to reduce chronic migraine: a sequential bayesian analysis. Headache. 2018;58(7):1052–9. https://doi.org/10.1111/head.13313.

18. Martin PR, Aiello R, Gilson K, Meadows G, Milgrom J, Reece J. Cognitive behavior therapy for comorbid migraine and tension-type headache and major depressive disorder: an exploratory randomized controlled trial. Behav Res Ther. 2015;73:8–18. https://doi.org/10.1016/j.brat.2015.07.005.

19. Baumeister H, Paganini S, Sander LB, Lin J, Schlicker S, Terhorst Y, et al. Effectiveness of a guided internet- and mobile-based intervention for patients with chronic back pain and depression (WARD-BP): a multicenter, pragmatic randomized controlled trial. Psychother Psychosom. 2021;90(4):255–68. https://doi.org/10.1159/000511588.

20. Lin TH, Tam KW, Yang YL, Liou TH, Hsu TH, Rau CL. Meditation-based therapy for chronic low back pain management: a systematic review and meta-analysis of randomized controlled trials. Pain Med. 2022. https://doi.org/10.1093/pm/pnz037.

21. Anhedyer D, Leach MJ, Klose P, Dobos G, Cramer H. Mindfulness-based stress reduction for treating chronic headache: a systematic review and meta-analysis. Cephalalgia. 2019;39(4):544–55. https://doi.org/10.1177/0333102418781795.

22. Mattocks K, Rosen ML, Sellinger J, Ngo T, Brummett B, Higgins DM, et al. Pain care in the department of veterans affairs: understanding how a cultural shift in pain care impacts provider decisions and collaboration. Pain Med. 2020;21(5):970–7. https://doi.org/10.1093/pm/pnz341.

23. Dickinson KC, Sharma R, Duckart JP, Corson K, Gerrity MS, Dobscha SK. VA healthcare costs of a collaborative intervention for chronic pain in primary care. Med Care. 2010;48(1):38–44. https://doi.org/10.1097/MLO.0b013e3181bd49e2.

24. Kroenke K, Krebs EE, Wu J, Yu Z, Chrumbler NR, Bair MJ. Telecare collaborative management of chronic pain in primary care: a randomized clinical trial. JAMA. 2020;323(24):2340–8. https://doi.org/10.1001/jama.2020.7489.

25. Singer AB, Buse DC, Seng EK. Behavioral treatments for migraine management: useful at each step of migraine care. Curr Neurol Neurosci Rep. 2015;15(4):14. https://doi.org/10.1007/s11910-015-0533-5.

26. Edmond SN, Moore BA, Dorflinger LM, Goulet JL, Becker WC, Heapy AA, et al. Project STEP: Implementing the veterans health administration's stepped care model of pain management. Pain Med. 2018;19(suppl_1):S30-S7. https://doi.org/10.1093/pm/pny094.

27. Institute of Medicine Committee on Evaluating Clinical Applications of Telemedicine. The National Academies Collection: reports funded by National Institutes of Health. In: Field MJ, ed. Telemedicine: a guide to accessing telecommu-nications in health care. Washington, DC: National Academies Press (US), 1996.

28. Darkins AW, Cary MA. Telemedicine and telehealth: principles, policies, performance, and pitfalls. New York: Springer; 2000.

29. Uscher-Pines L, Bouskill KE, Sousa J, Shen M, Fischer S. Experiences of medicaid programs and health centers in implementing telehealth. Rand Health Q. 2020;8(4). PMID: 32528468.

30. Sadej J, Lum J, Pearson E, Pizer SD. Virtual health care: using telehealth to provide care in VHA. PEPReC Policy Brief. 2021;6(2).

31. Bagelman E. The number of veterans that use VA Health Care services: a fact sheet. Library of Congress: Congressional Research Service; 2014.

32. Centers for Medicare & Medicaid Services. Telemedicine health care provider fact sheet. Baltimore, MD: Department of Health and Human Services; 2020. https://www.cms.gov/newsroom/fact-sheets/medicare-telemedicine-health-care-provider-fact-sheet.

33. Demeke HB, Pao LZ, Clark H, Romero L, Neri A, Shah R, et al. Telehealth practice among health centers during the COVID-19 pandemic - United States, July 11–17, 2020. MMWR Morb Mortal Wkly Rep. 2020;69(50):1902–5. https://doi.org/10.15585/mmwr.mm6950a4.

34. Assistant Secretary for Planning and Evaluation, Department of Human & Health Services. Medicare beneficiary use of telehealth visits: early data from the start of the COVID-19 pandemic. Issue Brief, 2020. https://aspe.hhs.gov/reports/medicare-beneficiary-use-telehealth-visits-early-data-start-covid-19-pandemic.

35. Assistant Secretary for Planning and Response, Department of Human & Health Services. Renewal of determination that a public health emergency exists. Public Health Emergency Declaration, 2022. https://aspr.hhs.gov/legal/PHE/Pages/COVID-19-12Apr2022.aspx.

36. Interstate Medical Licensure Compact. Participating states. https://www.illmmc.org/participating-states (Accessed May 2022).

37. Psychology Interjurisdictional Compact. PSYPACT Map/States. https://psypact-site.ym.com/page/psypactmap (Accessed May 2022).

38. Cascella M, Marinangeli F, Vittori A, Scala C, Piccinini M, Braga A, et al. Open issues and practical suggestions for telemedicine in chronic pain. Int J Environ Res Public Health. 2021;18(23). https://doi.org/10.3390/ijerph182312416.

39. Minen MT, Jalloh A, Begasse de Dhaem O, Seng EK. Behavioral therapy preferences in people with migraine. Headache. 2020;60(6):1093–102. https://doi.org/10.1111/head.13790.

40. Malatre-Lansac A, Engel CC, Xenakis L, Carlasare L, Blake K, Vargo C, et al. Factors influencing physician practices’
adoption of behavioral health integration in the united states: a qualitative study. Ann Intern Med. 2020;173(2):92–9. https://doi.org/10.7326/M20-0132.

41. Collard VEJ, Moore C, Nichols V, Ellard DR, Patel S, Sandhu H, et al. Challenges and visions for managing pain-related insomnia in primary care using the hybrid CBT approach: a small-scale qualitative interview study with GPs, nurses, and practice managers. BMC Fam Pract. 2021;22(1):210. https://doi.org/10.1186/s12875-021-01552-3.

42. Kuruvilla DE, Lindsey H, Grinberg AS, Goldman RE, Riley S, Baird S, et al. Comprehensive and integrative medicine perspectives among veteran patients and VHA healthcare providers for the treatment of headache disorders: a qualitative study. BMC Complement Med Ther. 2022;22(1):22. https://doi.org/10.1186/s12906-022-03511-6.

43. Chen JA, DeFiacco RJ, Gelman H, Thomas ER, Indresano JA, Dawson TC, et al. Telehealth and rural-urban differences in receipt of pain care in the veterans health administration. Pain Med. 2022;23(3):466–74. https://doi.org/10.1093/pm/pnb194.

44. Grinberg AS, Fenton BT, Wang K, Lindsey H, Goldman RE, Baird S, et al. Telehealth perceptions and utilization for the delivery of headache care before and during the COVID-19 pandemic: a mixed-methods study. Headache. 2022;62(5):613–23. https://doi.org/10.1111/head.14310. Mixed-method study including qualitative analysis of provider perceptions of telemedicine.

45. Langenbahn D, Matsuura Y, Lee YSC, Fraser F, Penzien DB, Simon NM, et al. Underuse of behavioral treatments for headache: a narrative review examining societal and cultural factors. J Gen Intern Med. 2021;36(10):3103–12. https://doi.org/10.1007/s11606-020-06539-x.

46. Lawford BJ, Delany C, Bennell KL, Hinman RS. “I was really sceptical...But it worked really well”: a qualitative study of patient perceptions of telephone-delivered exercise therapy by physiotherapists for people with knee osteoarthritis. Osteoarthr Cartil. 2018;26(6):741–50. https://doi.org/10.1016/j.joca.2018.02.909.

47. Fernandes LG, Devan H, Fioratti I, Kamper SJ, Williams CM, Saragiotto BT. At my own pace, space, and place: a systematic review of qualitative studies of enablement and barriers to telehealth interventions for people with chronic pain. Pain. 2022;163(2):e165-e181. https://doi.org/10.1097/J.PAIN.0000000000003264. Systematic review of patient-focused studies outlining barriers to telemedicine.

48. Bhuvu S, Lankford C, Patel N, Haddas R. Implementation and patient satisfaction of telemmedicine in spine physical medicine and rehabilitation patients during the COVID-19 shutdown. Am J Phys Med Rehabil. 2020;99(12):1079–85. https://doi.org/10.1097/PHM.0000000000001600.

49. Chiang CC, Halker Singh R, Lalvani N, Shubin Stein K, Henscheid Lorenz D, Lay C, et al. Patient experience of telemedicine for headache care during the COVID-19 pandemic: an American Migraine Foundation survey study. Headache. 2021;61(5):734–9. https://doi.org/10.1111/head.14110.

50. Muller KI, Alstdadhaug KB, Bekkelund SI. Telemedicine in the management of non-acute headaches: a prospective, open-labelled non-inferiority, randomised clinical trial. Cephalalgia. 2017;37(9):855–63. https://doi.org/10.1177/0333102416654885.

51. Garg S, Garg D, Turin TC, Chadhury MF. Web-based interventions for chronic back pain: a systematic review. J Med Internet Res. 2016;18(7):e139. https://doi.org/10.2196/jmir.4932.

52. Bjornnana J, Bowers A, Mino D, Choice D, Metz D, Wagner K. Effects of a remotely delivered cognitive behavioral coaching program on the self-rated functional disability of participants with low back pain. Pain Manag Nurs. 2021. https://doi.org/10.1016/j.pmn.2021.08.006.

53. McCurry SM, Zhu W, Von Korff M, Wellman R, Morin CM, Thakral M, et al. Effect of telephone cognitive behavioral therapy for insomnia in older adults with osteoarthritis pain: a randomized clinical trial. JAMA Intern Med. 2021;181(4):530–8. https://doi.org/10.1001/jamauro.2020.9049.

54. Rutledge T, Atkinson JH, Holloway R, Chircop-Rollick T, D’Andrea J, Garfin SR, et al. Randomized controlled trial of nurse-delivered cognitive-behavioral therapy versus supportive psychotherapy telehealth interventions for chronic back pain. J Pain. 2018;19(9):1033–9. https://doi.org/10.1016/j.jpain.2018.03.017.

55. Herbert MS, Afari N, Liu L, Heppner P, Rutledge T, Williams K, et al. Telehealth versus in-person acceptance and commitment therapy for chronic pain: a randomized noninferiority trial. J Pain. 2017;18(2):200–11. https://doi.org/10.1016/j.jpain.2016.01.014.

56. Higgins DM, Bota E, Williams DA, Halat A, Bair MJ, Heapy AA, et al. Internet-based pain self-management for veterans: feasibility and preliminary efficacy of the pain EASE program. Pain Pract. 2020;20(4):357–70. https://doi.org/10.1111/papr.12861.

57. Minen MT, Adhikari S, Padikkala J, Tasneem S, Bagheri A, Goldberg E, et al. Smartphone-delivered progressive muscle relaxation for the treatment of migraine in primary care: a randomized controlled trial. Headache. 2020;60(10):2232–46. https://doi.org/10.1111/heid.14010.

58. Taguchi K, Numata N, Takarashi R, Takemura R, Yoshida T, Kutsuzawa K, et al. Clinical effectiveness and cost-effectiveness of videoconference-based integrated cognitive behavioral therapy for chronic pain: randomized controlled trial. J Med Internet Res. 2021;23(11):e30690. https://doi.org/10.2196/jmir.30690.

59. Friesen LN, Hadjistavropoulos HD, Schneider LH, Alberts NM, Titov N, Dear BF. Examination of an internet-delivered cognitive behavioural pain management course for adults with fibromyalgia: a randomized controlled trial. Pain. 2017;158(4):593–604. https://doi.org/10.1097/J.PAIN.0000000000000802.

60. World Health Organization. Telemedicine: opportunities and developments in Member States: report on the second global survey on eHealth. Global Observatory for eHealth Series, vol 2. 2010;2. ISBN: 978–92–4–156414–4.

61. Heapy AA, Higgins DM, Goulet JL, LaChappelle KM, Driscoll MA, Czlapinski RA, et al. Interactive voice response-based self-management for chronic back pain: the COPES noninferiority randomized trial. JAMA Intern Med. 2017;177(6):765–73. https://doi.org/10.1001/jamainternalmed.2017.0223.

62. Ankawi B, Piette JD, Bota E, Edmond SN, MacLean R, et al. Adherence to daily interactive voice response calls for a chronic pain intervention. J technol behav sci 2022;online. https://doi.org/10.1007/s41347-022-00254-6.

63. Heapy AA, Driscoll MA, Bota E, LaChappelle KM, Edmond S, Krein SL, et al. Co-operative pain education and self-management (COPES) expanding treatment for real-world access (ExTRA): pragmatic trial protocol. Pain Med. 2020;21(12 Suppl 2):S21–8. https://doi.org/10.1093/pm/paa365.

64. Dear BF, Titov N, Perry KN, Johnston L, Wootton BM, Terides MD, et al. The Pain Course: a randomised controlled trial of a clinician-guided Internet-delivered cognitive behaviour therapy program for managing chronic pain and emotional well-being. Pain. 2013;154(6):942–50. https://doi.org/10.1016/j.jpain.2013.03.005.

65. Dear BF, Gandy M, Karin E, Staples LG, Johnston L, Fogliati VJ, et al. The Pain Course: a randomised controlled trial examining an internet-delivered pain management program when provided with different levels of clinician support. Pain. 2015;156(10):1920–35. https://doi.org/10.1097/J.PAIN.000000000000251.
66. World Health Organization mHealth: new horizons for health through mobile technologies: based on the findings of the second global survey on eHealth. Global Observatory for eHealth Series, vol 3. 2011. ISBN: 978–92–4–156425–0

67. Noser AE, Klages KL, Gamwell KL, Brammer CN, Hommel KA, Ramsey RR. A systematic evaluation of primary headache management apps leveraging behavior change techniques. Cephalalgia. 2022;42(6):510–23. https://doi.org/10.1177/03331024211053572. Systematic review of mobile behavior change applications for headache.

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