

Supplement to
Telehealth Outcomes and Impact on Care Delivery:
A Review of Evidence

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About the Authors

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Founded in 1972, [IHPS](#) is an interdisciplinary group of researchers whose mission is to improve health and transform health care in America by working across competing interests, collecting evidence, informing policy, and improving practice.

[CHBRP](#) was established in 2002. Per its authorizing statute, CHBRP provides the California Legislature with independent analysis of the medical, financial, and public health impacts of proposed legislation related to health insurance benefits.

INTRODUCTION

This document serves as a technical supplement to *Telehealth Outcomes and Impact on Care Delivery: A Review of Existing Evidence*. The authors conducted a rapid literature review of peer-reviewed studies published between January 2021 and October 2022. The supplement consists of three appendices:

- A. Telehealth Outcomes by Modality and Disease/Condition/Care Category
- B. Multimodality and Cross-Modality Studies
- C. Stakeholders Roundtable

Appendices A and B describe the 80 studies that were used to determine the strength of the evidence for whether telehealth resulted in equal or better outcomes as compared with in-person care.

Definitions of Telehealth Modalities

Live video: Two-way, real-time interactive video to facilitate interactions between a patient and a provider.

Telephone: Two-way, interactive audio via a landline or cell phone to facilitate interactions between a patient and a provider.

Email, text, and chat: Providers communicate with patients via services that involve email, text, and chat applications, whether asynchronously or in real time.

E-visit: Typically a series of two-way messages between the patient and provider, or a short questionnaire on a health portal, used to diagnose a condition without a phone or video appointment.

Store and forward: Patients capture photos, audio or video recordings, and other medical information and transmit these data to a remote provider for review.

Hybrid care: Patients receive a combination of in-person and telehealth services from the same providers or network of providers.

APPENDIX A. TELEHEALTH OUTCOMES BY MODALITY AND DISEASE/CONDITION/CARE CATEGORY

Live Video

Health Outcomes

Previous research comparing the effects of live video and in-person care on health outcomes reported that quality of life, clinical outcomes, and functional status — such as severity of depression symptoms, recovery from brain trauma, and disease management — are similar between people who participate in live video and people who receive in-person care.¹

Behavioral Health

Two systematic reviews and one meta-analysis found that the quality of telepsychiatry care delivered via live video is similar to in-person care for the management of mental health conditions. A systematic review reported that patients with post-traumatic stress disorder (PTSD) in programs using live video reported similar effectiveness, quality, and long term effects with shorter total therapeutic hours than patients receiving in-person therapy.² One meta-analysis (18 Randomized controlled trials [RCTs] with 2,648 subjects) found that telepsychiatry delivered through live video has a moderate to strong effect on mental health outcomes and has similar effects to in-person care for the management of symptoms of PTSD, specifically trauma and depression, among veterans.³ In an analysis of systematic reviews that encompass multiple mental health conditions, Barnett et al. (2021) reported that across all patient populations reviewed, video interventions were associated with significant reductions in symptom severity for anxiety, PTSD, depression, and substance use disorders, with outcomes similar to those of in-person interventions (in studies with a comparison group).⁴

In an RCT, Bean et al. (2022; 69 subjects) reported similar improvements in Depression Anxiety Stress Scales (DASS) between in-person and video behavioral therapy for patients with comorbid mental health and substance use disorder diagnoses.⁵ In an RCT comparing videoconference to in-person behavior therapy for children with Tourette syndrome, Prato et al. (2022; 40 subjects) reported similar scores for tests that measure tics, obsessive compulsive disorder (OCD), severity of attention deficit hyperactivity disorder (ADHD) symptoms, anxiety scores, and depressive symptom scores.⁶ Another RCT of adults with insomnia that compared in-person cognitive behavioral therapy (CBT) and wait-list controls to CBT via videoconference reported similar scores on the Insomnia Severity Index (ISI), depression, anxiety, work, social adjustment scales, and quality of life for video telehealth compared to in-person treatment (40 subjects).⁷ In an RCT, Arnedt et al. (2021; 65 subjects) reported significant and similar improvements in insomnia severity, measured with the ISI, and daytime functioning measures for subjects who received CBT via live video versus in-person treatment immediately post treatment and at three months' follow-up.⁸ Daytime functioning measures included reductions in fatigue, depression and anxiety symptoms, and sleep-related cognitions, as well as improvement in quality of life.

Chronic Conditions

In a rapid review of RCTs, Albritton et al. (2022; 38 studies) reported that four RCTs (818 participants) suggested similar effects for video versus in-person care for the management of diabetes-related outcomes, including the incidence of hypoglycemia at six and eight months (two studies), adverse events (three studies), and participants' health-related quality-of-life scores (one study).⁹ Over time, hemoglobin A1c (HbA1c) levels (average blood glucose levels, used to assess diabetes control) were not worse among persons receiving diabetes care via live video compared to persons receiving in-person diabetes care, relative to either control or baseline values (six studies). In a literature review on diabetes management, Hall, Harvey, and Patel (2022; 12 studies with 2,439 participants) reported that for patients with type 1 or type 2 diabetes, overall, high-density lipoprotein (HDL) cholesterol levels (5 of 12 studies) and blood pressure (6 of 12 studies) were stable over time for both video and in-person care.¹⁰ HbA1c

levels remained stable or improved over time in video groups compared to in-person diabetes care and baseline values (6 of 12 studies); all but two quantitative studies reported significant reductions in HbA1c levels.

In a systemic review of chronic headache patients, Clausen et al. (2022; 9 of 13 studies) reported no statistically significant differences in treatment capability and headache status between patients who had follow-up video consultations compared to patients who had in-person consultations, measured by number of headache days per month, medication use, the Migraine Disability Assessment (MIDAS) test, the Headache Impact Test, the Visual Analogue Scale (VAS), subjective changes in headache status, and remission rate of chronic headache.¹¹ One study in this review reported safety to be similar between video groups and in-person groups. Safety was assessed by the presence of secondary headaches within 12 months after a one-time consultation, number of abnormal findings on brain imaging, number of hospitalizations, and other factors used as outcome measures. An RCT examining patients with chronic headaches (Bekkelund and Müller, 2021) reported no statistically significant differences in one-year remission rates of chronic headache between patients receiving video consultations and patients receiving in-person consultations by a neurologist (43.0% [37 of 86] vs. 39.5% [30 of 76], respectively).¹² In Albritton et al.'s (2022; 38 studies) rapid review of RCTs, one RCT (409 participants) reported similar effects for reduced headache pain, as measured on the Headache Impact Test at 12 months.¹³

In a retrospective cohort study of patients living with human immunodeficiency virus (HIV) in rural Georgia who received specialty care through either video appointments or in-person care, Lawal et al. (2021; 385 patients) reported that while mean CD4 count, a measure of treatment success, was statistically higher in the video group, the mean changes in CD4 count were similar in both groups.¹⁴ There was no statistically significant difference in viral load reduction between patients receiving video appointments and those receiving in-person appointments.

Multiple Conditions

In a systematic review, Shah and Badawy (2021) reported that five studies (1,129 subjects) of persons with multiple health conditions concluded that live video consultations resulted in outcomes that were similar to or better than the outcomes of an in-person visit.¹⁵

Ophthalmology

In a retrospective chart review, Li et al. (2021; 855 subjects) reported that among patients seen in person or through video for emergency ophthalmology exams, there were higher rates of potential harm in the patients seen in the video triage group.¹⁶ However, there was no difference in rates of actual harm between visit methods. Both in-person and video consultation graders (clinicians who reviewed outcomes of the visits) found a 0% rate of actual harm, and the authors concluded that patient safety for those seen by video was comparable to that of in-person visits.

Orthopedics

In a meta-analysis of 11 RCTs (1,059 subjects), McDonnell et al. (2022) reported no significant differences in measures of functionality during the postoperative recovery period using standard scoring tests for postoperative orthopedic patients managed through video or in-person appointments.¹⁷ However, scores on pain scales (five studies) were significantly lower in the in-person group. In a rapid review of RCTs, Albritton et al. (2022; 38 studies) reported that seven RCTs (756 participants) found similar effects on symptom severity for the use of video as a replacement for in-person care for the treatment of chronic pain, knee pain, non-acute headaches, and abdominal pain.¹⁸

Reproductive Health

A 2019 retrospective cohort study (5,952 patients: 738 telemedicine visits and 5,214 standard visits) comparing medication abortion with a live video to an in-person visit for medication abortion reported that

health outcomes for medication abortion provided via live video were similar to those of in-person visits.¹⁹ The study reported that ongoing pregnancy was less common among telemedicine patients (0.5%) than in-person patients (1.8%) (adjusted odds ratio [OR] = 0.23) and that follow-up aspiration procedures were less common among telemedicine patients (1.4%) than in-person patients (4.5%) (OR = 0.28). In both groups, fewer than 1% of patients reported clinically significant adverse events.

Surgical Care

In a randomized controlled trial (RCT) examining video virtual visits versus office visits for postoperative 30-day follow-up visits after pelvic organ prolapse surgery, Lee et al. (2021; 52 subjects) reported statistically similar complication rates (31% for virtual versus 46% for in-person [$p = .3$]).²⁰ In a retrospective review of preoperative care for robotic prostate, kidney, and cystectomy procedures, Bhanvadia et al. (2022; 314 subjects) reported no statistically significant differences in any grade of complications, perioperative outcomes, and blood loss between urology patients who had live video visits and those who had in-person visits prior to minimally invasive surgery.²¹

Weight Management

In a review of studies examining the use of live video to treat pediatric obesity, DeSilva and Vaidya (2021; 12 studies with 1,541 subjects) reported that studies included in the review reported similar outcomes for video versus in-person care for pediatric weight management.²² Studies indicated that body mass index (BMI) outcomes, such as the reduction in BMI, among children and adolescents who received care via live video were similar to those of children and adolescents who received in-person care.

Processes of Care

Previous research has reported no difference in processes of care between patients who received care via live video and patients who received in-person neurology consults for adult neurocognitive tests, psychiatric care for PTSD, psychotherapy for symptoms of dissociation and emotional dysregulation, and diagnosis and management of skin conditions. These studies include three systematic reviews and one RCT.²³

Antibiotic Prescribing

A retrospective cohort study (260 subjects) found no statistically significant difference in the rates at which patients seen via live video and patients seen in an ED were prescribed antibiotics for acute respiratory infections (29% of telemedicine visits and 28% of in-person visits [(OR = 1.038; $p = .846$]).²⁴

A large retrospective cohort study using claims data (528,213 total pediatric visits) that compared the quality of antibiotic prescribing for acute respiratory infections among children in three different health care settings — live video telehealth consultations using a direct-to-consumer platform, urgent care, and primary care provider offices — reached the opposite conclusion.²⁵ The study reported that clinicians who cared for children via live video were less likely to prescribe antibiotics in a manner that was consistent with clinical practice guidelines (59% of telemedicine visits vs. 67% of urgent care visits and 78% of primary care provider visits). For visits with a diagnosis of streptococcal pharyngitis (strep throat), live video providers were less likely to order a streptococcal test to confirm the diagnosis (4% of telemedicine visits vs. 75% of urgent care visits and 68% of primary care provider visits), which could have led live video providers to prescribe antibiotics unnecessarily because some children whom they suspected had strep throat may not have had it and, thus, did not need antibiotics. It is important to note that in this study the live video consultations were provided by physicians who were not the children's usual primary care providers.

Chronic Conditions

In a rapid review of RCTs, Albritton et al. (2022) reported that four RCTs (818 participants) suggested similar effects for video versus in-person care for the management of diabetes-related outcomes.²⁶ Three studies resulted in similar changes to HbA1c levels in the telehealth groups as compared with the in-person groups, and one RCT found similar effects for level of agreement in prescribing decisions for diabetes medication.

Examinations for Respiratory Illnesses

In a pilot prospective cohort study (28 subjects) of children presenting to the ED with lower respiratory tract symptoms, researchers compared two examinations performed simultaneously — one in person by the ED clinician with the patient, and one by a remote ED clinician using live video.²⁷ Except for heart rate, all examination findings (general appearance, capillary refill time, grunting, nasal flaring, shortness of breath, retractions, impression of respiratory distress, respiratory rate, and temperature) were similar for the in-person and live video groups.

Neuropsychology and Cognitive Assessments

A systematic review (64 studies) that examined the diagnostic accuracy of specific physical exam components for stroke patients over video compared to in person found overall moderate to high reliability of scores between the two (10 studies).²⁸ This review also reported that diagnostic accuracy of video assessment performed similarly to in-person exam for other exam components for, but studies showed that inter-rater reliability was inconsistent across studies for cognitive assessments (19 studies); movement disorders (eight studies); other neurological disorders (41 studies); head, eye, ear, nose, and throat (HEENT) exams (five studies); and cardiopulmonary exams (five studies).

One retrospective chart review study of patients referred for evaluation in an outpatient neuropsychology clinic compared the validity of in-home teleneuropsychology assessments using live video to in-person assessments.²⁹ Parks et al. (2021; 231 subjects) compared test scores for teleneuropsychology tests measuring attention/processing speed, verbal memory, naming, verbal fluency, and visuconstruction to in-person test scores. Teleneuropsychology test scores did not significantly differ from in-person testing across all tests except the Hopkins Verbal Learning Test – Revised Discrimination Index.

Orthopedics

Bradley et al. (2021) found no statistically significant difference (62 patients; $p = .98$) in the overall diagnostic reliability of a live video clinical examination compared to a traditional in-person shoulder clinical examination (with an MRI as reference) for patients with shoulder rotator cuff tears.³⁰ A study of 47 patients with shoulder disorders at a shoulder surgery clinic were assessed sequentially by live video examination and through an in-person examination.³¹ Researchers found that there was substantial to almost perfect agreement between the video examination and in-person examination for the diagnosis of patients with various shoulder disorders. Agreement between the live video examination and in-person examination for the treatment plan and the need for additional diagnostic studies was moderate. Another systematic review (47 studies) that examined the delivery of orthopedic care reported results from live video physical examination in seven studies, and they all indicated that the majority of providers were able to accurately examine patients over live video.³²

In a crossover study of 20 lung cancer survivors, Heredia-Ciuró et al. (2022) reported no difference in the reliability of video versus in-person assessment for upper limb function and musculoskeletal disturbances (active range of movement and trigger points).³³

Other Specialty Care

Del Campo et al. (2021; 61 subjects) compared in-person dysmorphology examinations for children with fetal alcohol syndrome (FAS) to two different types of remotely guided live video technology: a smartphone using Zoom and a tablet Transportable Examination Station (TES) system using a precision camera and a laptop.³⁴ The study reported “almost perfect” percentages of agreement and Cohen’s K coefficient between interviews when comparing both technologies with in-person interviews for most examinations, and a few “substantial” agreements for measurements of the head circumference (HC) and the evaluation of the three key facial features, including palpebral fissure length (PF), smooth philtrum, and thin and smooth vermilion of the upper lip, common traits of children born with FAS.

Primary Care

In a study examining whether there are differences in Healthcare Effectiveness Data and Information Set (HEDIS) quality performance measures for primary care patients receiving video telemedicine versus in-person visits, Baughman et al. (2022; 526,874 subjects: 409,732 in-person-only visits and 117,142 telemedicine-exposed patients) divided a cohort of patients by those with office-only (in-person) visits and those with exposure to telemedicine (either only video visits or a blend of video and office visits).³⁵ This study reported that patients who were exposed to video telemedicine had better performance in 11 of 16 quality measures that assess important components of chronic disease management, including testing-based measures, counseling-based measures, and medication-based measures. For all testing-based measures, patients with a telemedicine visit had significantly increased testing, when appropriate: lipid panels for patients with cardiovascular disease, HbA1c testing and nephropathy testing for patients with diabetes, and blood pressure control. Patients who were exposed to a telemedicine visit were significantly more likely to have cervical cancer screening, breast cancer screening, colon cancer screening, tobacco counseling and intervention, influenza vaccination, pneumococcal vaccination, and depression screening. However, patients with only in-person visits had better performance in medication-based measures. Patients with heart failure who only had in-person care were more likely to be prescribed beta-blockers, and those with diabetes were more likely to receive statins, but these differences were not statistically significant. Patients with cardiovascular disease (CVD) who only had in-person visits were more likely to receive antiplatelets and statins, while patients with upper respiratory infections were less likely to receive prescriptions for antibiotics (both results were statistically significant).

Surgical Care

In a retrospective review of preoperative care for robotic prostate, kidney, and cystectomy procedures, Bhanvadia et al. (2022; 314 subjects) reported that operative time and length of stay for patients whose preoperative visits consisted only of video visits were similar to those for patients who had in-person visits.³⁶ There was no difference in change in expected procedure, and no patients’ surgeries were converted from minimally invasive to open surgery in the video-only group. Additionally, time from preoperative visit to surgery was significantly shorter for the video group (by 13 days).

Another systematic review (35 studies with 2,700 subjects) reported that the studies consistently found diagnosis was the same for patients whose otolaryngologist visits were conducted via synchronous live video or in person (five studies).³⁷ One included study (48 subjects) found diagnostic concordance in 79.2% of the consultations between patients who had an otolaryngology visit at a general physician’s office via live video and patients who had an in-person otolaryngology clinic visit.³⁸

Utilization of Other Health Care Services

Two previously identified studies have found that live video increases access to care and decreases follow-up visits.³⁹

Chronic Conditions

In a systemic review of chronic headache patients, Clausen et al. (2022; 2 of 13 studies) reported no significant differences in treatment adherence for chronic headache patients receiving a first-time consultation through telemedicine compared to patients receiving traditional care.⁴⁰ In a rapid review of RCTs, Albritton et al. (2022; 38 studies) found one RCT (409 participants) that reported similar effects for reduced headache pain, as measured on the Headache Impact Test at 12 months, and found that people with video visits spent less time in consultation (4.9 minutes less) and had less frequent unplanned general practitioner visits because of headaches over three months compared with people who received in-person care.⁴¹ In a study of patients receiving video or in-person consultations by a neurologist for chronic headaches, Bekkelund and Müller (2021) reported no statistically significant differences between video or in-person groups in the percentage who consulted general practitioners during the follow-up period (30% [11 of 37] vs. 53% [16 of 30]), and reported that the median numbers of consultations were 1.0 (interquartile range [IQR], 0–13) and 1.5 (IQR, 0–15), respectively ($p = .19$).⁴²

Gastroenterology

In a retrospective analysis of patients who underwent their initial pediatric gastroenterology clinic visit for abdominal pain, Jazayeri et al. (2022; 1,769 subjects) reported that, overall, live video visits were associated with fewer resources and with equivalent outcome measurements in children with a chief complaint of abdominal pain.⁴³ Patients in the in-person visit group had higher rates of imaging, labs, medications, and referrals performed per visit compared to patients in the video visit group. There was no difference in number of procedures, ED visits, follow-up visits, or telephone encounters between the two groups.

Infectious Diseases

A recent large systematic review (18 studies) of the clinical effectiveness of live video for infectious disease consultations reported that people who received consultations via live video had shorter lengths of hospital stay, similar rates of readmission, and similar rates of adherence to treatment as people who received in-person care.⁴⁴

Ophthalmology

In a retrospective chart review study, Li et al. (2021; 855 subjects) reported that among patients triaged to in-person emergency ophthalmology exams compared to video ophthalmology exams, those initially attending video consultation and subsequently discharged without in-person examination were more likely to present to emergency services within one month compared to those who initially attended in-person exams.⁴⁵ However, significantly fewer patients seen by video consultations required specialist review compared to face-face visits, and there was perfect inter-rater reliability (100% rater agreement).

Orthopedics

In a meta-analysis of 11 RCTs (1,059 subjects), McDonnell et al. (2022) reported significantly lower rates of hospital readmissions (two studies) for postoperative orthopedic patients managed through video compared to patients managed in-person appointments during the postoperative recovery period (7.6% [13 of 171] vs. 17.2% [30 of 174], respectively).⁴⁶

Reproductive Health

A 2019 retrospective cohort study (5,952 patients: 738 telemedicine visits and 5,214 standard visits) comparing medication abortion with a live video to a standard in-person visit for medication abortion reported that medication abortion provided via live video significantly improves access to earlier abortion and abortion care services.⁴⁷ The study reported that aspiration procedures were less common among

telemedicine patients (1.4% [6 of 445]) than standard in-person patients (4.5% [182 of 4,011]; adjusted OR = 0.28).

Surgical Care

In a retrospective chart review, Burton et al. (2022; 62 patients) reported that a preoperative video visit was significantly associated with hospital length of stay (0.52 times lower) compared to an in-person visit.⁴⁸

In an RCT examining video virtual visits versus office visits for postoperative 30-day follow-up visit after pelvic organ prolapse surgery, Lee et al. (2021; 52 subjects) reported no significant differences in measures of unscheduled telephone calls, office visits, ED visits, and hospital readmissions within 90 days of surgery.⁴⁹

Telephone

Health Outcomes

Previous research reported that telephone consultations result in equal or better health outcomes than in-person consultations based on several studies.⁵⁰

Behavioral Health

A systematic review comparing telephone-delivered psychotherapy to in-person psychotherapy (6 of 13 studies with 1,850 subjects) reported similar reductions in depressive symptoms and symptom severity.⁵¹ However, researchers note results are limited by small samples sizes, selection bias of the less severely depressed patients using telephone visits, and the heterogeneity of rating scales. In an analysis of systematic reviews, Barnett et al. (2021) reported that across all patient populations reviewed, telephone interventions have been associated with significant reductions in symptom severity for anxiety, PTSD, depression, and substance use disorders, with outcomes comparable to those of in-person interventions.⁵²

Reproductive Health

One cohort study (12,607 subjects) of pregnant women compared perinatal outcomes of women who received prenatal care via in-person prenatal visits only with those who received audio-only virtual visits during the COVID-19 pandemic.⁵³ There was no significant difference in composite outcomes for placental abruption, stillbirth, cord pH <7.0, or full-term neonatal intensive care unit admission (2.9% vs. 3.0%).

Processes of Care

Research previously found that findings from studies of the effect of telephone consultations on processes of care are inconsistent. One systematic review reported mixed findings for antibiotic prescribing rates, one study reported acceptable concordance for detecting cancer recurrence using a telephone questionnaire, and one study found good reliability of telephone-based visual acuity tests.⁵⁴

Otolaryngology

In a retrospective review study of otolaryngology patients seen for head and neck surgery consultations in Australia, Kwok et al. (2021; 259 subjects) reported that overall diagnostic concordance of each subject's initial telephone primary care physician assessment and subsequent in-person appointment findings and management was low.⁵⁵ However, the overall diagnostic concordance of telephone consultations and concordance of recommended treatment plans between telephone and in-person consultations was good.

Residing less than 50 km from the hospital, not having concurrent medical conditions, and referrals for consideration of tonsillectomy with or without adenoidectomy were associated with significantly better telephone appointment diagnostic concordance rates. Pediatric patients were significantly more likely to have telephone appointment diagnostic rates that were similar to subsequent recommended in-person treatment plans. More accurate telephone examination findings were observed in referrals for head and neck cancer, and less accurate ones for laryngology and rhinology conditions.

In a retrospective cohort study of telephone versus in-person visits for the management of new otology referrals, Metcalfe et al. (2023; 150 subjects) reported that compared to telephone consultations, patients with an in-person consultation were more likely to receive a definitive outcome following initial review.⁵⁶ Additionally, 69% of telephone patients were followed up with an in-person examination, and significantly more appointments were required to reach a conclusive outcome for the telephone cohort than the in-person one.

Utilization of Other Health Care Services

Previous findings from RCTs and time-series studies of the effect of telephone consultations in primary care on utilization of other health care services are inconsistent; therefore, the evidence regarding the impact of medical care provided by telephone compared to medical care provided in person is inconclusive. Studies have found different effects for use of the same type of service (e.g., ED, hospitalization, or primary care).⁵⁷

Wound Care

One study (25 subjects) evaluated the impact of telephone follow-up and virtual wound checks on readmissions after head and neck surgery.⁵⁸ The study found no statistically significant differences in ED visits and readmission rates between patients who received telephone follow-up calls post-discharge to review symptoms and wound photos (30% of patients sent photos) and patients who received in-person follow-up care.

Email, Text, and Chat

Health Outcomes

Previous research reported on the effect of email communication as part of a multifaceted web portal on health outcomes among people with diabetes.⁵⁹ These studies consistently found that use of secure email was associated with better glycemic control as measured by HbA1c. There was less consistency in the findings regarding other conditions, such as hypertension or hyperlipidemia.

Eating Disorder Management

One newer systematic review was identified that examined the impact of text-based telehealth interventions — including email, web-based texting, text messaging and an online chat room — on eating disorder management for patients who went to the ED.⁶⁰ For eating disorder-related symptoms — including weight, body satisfaction, bulimia symptoms, and severity — all nine studies (860 participants) showed effectiveness (for RCTs) and usefulness (for quasi-experimental studies and qualitative studies) in treatment for eating disorders. For follow-up treatments of eating disorder-related symptoms after a patient presents at the ED, researchers reported that outcomes from six studies (364 participants) using text-based telehealth interventions to provide aftercare for participants to prevent relapse were mixed. Three studies indicated a reduction in eating disorder-related symptoms after intervention, one study with a similar intervention did not find statistically significant changes, and two studies indicated that use of an online chat group and email to provide aftercare support for eating disorder patients was not effective, in studies that compared telehealth to in-person care.

Processes of Care

Previously reported findings from studies of patients with diabetes found that those who had email access to their physicians via a multifaceted web portal had better screening adherence relative to those without such access, but these studies could not distinguish email use from other features of the web portal, such as reminder notices or electronic appointment scheduling.⁶¹ Moreover, two out of three of these studies had poorly controlled comparison groups, which limits the reliability of the findings.

The authors found no studies published since 2016 that examined the effect of email and synchronous text or chat on processes of care.

Utilization of Other Health Care Services

The authors previously concluded that there is *inconclusive evidence* for whether health care services delivered by email, synchronous text, or chat conferencing result in similar utilization of other health care services compared to services provided in person. Previously-identified studies of email access to physicians in the United States were conducted within an integrated health system that provided email access to physicians as part of a multifaceted web portal (such as Kaiser Permanente). The findings from these large and well-designed studies were inconsistent, with one showing a decrease in primary care visits, one showing no difference, and two showing an increase in visits associated with patients' use of email to access primary care providers.⁶²

The authors found no studies published since 2016 that examined the effect of email and synchronous text or chat conferencing on utilization of other health care services.

E-Visits

Health Outcomes

The authors previously found one study that examined the effect of e-visits on health outcomes for the general population. In a retrospective cohort study (350 patients) that evaluated adults diagnosed with sinusitis, patients treated through virtual text-based visits were more likely to have an unplanned revisit related to sinusitis within 24 hours (8.0% vs. 1.7%; $p = .006$) and within 30 days (14.9% vs. 7.4%; $p = .027$) compared with patients who had in-person office visits.⁶³

Two recent systematic reviews that discussed the effect of e-visits on health outcomes were identified (Bodle, Hunger, and Seyed Jafari, 2022; and Nguyen et al., 2021).⁶⁴ They reported a reduction in average total lesion count in the e-visit group compared with the in-person group and that patients in the e-visit group showed fewer side effects from medications at the end of the study compared with the in-person group.⁶⁵

Multiple Conditions

Nguyen et al. (2021) conducted a systematic review of the impact of e-visits on clinical outcomes in health care delivery.⁶⁶ The seven studies that included relevant measures reported that e-visits were associated with similar or better outcomes than in-person visits across the medical conditions examined.

Processes of Care

One previously identified study examined the effect of e-visits on processes of care. Johnson et al. (2019; 350 patients) evaluated adults diagnosed with sinusitis treated through virtual text-based visits compared to in-person office visits.⁶⁷ This study reported significantly more antibiotics prescribed in the in-person office visit group compared with the virtual visit group (94.3% vs. 68.6%; $p < .001$). However, when antibiotics were prescribed, the rate of guideline-concordant prescribing was not different between in-

person office visits and virtual visits (64.8% vs. 67.5%; $p = .641$), meaning that the antibiotics were appropriately prescribed according to patient condition.

Antibiotic Prescribing

Two additional studies examined process of care outcomes for e-visits for antibiotic prescribing. Johnson et al. (2021) evaluated adults diagnosed with uncomplicated urinary tract infections treated through e-visits compared with in-person visits.⁶⁸ This study reported that there was no difference in the rate of antibiotic prescribing between groups. However, e-visit patients were significantly more likely to receive a guideline-concordant first-line antibiotic agent prescription and guideline-concordant duration of antibiotic prescribing. The e-visit group was less likely to receive urinalysis, get an order of urine culture, or have a revisit within seven days. Penza et al. (2021) conducted a retrospective cohort study of adult primary care patients who had a clinical encounter for acute sinusitis.⁶⁹ The authors found patients seen via e-visit were just as likely as the in-person group and less likely than the phone group to receive an antibiotic prescription, and that there was no difference between groups for follow-up visits. Similar guideline-concordant recommendations were provided to patients in the e-visit and in-person groups, whereas the protocol for phone visits did not include some guideline-recommended instructions.

Multiple Conditions

Nguyen et al.'s (2021) systematic review found mixed effects of e-visits on quality of care.⁷⁰ For example, while one study reported similar prescribing rates for statins among patients with diabetes, another study found that e-visit usage was associated with significantly lower rates of diagnostic procedures and fewer preventive visits for sinusitis and urinary tract infections compared to controls.

Utilization of Other Health Care Services

The authors previously found one recent study that analyzed an e-visit system.⁷¹ Follow-up visit rates were higher in the e-visit group when an e-visit was the first time a patient saw that particular provider (12% vs. 9%), and the difference was statistically significant ($p < .04$).

Multiple Conditions

Across the 14 studies included in Nguyen et al.'s (2021) systematic review, the impact on use of other health care services was mixed.⁷² Four studies reported that health care utilization was lower for e-visit groups compared with in-person groups for primary care, specialty care, and emergency care. Three studies reported no differences in health care utilization such as follow-up visits, while two studies reported higher health care utilization for follow-up visits after an e-visit compared with in-person visits.

Store and Forward

Health Outcomes

Previously identified evidence was insufficient to make a conclusion about the effectiveness of store and forward on health outcomes, and was limited to dermatology and ophthalmology.⁷³

The authors identified three newer studies that reported health outcomes associated with the use of store and forward.

Dermatology

In a systematic review of literature comparing teledermatological examinations using store-and-forward images with in-person office visits in the management of acne, Bodle, Hunger, and Seyed Jafari (2022) found no significant differences in the course of the disease for mild acne.⁷⁴

Ophthalmology

Snoswell et al. (2021) conducted a systematic review of meta-analyses of the clinical effectiveness of store and forward.⁷⁵ They identified one meta-analysis of 11 studies examining tele-ophthalmology using store and forward. The authors concluded that store-and-forward teleglaucoma diagnosis was less specific (79.0%) but more sensitive (83.3%) than usual in-person care, and therefore the available evidence was sufficient to justify the use of store and forward for glaucoma diagnosis when patients were not easily able to be seen in person.

Wound Care

Kostovich et al.'s (2022) systematic review of outcomes of wound care using store-and-forward images found inconsistent results.⁷⁶ Of the seven studies that assessed overall healing of wounds, results were mixed. One study reported a significantly higher proportion of healed ulcers among patients who received store-and-forward telewound care. Two studies also found a higher proportion of healing among the store-and-forward telewound care group, and two studies found higher proportion of healing among the in-person care group, but these studies did not indicate whether the differences were statistically significant. Two additional studies did not find a difference in the percentage of wounds healed between groups. Results were also mixed for the seven studies that examined the time it took wounds to heal; healing time was significantly shorter among those who received store-and-forward telewound care in three studies, and did not differ significantly from the in-person care group in three others. One study reported significantly more days to heal pressure injuries and other chronic wounds among patients who received store-and-forward telewound care than among those who received in-person care. Amputation rates were examined in two studies; neither study reported a statistically significant difference in amputation rates among individuals who received store-and-forward telewound versus in-person care, though both reported fewer amputations in the store-and-forward telewound care group. Seven studies compared mortality between groups; three studies reported greater mortality among the store-and-forward telewound care groups, and three studies reported no difference in mortality between groups. One study reported a higher number of deaths among patients who received store-and-forward telewound care, but no statistical analyses were conducted.

Processes of Care

The authors previously found systematic reviews of the diagnostic accuracy of store-and-forward technology that reported inconsistent findings for dermatology and other conditions.⁷⁷ Studies of the use of store and forward for other conditions, including ophthalmology, have found that diagnoses are at least as accurate as those made via in-person consultations.⁷⁸ One systematic review found patients receiving care from any trained provider through tele-ophthalmology had significantly increased odds of having a screening eye examination for diabetic retinopathy.⁷⁹ Overall, the findings for processes of care are *inconclusive* for store and forward.

The authors did not identify any new studies examining process of care outcomes for store and forward.

Utilization of Other Health Care Services

The authors did not identify studies examining the impact of store-and-forward telehealth on utilization of other health care services.

Hybrid Care

In hybrid care, patients receive a combination of in-person and telehealth services from the same providers or network of providers.

Health Outcomes

Behavioral Health

In a retrospective cohort study (55,924 subjects) comparing in-person, telemedicine hybrid care, and telemedicine-based opioid agonist treatment, researchers reported no difference in all-cause mortality (OR = 0.9; 95% confidence interval [CI]: 0.8–1.0) for patients receiving opioid agonist treatment by in-person, hybrid, or telemedicine-based care.⁸⁰

Chronic Conditions

One observational study of individuals in the Alaska tribal health system with a diagnosis of rheumatoid arthritis compared patients seen by a rheumatologist with video telemedicine incorporated into their follow-up care to patients who received in-person-only follow-up care (122 subjects).⁸¹ The researchers reported no difference in RAPID3 (Routine Assessment of Patient Index Data 3),* remission or low disease activity (by RAPID3), or functional status scores between patients in the in-person-only and video telemedicine hybrid groups during the one-year study period.

Reproductive Health

In a cohort analysis (52,142 subjects) of data from abortion providers in the United Kingdom, researchers reported that a telemedicine hybrid model for medical abortion (including no laboratory test or ultrasound in the telemedicine group)[†] was as effective and safe as in-person care for medication abortion.⁸² Researchers reported that effectiveness, defined as the proportion of medical abortions that were successful,[‡] was higher with telemedicine than in-person medication abortion (99.2% vs. 98.1%). Additionally, there was no difference in serious adverse events and incidence of ectopic pregnancy between groups.

A retrospective cohort study (115 subjects) of neonates with birth weights in the 10th percentile or lower at term compared usual, in-person prenatal care to hybrid care (both in-person and telemedicine prenatal care).⁸³ Researchers reported no difference in fetal growth retardation (FGR) diagnoses and found that median gestational age at diagnosis did not significantly vary between in-person and hybrid groups (36 vs. 37 weeks).

In an interrupted time-series analysis, Palmer et al. (2021) examined the impacts of telehealth in the delivery of antenatal care during the COVID-19 pandemic by comparing a cohort of women receiving care primarily in person before the COVID-19 pandemic with women receiving care both in person and via telehealth during the pandemic (either video or telephone; 22,323 total subjects).⁸⁴ There were no significant differences between women who delivered during the conventional care period and women who delivered during the hybrid care period in fetal growth rate, preeclampsia, gestational diabetes, overall incidence of stillbirth, or preterm births. There was a significantly higher percentage of newborns with neonatal intensive care unit (NICU) admissions in the hybrid care period compared with the conventional care period (18% vs. 15%) among women with high-risk pregnancies, although there was no difference in NICU admissions between care groups among women with low-risk pregnancies.

* RAPID3 (Routine Assessment of Patient Index Data 3) is a pooled index of the three patient-reported American College of Rheumatology rheumatoid arthritis (RA) Core Data Set measures: function, pain, and patient global estimate of status. Each of the three individual measures is scored 0 to 10, for a total possible score of 30.

[†] Some participants were not qualified for a no-test, no-ultrasound in-home abortion, so they had an in-person assessment with ultrasound per the “traditional” model. After the in-person assessment, medications for this group were then provided by the clinic for home use.

[‡] Success was defined according to the Medical Abortion Reporting of Efficacy (MARE) guidelines as successful expulsion of an intrauterine pregnancy without the need for surgical intervention.

Processes of Care

Chronic Conditions

In an observational study of individuals in the Alaska tribal health system with a diagnosis of rheumatoid arthritis seen by a rheumatologist with video telemedicine incorporated into their follow-up care compared to in-person-only follow-up care, Ferucci et al. (2022; 122 subjects) reported no statistically significant difference in change in medications when disease activity was moderate or high, no statistically significant difference in having a functional status assessment, and no statistically significant difference in having disease-modifying antirheumatic drugs (DMARDs) prescribed over the one-year study period in either group.⁸⁵

Primary Care

In a study examining whether there are differences in HEDIS quality performance measures for abnormal BMI screening and management in primary care between video telemedicine and in-person visits, Baughman et al. (2023; 287,387 subjects) divided a cohort of patients into three exposure groups: office only (no telemedicine), telemedicine only (no office visits), and blended telemedicine (office and telemedicine).⁸⁶ In both HEDIS-specified and HEDIS-modified performance indicators, blended telemedicine performed significantly better (i.e., was more likely to conform to HEDIS quality standards) than office only, and office only performed significantly better than telemedicine only.

Utilization of Other Health Care Services

Behavioral Health

A retrospective cohort study (55,924 subjects) comparing in-person, telemedicine hybrid care, and telemedicine-based opioid agonist treatment reported mixed effects on the utilization of other health care services.⁸⁷ The researchers reported no difference in one-year treatment retention and opioid-related ED visits for patients receiving opioid agonist treatment by predominantly in-person, hybrid, or telemedicine-based visits. However, the researchers reported more overall ED visits, a higher rate of mental health-related ED visits, and a higher rate of mental health-related hospitalizations for patients who were seen primarily by telemedicine and hybrid care versus in-person care.

APPENDIX B. MULTIMODALITY AND CROSS-MODALITY STUDIES

Telerehabilitation Studies

Telerehabilitation modalities can include video-based therapy programs, remote patient monitoring, telephone calls, and live video meetings with providers, including physiotherapists, physical therapists, occupational therapists, neurologists, or physicians. Care is distinct from standard rehabilitation or home-based exercise programs.

Health Outcomes

Two meta-analyses of 21 studies reported that compared to in-person rehabilitation, telerehabilitation is effective in improving health outcomes such as activities of daily living, motor function, and physical activity.⁸⁸ In a systematic review of 12 studies, researchers examined telerehabilitation compared to in-person, traditional rehabilitation in patients following total hip replacement and found that telerehabilitation patients reported similar improvement in activities of daily living, including movement, mobility, hip function, and quality of life, compared to patients receiving traditional rehabilitation.⁸⁹

A scoping review (44 studies) reported the effect of telemonitoring (defined as technology that can be used to recognize and treat changes in the patient's health status; 25 studies), telerehabilitation (8 studies), or both (11 studies) on physical activity, exercise capacity, health-related quality of life, and health care use in patients with chronic lung diseases or COVID-19.⁹⁰ Researchers reported that compared to usual care, no statistically significant differences were found in the intervention groups' exercise capacity scores (five of six studies), physical activity (three of three studies), and health-related quality-of-life scores (21 of 25 studies).

In a systemic review, Cox et al. (2021; 15 studies) compared patients with chronic obstructive pulmonary disease (COPD) receiving telerehabilitation to those receiving traditional in-person pulmonary rehabilitation. Researchers reported no statistically significant difference between telerehabilitation and in-person pulmonary rehabilitation for exercise capacity, quality of life, and breathlessness.⁹¹

In a case-control study (Sarpong et al., 2022) that examined outcomes for patients undergoing elective primary unilateral total hip replacement, a study group of 757 patients seen through telehealth during the COVID-19 pandemic was matched 1:1 with a comparison group of patients who had had the same elective primary unilateral total hip replacement during the prior year (2019).⁹² During the COVID-19 pandemic there were substantial changes in postoperative care, including more intensive hospital rehabilitation, shorter hospitalization, and increased post-discharge telemedicine care and telerehabilitation in order to maximize social-distancing measures. Researchers reported similar rates of surgical complications (0.04% vs. 0.03%) and three-month patient reported outcomes (such as pain) between the pandemic and pre-pandemic cohorts.

In an RCT of patients with subacute mild traumatic brain injury, Campbell et al. (2022; 73 subjects) reported no adverse events for patients receiving video telerehabilitation compared to those receiving in-person rehabilitation.⁹³ However, patients in the in-person group experienced a larger decrease in symptom severity scores than those in the video telerehabilitation group (effect size: -0.94 vs. -0.73).

In a rapid review of RCTs, Albritton et al. (38 studies) reported that three RCTs (330 participants) found that video-based cardiac rehabilitation was generally noninferior compared with in-person rehabilitation for patients with chronic heart failure on heart-related quality-of-life scores and nonfatal heart failure events.⁹⁴

In a retrospective matched-cohort study of 51 patients, Horton et al. (2021) reported that patients undergoing initial in-person visits followed by a transition to telehealth physical therapy for three months postoperatively showed similar outcomes to patients undergoing in-person physical therapy with the

same physical therapy team as the telehealth group and patients undergoing in-person therapy with a different therapy team at the same facility.⁹⁵

Processes of Care

The authors did not identify any new studies for process-of-care outcomes for telerehabilitation.

Utilization of Other Health Care Services

Albritton et al. (2022) reported that video-based cardiac rehabilitation was associated with greater reduction in the number of heart failure hospitalizations and all-cause hospitalizations and ED visits over six months as compared to in-person care.⁹⁶ There were similar between-group effects on the total number of patients hospitalized for any reason and similar rates of adverse events for telerehabilitation compared to in-person care. Sanchez-Ramirez et al. (2022; 44 studies) found no statistically significant differences COPD exacerbation-related hospital admissions by people in the intervention and comparison groups (15 of 20 studies).⁹⁷

Sarpong et al. (2022) reported similar rates of 90-day unscheduled outpatient visits (5.0% vs. 7.3%), ED visits (5.0% vs. 4.8%), hospital readmissions (4.0% vs. 2.8%), and surgical complications (0.04% vs. 0.03%) between cohorts.⁹⁸

Findings That Compare Live Video to Telephone Visits

Health Outcomes

Behavioral Health

A meta-analysis (18 RCTs with 2,648 subjects) that evaluated the effectiveness of telepsychiatry delivered through both telephone and live videoconference on mental health outcomes as compared with in-person care for the management of symptoms of PTSD, specifically trauma and depression, in veterans reported that telepsychiatry delivered through videoconference was superior to telepsychiatry delivered through telephone for the treatment of trauma and depression.⁹⁹

Weight Management

A systematic review (Shah and Badawy, 2021) included one cluster RCT of physicians delivering behavioral group interventions for obesity to families through telephone or video (Davis et al., 2016; 103 subjects).¹⁰⁰ The study reported no significant differences in changes in patients' or parents' BMIs (pretreatment to posttreatment) between the video and telephone groups ($p > .05$).

Processes of Care

Primary Care

In a study of a health system that utilized multiple telehealth modalities, Bernstein et al. (2021) found that for conditions such as eye infections, skin conditions, and allergies, telephone was as effective as live video at achieving resolution, defined as a visit with no follow-up within 30 days for the same condition.¹⁰¹

Utilization of Other Health Care Services

The authors did not identify any new studies that described differences in utilization of other health care services between live video and telephone.

Combined Reporting of Telehealth Modalities

Studies in this section combine the reporting of effectiveness of telehealth of multiple modalities even though patients received only one form of telehealth (e.g., patients received care via live video or telephone, but the study outcomes were not described separately).

Health Outcomes

Antibiotic Prescribing

In a systematic review of antibiotic prescribing for acute infections in synchronous telehealth (telephone or video) consultations, Bakhit et al. (2021) described one study that reported no statistically significant differences in the reported adverse events as evaluated by diagnosis of pyelonephritis within a 30-day follow-up for patients with urinary tract infections.¹⁰²

Behavioral Health

A systematic review of the effectiveness of teleconsultations in mental health care (17 studies) found that, overall, consultations via telephone and video were as effective as in-person visits in improving clinical outcomes in mental health.¹⁰³ While the majority of studies in patients with depression reported similar effectiveness for the two delivery options to reduce depression symptoms at various time points of follow-up, three studies conducted in primary care that evaluated reductions in depression outcomes reached different conclusions; one study found the telehealth intervention was inferior to in-person care, one found no significant differences between groups, and one found the telehealth group experienced greater reductions in worry outcomes. Three of the noninferiority trials found video consultations were noninferior to face-to-face treatments. Therapeutic alliance was also similar between teleconsultation and face-to-face groups in a wide range of patient populations, including patients with depression in primary care, patients with PTSD, individuals undergoing counseling for substance use disorder, patients with depression following traumatic brain injury, and patients with medically unexplained pain.

Another systematic review of 11 studies that assessed the effects on depression symptoms, such as depression severity, severity improvement rate, and depression-free days, found that use of telehealth was associated with equivalent or better outcomes than in-person care.¹⁰⁴ Greenwood et al. (2022) conducted a systematic review and meta-analysis of 12 RCTs that compared telehealth to in-person psychotherapy for less common mental health conditions, including addiction disorders, eating disorders, childhood mental health problems, and chronic conditions.¹⁰⁵ Authors found there was no significant difference in symptom severity or overall improvement between telehealth and in-person therapy immediately after treatment or at any other follow-up time point.

Scott et al.'s (2022) systematic review and meta-analysis of synchronous telehealth versus in-person management for patients with PTSD in primary care settings found no statistically significant difference in PTSD severity at six months, depression severity at six months, quality of life, therapeutic alliance at three months, and treatment satisfaction outcomes at three months.¹⁰⁶

In a systematic review of eight studies that compared the efficacy of telehealth addiction treatment with in-person treatment, Mark et al. (2022) found there was no significant difference in excessive alcohol consumption (three studies), drug-positive tests (one study), and therapeutic alliance (one study).¹⁰⁷ For medication management, two studies found no significant difference between the telehealth and in-person groups, while one large comparison study found that receipt of telehealth was associated with better medication management.

Chronic Conditions

In a propensity matched-cohort study comparing 4,541 outpatient telehealth visits to 4,541 outpatient in-person visits for patients with heart failure, Sammour et al. (2021) reported similar rates of mortality for patients with in-person visits compared to video or telephone visits at 30 and 90 days (0.8% vs 0.7%, and 2.9% vs. 2.4%, respectively).¹⁰⁸

Genetic Counseling

In Danylchuk et al.'s (2021) systematic review of telehealth for genetic counseling (13 RCTs and 29 nonrandomized observational studies, with 13,901 subjects), the authors found that telehealth was generally noninferior or not statistically different when compared to in-person genetic testing for patient experience outcomes, including psychosocial topics of anxiety, depression, and stress, and quality of life.¹⁰⁹

Orthopedics

In a systematic rapid review of nonpharmacologic interventions for the management of non-acute musculoskeletal conditions, Corso et al. (2022; three studies) determined that health outcomes were similar for video (one study) or telephone (two studies) visits compared to in-person care for non-acute headaches, chronic nonspecific low back pain, or knee osteoarthritis outcomes.¹¹⁰

Fahey et al. (2022; 41 studies) conducted a systematic review of telemedicine in orthopedic surgery. Fifteen studies measured clinical outcomes after telemedicine interventions and compared telemedicine interventions (including video, other mixed modalities, and telerehabilitation) to traditional in-person care.¹¹¹ There was no clinically significant difference between the telemedicine and traditional study arms in 10 of the studies. In four of the studies, telemedicine was shown to be superior to traditional care. None of the studies found that telemedicine was associated with worse health outcomes than traditional care. Similarly, Haider et al.'s (2022) systematic review of telemedicine in orthopedics found no clinical differences in the validity of telemedicine examination for use in diagnosis and assessment of patient-reported outcome measures, such as pain scores and range of motion.¹¹² Melian et al.'s (2022) systematic review of teleconsultation in orthopedic surgery found no statistical difference between telehealth groups and in-person groups for range of motion, pain, or quality of life.¹¹³

Primary Care

A systematic review of the effectiveness of teleconsultations in primary care (11 studies) found that, overall, consultations via telephone and video were as effective as in-person visits in improving clinical outcomes in primary care settings.¹¹⁴

Reproductive Health

Kerestes et al. (2021) examined the effectiveness of the provision of medication abortion in Hawaii through multiple care delivery models, including via telephone or video consultations.¹¹⁵ Approximately 45% of the 334 patients who had a medication abortion received care via telemedicine (telephone or video consultations) with in-person pickup of medication (n = 149), 22.5% of patients received care via telemedicine (telephone or video consultations) with medications mailed to them (n = 75), and 33% of the patients received care via traditional in-person visits (n = 110). There were no statistical differences between the three groups in the rate of successful medication abortion or in abortion-related complications.

Weight Management

Whitley and Yahia (2021) conducted a systematic review of the efficacy of synchronous telehealth versus in-person interventions for obesity treatment in children and adolescents. Five studies found that both telehealth and in-person modalities combined and as stand-alone interventions were equally effective in improving obesity outcomes.¹¹⁶

Processes of Care

Antibiotic Prescribing

Bakhit et al. (2021) found no statistical differences in antibiotic prescribing patterns in the RCT included in the systematic review and most cross-sectional studies, significantly less prescribing in telehealth consultations in one observational study, and significantly more antibiotic prescribing for patients with acute otitis media in the telehealth group.¹¹⁷ In Turk, Jacobson Vann, and Oppewal's (2022) systematic review of antibiotic prescribing patterns, two studies reported less frequent antibiotic prescribing during virtual visits compared with in-person visits (approximately 25% lower for virtual visits), while four other studies observed small differences in antibiotic prescribing between virtual and in-person care (ranging from 1% lower to 4% higher in the virtual groups).¹¹⁸ Broad-spectrum antibiotic prescribing was compared in two studies, with differences in prescribing ranging from 2% lower to 30% higher in virtual care compared with in-person visits. Three studies assessed adherence to guidelines in diagnosing and treating acute respiratory tract infections (ARTIs), and differences in guideline-concordant prescribing between study groups ranged from 2.7% higher concordance with virtual care to 11.2% lower. Murray et al. (2023) compared antifungal prescribing rates for treatment of vulvovaginal candidiasis between three groups: traditional in-person care, care via telephone with a registered nurse, and e-visit.¹¹⁹ Patients utilizing phone visits were significantly more likely to be treated with oral fluconazole than those treated by e-visit or face-to-face encounters. Patients were significantly less likely to receive antifungal medication at an in-person visit than an e-visit or phone encounter. There was no significant difference in follow-up rates between the three groups.

Chronic Conditions

Grauer et al. (2022) included adult patients with diabetes in a retrospective cohort study in a primary care network (40,602 patients) to assess the association between telemedicine use and diabetes risk factor assessment and control.¹²⁰ Authors found that telemedicine was associated with lower odds of assessment for each individual risk factor (i.e., HbA1c, blood pressure, or low-density lipoprotein cholesterol). In patients for whom the individual risk factor was assessed, there was generally no statistically significant association between telemedicine use and risk factor control.

Neuropsychology and Cognitive Assessments

In a review of diagnostic test accuracy of providing multidomain cognitive assessments for dementia via telehealth, Beishon et al. (2022) found that tests could correctly identify people with dementia between 26% and 100% of the time, and could correctly rule out dementia between 65% and 100% of the time.¹²¹ Studies that compared the findings of tests performed via telehealth versus equivalent in-person tests suggested that telehealth test scores usually agree with in-person testing.

Orthopedics

Ajrawat et al. (2021) conducted a systematic review of the use of telehealth for orthopedic consultations and assessments, and studies included various modalities: video (18 studies), messaging (10 studies), store and forward (10 studies), and telephone (two studies).¹²² There were 25 studies that examined the accuracy of radiographic reviews. Six studies reported radiographic image quality, with four studies stating good to excellent visualization, one stating poor visualization, and one indicating no differences

between teleradiology and conventional radiograph review. Ten studies assessed the accuracy, sensitivity, and specificity of teleradiology, with eight studies indicating moderate to high diagnostic confidence in terms of sensitivity range and specificity range, as well as low to high diagnostic accuracy range. The remaining two studies indicated no significant difference between teleradiology and in-person radiographs. Nine studies assessed the interobserver reliability of teleradiology, with seven studies demonstrating substantial agreement for classification and management among interpretations. One study indicated no significant difference, and another study showed low to moderate interobserver reliability with teleradiology. Fahey et al. (2022) synthesized findings from seven studies that compared the accuracy of clinical examination by telemedicine to traditional face-to-face examinations; these studies showed good to excellent reliability coefficients when comparing telehealth assessment to traditional examinations.¹²³ The systematic review by Melian et al. (2022) found no statistical difference between telehealth and in-person groups in ongoing management plans for orthopedic surgical patients.¹²⁴

Primary Care

Reed et al. (2021) examined treatment and follow-up associated with patient-scheduled primary care delivered via telemedicine (video or telephone) or in person.¹²⁵ This cohort study of over one million patients found that the adjusted rates of any medication prescribed were significantly lower for telemedicine visits than for clinic visits. The adjusted rates of laboratory tests or imaging ordered were also significantly lower for telemedicine visits than for clinic visits.

In a retrospective cohort study, Bernstein et al. (2021) compared telehealth care with in-person care for urgent and non-emergent visits for seniors.¹²⁶ Telehealth was provided via video, telephone, and e-visit. The median rate of visit resolution for telehealth visits was lower than clinically comparable in-person visits, but telehealth was effective in resolving urgent, non-emergent conditions a high percentage of the time. The number of visits within an episode of care was largely similar to the in-person cohort.

Reproductive Health

In a retrospective cohort study on the impact of postpartum care by telehealth, Arias et al. (2022) found that patients who received telehealth care were 90% more likely to attend a postpartum visit and more likely to receive postpartum depression screening than those attending in-person visits.¹²⁷ There were no statistically significant differences in breastfeeding status, completion of postpartum glucose test rates, or follow-up cardiology appointments between the two groups.

Utilization of Other Health Care Services

Antibiotic Prescribing

A systematic review of antibiotic prescribing patterns and guideline-concordant management of ARTIs found unplanned follow-up visits occurred with greater frequency among virtual visits compared with in-person visits in two out of three studies.¹²⁸

Chronic Conditions

Sammour et al. (2021) reported that video or telephone visits were associated with fewer ED or hospital visits at 30 and 90 days (6.8% vs. 10.4%, and 17.9% vs. 23.3%, respectively; $p < .001$ for both) compared to in-person visits.¹²⁹

Primary Care

In the study by Reed et al. (2021) examining treatment and follow-up associated with patient-scheduled primary care, the adjusted rate for follow-up within seven days was slightly higher for the telemedicine

group compared with the in-person visits group, but there was no significant difference in ED visits or hospitalization.¹³⁰

Bernstein et al. (2021) found that among senior citizens downstream utilization rates for ED and in-person visits were similar between telehealth and in-person cohorts for urgent care and non-emergent conditions.¹³¹ Hatef et al. (2022) examined outcomes of in-person and telehealth ambulatory encounters during COVID-19 in a retrospective cohort study of 40.7 million commercially insured patients.¹³² Patients with an initial telehealth encounter, compared with an in-person encounter, had higher odds for any follow-up encounter and ED encounter, and lower odds for in-patient admissions. Bakhit et al. (2021) found that, in general, patients who were initially evaluated through phone or video contact were more likely to receive follow-up in-person appointments.¹³³

APPENDIX C. STAKEHOLDERS ROUNDTABLE

The California Health Care Foundation (CHCF) convened a roundtable with policy stakeholders in March 2023. The goals of this roundtable were as follows:

- Inform telehealth policy stakeholders about recent evidence on effectiveness, quality, and equity of telehealth in order to inform future policymaking.
- Gather reactions about the findings of the updated evidence review.
- Identify key questions that remain for policymakers and stakeholders to guide future telehealth research, including identifying research priorities.

The roundtable included attendees from the following organizations:

- Alameda Health Consortium
- Alameda Health System
- Anthem
- California Association of Public Hospitals and Health Systems
- California Hospital Association
- California Psychological Association
- Center for Connected Health Policy
- Central Valley Health Network (CVHN)
- The Children's Partnership
- Community Clinic Association of Los Angeles County
- Institute for Local Self-Reliance
- Insure the Uninsured Project (ITUP)
- Kaiser Permanente Institute for Health Policy
- Local Health Plans of California (LHPC)
- MedWand Solutions
- National Health Law Program (NHeLP)
- Planned Parenthood Affiliates of California
- West Health

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