By Erin Shigekawa, Margaret Fix, Garen Corbett, Dylan H. Roby, and Janet Coffman

The Current State Of Telehealth Evidence: A Rapid Review

DOI: 10.1377/hlthaff.2018.05132
HEALTH AFFAIRS 37,
NO. 12 (2018): 1975–1982

ABSTRACT Policy makers and practitioners show a continued interest in telehealth's potential to increase efficiency and reach patients facing access barriers. However, telehealth encompasses many applications for varied conditions and populations. It is therefore difficult to draw broad conclusions about telehealth's efficacy. This rapid review examines recent evidence both about telehealth's efficacy by clinical area and about telehealth's impact on utilization. We searched for systematic reviews and meta-analyses of the use of telehealth services by patients of any age for any condition published in English in the period January 2004–May 2018. Twenty systematic reviews and associated meta-analyses are included in this review, covering clinical areas such as mental health and rehabilitation. Broadly, telehealth interventions appear generally equivalent to in-person care. However, telehealth's impact on the use of other services is unclear. Many factors should be carefully considered when weighing the evidence of telehealth's efficacy, including modality, evidence quality, population demographics, and point-in-time measurement of outcomes.

Erin Shigekawa (erin_shigekawa@jsi.com) is a consultant, John Snow, Inc. (JSI), in San Francisco, California. She was a principal analyst in the California Health Benefits Review Program, University of California Berkeley, when this work was completed.

Margaret Fix is a research associate at the Philip R. Lee Institute for Health Policy Studies, University of California San Francisco.

Garen Corbett is director of the California Health Benefits Review Program, University of California Berkeley.

Dylan H. Roby is an associate professor in and associate chair of the Department of Health Services Administration at the University of Maryland School of Public Health, in College Park; an adjunct associate professor in the Fielding School of Public Health, University of California Los Angeles (UCLA); and a faculty associate in the UCLA Center for Health Policy Research.

Janet Coffman is a full adjunct professor at the Philip R. Lee Institute for Health Policy Studies, University of California San Francisco.

Telehealth is often framed by proponents as a way to deliver high-quality care at a lower cost or to expand access. Recently, policy makers have paid significant attention to telehealth in the legislative process and administrative rule making. The Center for Connected Health Policy reports that over 160 telehealth bills were introduced in forty-four states in 2018.[1] In July 2018 the Centers for Medicare and Medicaid Services released a proposed rule providing guidance on and expanding access to telehealth for Medicare beneficiaries.[2]

However, telehealth encompasses a variety of modalities that can be used for varied conditions and patient populations. It is difficult to make blanket statements about telehealth's efficacy, as that may vary by application and modality. In addition, impacts on utilization may vary because telehealth can either substitute for or supplement in-person visits. Although telehealth experts may view telehealth as an additional service that can benefit patients, policy makers often argue that telehealth services will achieve cost savings and increase access by replacing in-person visits with less costly virtual visits. Recent evidence suggests that third-party direct-to-consumer telehealth services replaced office visits or other in-person services (for example, urgent care) 12–85 percent of the time, which indicates that substitution or supplementation varies widely.[3,4]

This article describes a rapid review of systematic reviews and meta-analyses that were published in the period January 2004–May 2018 regarding telehealth services. The review focuses on telehealth interventions that facilitate direct interaction between patient and provider. We examine two questions. First, does the evidence indicate whether services delivered via tele-

health are equivalent to in-person services? Second, does the evidence indicate whether the use of telehealth services affects the use of other services?

Study Data And Methods

A rapid review can be used for time-sensitive policy decisions and is relevant for dynamic fields. There is no single formally accepted definition or protocol for a rapid review. The World Health Organization (WHO) defines it as "a type of knowledge synthesis in which the steps of a systematic review are streamlined or accelerated to produce evidence in a shortened timeframe."[5] The WHO notes that when time and cost are a barrier to systematic reviews, rapid reviews are an affordable and timely alternative. However, compared to systematic reviews, rapid reviews are less rigorous and may miss important nuances that systematic reviews could uncover.

This rapid review includes systematic reviews and meta-analyses regarding the medical effectiveness of care delivered in seven clinical areas via several telehealth modalities: live videoconferencing, asynchronous store and forward of data, telephone, email, text, and chat.

Because the focus of this review is on telehealth that involves patient-provider interaction, studies of services that are primarily used for disease management or self-maintenance between in-person visits were excluded. These telehealth services include remote monitoring, mobile applications, structured phone disease management by nurses, and fully automated website interventions.

Given the volume of the literature and the variability of telehealth research in sample size and study design, the review included only systematic reviews and meta-analyses.

This review updates a prior review completed for the California State Legislature in 2016.[6] However, the findings of this review are distinct from those prepared for the legislature. The research questions in the two reviews are related, but the findings are grouped differently. Notably, these results are presented by clinical area rather than telehealth modality. We expect this to be a useful grouping for practitioners and decision makers, as it allows for observations about clinical outcomes in telehealth by condition. Additionally, many systematic reviews spanned multiple telehealth modalities but focused on a single clinical area. Lastly, this review includes findings from recent systematic reviews and associated meta-analyses, with fourteen of the twenty published in the period 2016–18. In particular, this update includes several recent systematic reviews and associated meta-analyses related to mental health and rehabilitation delivered via telehealth.

STUDY SELECTION The following databases of peer-reviewed literature were searched for telehealth systematic reviews and meta-analyses: MEDLINE, the Cochrane Library, CINAHL, EconLit, and Web of Science.

Two authors (Erin Shigekawa and Margaret Fix) independently screened abstracts of the systematic reviews and meta-analyses for inclusion. When the authors disagreed, they discussed the abstract to reach consensus. If they could not reach consensus, they consulted with another author (Janet Coffman).

Study eligibility criteria were based on the population, intervention, comparison, and outcome (PICO) framework, which was used to identify the factors of interest.[7] The population was adults and children receiving a telehealth intervention for any disease or condition. The intervention was any diagnosis or treatment intervention delivered via live videoconferencing; asynchronous store and forward of data; or telephone (excluding telephonic disease management delivered by nurses), email, text, or chat messaging directly with a health care provider. The comparison was usual care or in-person treatment. And the outcomes were health outcomes (such as change in depressive symptoms or pain), process outcomes (for example, diagnostic accuracy), and utilization outcomes (such as hospitalizations and follow-up visits).

Two authors (Shigekawa and Fix) abstracted key findings from the included studies and rated the studies using the AMSTAR 2 tool, an instrument used to assess the methodological quality of systematic reviews.[8]

LIMITATIONS Our study had several limitations. First, a methodological limitation for any review of the telehealth literature is the rapid pace of technological change. By the time a study is published, the studied technology may be outdated, which makes it difficult to draw conclusions about the medical effectiveness of technologies currently in use. We hope to have addressed this limitation to the extent possible by including the most up-to-date systematic reviews in this field.

A second limitation was the use of a rapid review format. As noted above, this is less rigorous than a systematic review format.

Study Results

The search included articles published in the period January 2004–May 2018. Of the 3,125 articles retrieved, 316 abstracts were reviewed for potential inclusion. Full text for 43 of the 316 articles was retrieved and reviewed. At full-

text review, an additional 25 articles were excluded. Thus, we identified 18 relevant systematic reviews and associated meta-analyses that met the inclusion criteria. Two additional systematic reviews were included based on input from reviewers, for a total of 20 relevant systematic reviews (most of which included associated meta-analyses).

Studies were eliminated if they did not report findings from clinical research studies, did not focus on the telehealth modalities listed above, did not compare telehealth to in-person or usual care, or focused on feasibility or patient satisfaction. When systematic reviews had inclusion criteria broader than the scope of this review, we summarized findings only from studies that met our inclusion criteria. We considered only studies published in English.

Systematic reviews and meta-analyses included in the review addressed the following uses of telehealth: telemental health, or mental health diagnosis and treatment (eight studies); telerehabilitation (five), teledermatology (two), teleconsultation (two), oral anticoagulation management (one), nutrition management (one), and diabetic foot ulcer treatment (one).

The included studies are listed in exhibit 1, with key findings highlighted in exhibit 2. The systematic review characteristics and findings are summarized in the following sections and in online appendix tables 1 and 2.[9]

TELEMENTAL HEALTH We identified eight systematic reviews of telehealth in mental health. Studies examining telemental health services generally found that outcomes of telehealth interventions did not differ significantly from in-person interventions. The studies tended to report findings for either assessment of mental health conditions (for example, test administration) or treatment (such as telepsychotherapy).

▶ **ASSESSMENT:** The findings related to assessment indicate some support for the equivalence of remote assessment via telehealth compared to in-person assessment for psychiatric conditions. Two systematic reviews reported consistency between remote and in-person psychiatric assessment. Antonio Drago and coauthors found that twelve randomized controlled trials reported consistency between telehealth and in-person psychiatric assessment for multiple conditions, including post-traumatic stress disorder (PTSD), attention deficit hyperactivity disorder (ADHD), major depressive disorder, and autism.[10] Timothy Brearly and coauthors examined neurocognitive assessment administered via videoconferencing for patients with mild cognitive impairment, Alzheimer disease, and substance use disorder.[11] For neurocognitive assessment, videoconferencing administration did not result in a significant change in test scores ($g = -0.03$; standard error: 0.03; 95% confidence interval: –0.08, 0.02; $p = 0.253$). Brearly and coauthors reported heterogeneity between studies (Q: 55.67; $p = 0.001$; $I^2 = 80.24$). Lastly, the authors reported that studies with participants ages sixty-five and older and those with slower internet connections reported more variability in their findings. This suggests that a patient's demographic characteristics and internet access could affect the use of a telehealth-administered neurocognitive test.

▶ **TREATMENT:** Systematic reviews of mental health treatment via telehealth tended to report that telehealth treatment outcomes for psychiat-

EXHIBIT 1

Systematic reviews and meta-analyses of telehealth included in the rapid review, by clinical area

Clinical area	Number of reviews and meta-analyses	Articles cited
Telemental health	8	Bashshur, 2016 (15); Brearly, 2017 (11); Drago, 2016 (10); García-Lizana, 2010 (13); Lau, 2017 (16); Olthuis, 2016 (12); Simpson, 2014 (14); Wootton, 2016 (17)
Telerehabilitation	5	Cottrell, 2017 (20); Kairy, 2009 (18); Ownsworth, 2018 (22); Pastora-Bernal, 2017 (21); van der Meij, 2016 (19)
Teledermatology	2	Bashshur, 2015 (24); Warshaw, 2011 (23)
Teleconsultation	2	Bunn, 2004 (25); Downes, 2017 (26)
Other (oral anticoagulation management, nutrition management, and diabetic foot ulcer treatment)	3	Lee, 2018 (27); Marx, 2018 (28); Singh, 2016 (29)

SOURCE Authors' analysis. **NOTE** Numbers in parentheses refer to endnotes in the text.

EXHIBIT 2

Key findings of included systematic reviews and meta-analyses of telehealth, by clinical area

Clinical area	Equivalence to in-person care
Telemental health	Generally equivalent to in-person care for a variety of mental health conditions
Telerehabilitation	Generally equivalent to or yields better outcomes than in-person care
Teledermatology	Diagnosis and treatment concordance ranges from "acceptable"/"good" to equivalent compared to in-person care
Teleconsultation	Potential alternative to in-person care, but equivalence is unclear as teleconsultation encompasses widely varied conditions

SOURCE Authors' analysis. **NOTE** The impact on use of other services was unknown in each of the clinical areas shown.

ric conditions were similar to in-person treatment outcomes. This suggests that telehealth could be a viable substitute for in-person care in the studied mental health conditions and treatments. However, Janine Olthuis and coauthors reported differences by condition and by point in time of outcome measurement (for example, immediately after treatment versus follow-up at three to six months).[12]

A review by Francisca García-Lizana and Ingrid Muñoz-Mayorga reported no significant differences between telepsychiatry videoconferencing and face-to-face visits for symptoms.[13] However, the authors concluded that there was insufficient evidence for the effectiveness or efficiency of telepsychiatry in managing mental illness. A systematic review by Susan Simpson and Corinne Reid of twenty-three studies of psychotherapy via live videoconferencing found strong support for the development of a therapeutic alliance that was at least as strong as that with in-person therapy.[14]

Reviews by Rashid Bashshur and coauthors, Drago and coauthors, Ying Lau and coauthors, and Bethany Wootton reported that telehealth treatment interventions appeared as efficacious as in-person treatment for studied mental health conditions.

Bashshur and coauthors examined telemental health for depression, anxiety, and substance use and mood disorders using telephone, internet, or video.[15] All studies that examined the impact of telemental health on medication adherence, depressive symptoms, and quality of life found improvements.

Drago and coauthors completed a meta-analysis of fourteen randomized controlled trials.[10] The results indicated that videoconferencing used for psychiatry treatment was as efficacious as in-person treatment for psychiatric disorders including major depressive disorder, ADHD, PTSD, and eating disorders.

A systematic review and meta-analysis of eight randomized controlled trials by Lau and coauthors examined the effects of therapist-supported internet cognitive behavioral therapy (iCBT) on stress, anxiety, and depressive symptoms among postpartum women.[16] *Therapist-supported* indicates that there is interaction with a therapist who is available for feedback. The meta-analysis reported support for the efficacy of therapist-supported iCBT for improving stress symptoms (large effect size; $d = 0.84$), anxiety symptoms (small effect size; $d = 0.36$), and depressive symptoms (medium effect size; $d = 0.63$). The authors reported no significant difference between therapist-supported iCBT and treatment as usual for stress symptoms. However, they do not appear to have reported outcomes for iCBT compared to treatment as usual for depressive and anxiety symptoms.

Wootton reviewed studies of remote cognitive behavior therapy for obsessive-compulsive disorder that compared remote treatment to face-to-face treatment or another control (being on a waiting list or attentional control).[17] Interventions included telephone and videoconferencing used for remote cognitive behavioral therapy. When comparing remote to face-to-face cognitive behavioral therapy, the analysis did not find significant differences in outcomes ($g = -0.21$; 95% CI: −0.43, 0.02).

As noted above, one review indicated that comparisons between videoconferencing treatment and in-person treatment differed by symptom type (PTSD versus depressive symptoms) and by point-in-time of outcome measurement (immediately after treatment versus follow-up at three to six months). For PTSD symptoms, Olthuis and coauthors reported that treatment delivered via videoconferencing did not result in significantly different symptoms immediately after treatment ($g = -0.05$; 95% CI: −0.31, 0.20) but reported worse outcomes compared to in-person treatment at three-to-six-month follow-up ($g = -0.25$; 95% CI: −0.44,−0.07). For depressive symptoms, the authors reported that telehealth interventions were less effective than face-to-face treatment in reducing symptoms in the short term ($g = -0.22$; 95% CI: −0.31, −0.14). However, the difference did not remain at three-to-six-month follow-up.

TELEREHABILITATION We identified five systematic reviews of telerehabilitation via multiple modalities, including live videoconferencing and telephone.

Dahlia Kairy and coauthors found that multiple types of telerehabilitation (neurological, cardiac, and speech-language) demonstrated improvements in clinical outcomes that were

similar to or better than those of control interventions, including face-to-face interventions.[18] Telerehabilitation tended to require more provider time for consultations, and the few studies that reported effects on utilization (for example, doctor visits or emergency department visits) found mixed results.

Three reviews focused on musculoskeletal conditions, including postoperative telerehabilitation. Eva van der Meij and coauthors reported on six studies that compared home telerehabilitation to in-person rehabilitation for total knee arthroplasty (four studies), shoulder joint replacement (one), and cardiac surgery (one).[19] Overall, the authors reported mixed findings indicating that telerehabilitation performed better than or not significantly differently from usual care: Two studies reported significant improvement in physical functioning for telerehabilitation compared to usual care, one reported significant improvements in pain for telerehabilitation, and two showed no significant differences between telerehabilitation and control groups.

A systematic review and meta-analysis by Michelle Cottrell and coauthors found that both real-time telerehabilitation and usual care reduced pain and improved quality of life and physical, psychological, and social functioning, with a moderate effect in favor of telerehabilitation over usual care (standardized mean differences: 0.45; 95% CI: 0.20, 0.70, $I^2 = 56$ percent).[20] Subgroup analysis indicated that combining telerehabilitation with usual care yielded more favorable outcomes than usual care alone (SMD: 0.64; 95% CI: 0.43, 0.85; $I^2 = 10$ percent), and that telerehabilitation outcomes were equivalent to face-to-face care outcomes. However, the authors also reported different findings for different conditions. Telerehabilitation and in-person rehabilitation for total knee arthroplasty had equivalent effects on outcomes, whereas telerehabilitation resulted in significantly better outcomes for people with total hip arthroscopy.

In contrast, José Pastora-Bernal and coauthors reported strong evidence that telerehabilitation following total knee arthroplasty and total hip arthroplasty yielded better outcomes than usual care did, with moderate and weak evidence in favor of telerehabilitation for upper-limb intervention.[21]

One review examined telerehabilitation for traumatic brain injury using telephone-based interventions. Tamara Ownsworth and coauthors found that compared to usual care, telephone-based interventions improved certain outcomes such as sleep quality and depressive symptoms postintervention in four of five randomized controlled trials, with significant outcomes ranging from small to medium effect sizes ($d = 0.28 – 0.51$).[22] Two studies found that benefits of telephone-based therapy for sleep quality and depressive symptoms posttreatment did not remain at follow-up. One trial reported no significant differences between telephone-based therapies and usual care.

TELEDERMATOLOGY We identified two systematic reviews of teledermatology. Erin Warshaw and coauthors indicated differences by telehealth modality and by diagnosis versus management. Warshaw and coauthors reported that, overall, diagnostic accuracy of in-person clinic dermatology is better than teledermatology (when comparing both to a gold standard of histopathology or other lab test). By modality, they found that diagnostic concordance of store and forward and clinic dermatology was "acceptable"/"good," but concordance rates were better for live video and clinic dermatology although based on fewer patients. For management accuracy, overall accuracy was equivalent between teledermatology and clinic dermatology, but teledermatology was inferior for malignant lesions.[23] Bashshur and coauthors found that evidence consistently supported teledermatology's effectiveness in diagnostic and treatment concordance with in-person dermatology.[24]

TELECONSULTATION We identified two teleconsultation systematic reviews. Frances Bunn and coauthors reported mixed findings about telephone consultation's effect on service use.[25] They found that telephone consultation reduced immediate visits to general practitioners, but it is unclear whether some visits were simply delayed. Three of five studies found a significant decrease in visits to general practitioners, but two studies found an increase in return consultations following telephone consultation. The authors did not report an increase in adverse events or emergency visits associated with telephone consultation.

Another systematic review studied teleconsultations with a general practitioner. Martin Downes and coauthors concluded that such consultations can be an appropriate alternative to in-person consultations.[26] Regarding utilization, the authors reported that teleconsultations resulted in more repeated visits but required providers to spend less total time with patients. One challenge of researching general practitioner consultation is the wide variety of conditions with which patients present. The many conditions addressed impede the measurement of diagnostic agreement between teleconsultation and in-person consultation.

OTHER The remaining identified systematic reviews and meta-analyses focused on oral anticoagulation management, nutrition management,

and diabetic foot ulcer treatment.

Munil Lee and coauthors reviewed telehealth interventions for oral anticoagulation management, primarily involving telephone interventions with clinicians.[27] They found that most reported outcomes (bleeding events, hospitalizations, and mortality) were similar across telehealth and usual care. While the authors reported a significantly lower rate of thromboembolic events among people who received the telehealth intervention, the authors also cautioned that the studies had a high risk of bias, low-quality designs, and wide confidence intervals.

A systematic review by Wolfgang Marx and coauthors on malnutrition-related interventions for community-dwelling older adults reported that telehealth was effective for managing nutrition.[28] The review included asynchronous and synchronous telehealth delivered via telephone or internet. The authors concluded that telehealth interventions are as likely as usual care to result in clinical improvement, but they also noted low to very low confidence in the reported effect sizes.

A systematic review (without meta-analysis) by Tejas Singh and coauthors examined diabetic foot ulcer treatment.[29] The interventions included care delivered via live video and digital wound images shared with wound consultants. The authors found that telehealth for diabetic foot ulcers showed high diagnostic accuracy and agreement with assessments performed in person. However, it was unclear whether telehealth treatment of diabetic foot ulcers had favorable clinical outcomes.

Overall, the quality of the included systematic reviews ranged from critically low to high, determined by assessment using AMSTAR 2. In some cases, systematic reviews recommended caution in interpreting their findings, given study design issues such as small sample sizes and limited follow-up time.

Discussion

The two overarching questions of this review are, Does the research evidence indicate whether services delivered via telehealth are equivalent to in-person services, and does the research evidence indicate whether the use of telehealth services affects the use of other services.

Regarding the first question, the included systematic reviews indicated that for the studied conditions, in most cases, telehealth appeared to be equivalent to in-person care. Telemental health findings indicated that for assessment and treatment for a variety of mental health conditions, outcomes of telemental health were not significantly different from those of in-person care. Telerehabilitation findings indicated that care delivered via telerehabilitation was generally either equivalent to or yielded better outcomes than in-person care. Teleconsultation findings indicate that teleconsultation may be an appropriate alternative for in-person consultation. However, because of the wide variety of conditions with which patients can present, it was difficult to measure diagnostic agreement between teleconsultation and in-person consultation.

The effects of providing oral anticoagulation management via telehealth and in person were similar; telehealth for nutrition management in older adults living at home was likely to yield clinical improvements compared to usual care or no intervention; and telehealth was effective for diagnosing diabetic foot ulcers, but it was unclear whether it was effective for treating them. Teledermatology findings vary: Bashshur and coauthors noted consistent diagnostic and treatment concordance between teledermatology and in-person dermatology.[24] However, Warshaw and coauthors reported that in-person dermatology performs better for diagnostic accuracy than teledermatology (comparing both to a gold standard of histopathology or other lab test). They also found higher diagnostic concordance between in-person dermatology and live video as compared to store and forward. For management, they reported equivalent overall accuracy between teledermatology and in-person dermatology.[23]

Regarding our second question, whether telehealth services affect the use of other services, the evidence base is much less robust. The majority of included systematic reviews did not consistently examine impacts on use of other services. The few reviews that did report on this question sometimes had mixed findings.

A systematic review by Lee and coauthors on oral anticoagulation management reported that two studies found no significant difference in the number of patients hospitalized at least once, while one study indicated lower hospitalization rates in the telehealth intervention group.[27] In the review by Marx and coauthors on telehealth for malnutrition in older adults, two included studies reported a significant decrease in hospital readmissions for telehealth interventions, though the decreased odds were not significant when pooled.[28] Downes and coauthors reported that although telephone consultations resulted in more repeat visits, they required less total time from providers, compared to in-person visits.[26] Lastly, Kairy and coauthors reported that telerehabilitation tended to require more provider time for consultations.[18] However, they were unable to reach any conclusions about telehealth's

impacts on utilization because few studies examined this question, and those that did reported conflicting findings.

We therefore observe that it is unclear whether the use of telehealth services reduces the use of other services, duplicates services, or improves access to beneficial services.

However, some noteworthy findings from individual studies not included in this systematic review merit attention. Some research indicates that telehealth use may not change the volume of in-person office visits. Robert Pearl reported that at Kaiser Permanente Northern California, virtual visits via telephone and secure email more than doubled from 2008 to 2013 (from under five million to over ten million) but did not affect the number of in-person office visits.[30] J. Scott Ashwood and coauthors indicated that in direct-to-consumer telehealth, 12 percent of visits replaced in-person care, while 88 percent represented new utilization—possibly meeting otherwise unmet demand.[4]

Increased access leading to increased use of needed services that patients would not otherwise receive is desirable. However, it is difficult to differentiate between needed and duplicative services. Given that an argument for telehealth is its potential to improve efficiency, further research is needed in this area to inform decision making.

The included systematic reviews and meta-analyses indicate that many factors should be carefully considered when weighing the evidence of telehealth efficacy, including modality, evidence quality, population demographic characteristics, and point-in-time measurement of outcomes.

Implications

This rapid review suggests that current evidence supports the effectiveness of telehealth interventions for certain conditions, but there is insufficient evidence about the impact of telehealth on utilization. Despite this lack of evidence, some research suggests that telehealth interventions that could substitute for office visits are instead likely to increase the use of services more broadly (both in-person and telehealth services).[3,4,30] Systematic reviews of such studies are needed to discern what factors affect the extent to which telehealth interventions substitute for or complement in-person visits and whether those effects change as telehealth is more widely adopted.

Another implication of our findings is that telehealth has the potential to improve access to care for specific patient populations of particular concern, including people living in rural areas, those with transportation barriers, and those facing provider shortages.[31]

As states and Medicare consider broader reimbursement for telehealth services, our findings indicate that decision makers need to understand whether telehealth is providing needed services that were not previously being delivered, replacing similarly effective in-person services, or supplementing effective in-person services. This rapid review was not able to explore those issues because of the lack of evidence, but the review does indicate that telehealth is broadly effective for mental health, rehabilitation, and other studied conditions. ■

The authors gratefully acknowledge Bruce Abbott of the University of California Davis, who helped complete the literature search for this article, and Meghan Weyrich and Shauna Durbin of UC Davis for their guidance.

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