
Virtual Care for the Longitudinal Management of Chronic Conditions: A Systematic Review

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PREFACE

The VA Evidence Synthesis Program (ESP) was established in 2007 to provide timely and accurate syntheses of targeted health care topics of importance to clinicians, managers, and policymakers as they work to improve the health and health care of Veterans. These reports help:

- Develop clinical policies informed by evidence;
- Implement effective services to improve patient outcomes and to support VA clinical practice guidelines and performance measures; and
- Set the direction for future research to address gaps in clinical knowledge.

The program comprises three ESP Centers across the US and a Coordinating Center located in Portland, Oregon. Center Directors are VA clinicians and recognized leaders in the field of evidence synthesis with close ties to the AHRQ Evidence-based Practice Center. The Coordinating Center was created to manage program operations, ensure methodological consistency and quality of products, and interface with stakeholders. To ensure responsiveness to the needs of decision-makers, the program is governed by a Steering Committee composed of health system leadership and researchers. The program solicits nominations for review topics several times a year via the [program website](#).

Comments on this evidence report are welcome and can be sent to Nicole Floyd, Deputy Director, ESP Coordinating Center at Nicole.Floyd@va.gov.

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The findings and conclusions in this document are those of the author(s) who are responsible for its contents and do not necessarily represent the views of the Department of Veterans Affairs or the United States government. Therefore, no statement in this article should be construed as an official position of the Department of Veterans Affairs. No investigators have any affiliations or financial involvement (eg, employment, consultancies, honoraria, stock ownership or options, expert testimony, grants or patents received or pending, or royalties) that conflict with material presented in the report.

ACKNOWLEDGMENTS

This topic was developed in response to a nomination by Carolyn Turvey, Office of Rural Health, for the purpose of informing future research and to support adoption of effective virtual care service models. The scope was further developed with input from the topic nominators (*ie*, Operational Partners), the ESP Coordinating Center, the review team, and the Technical Expert Panel (TEP).

In designing the study questions and methodology at the outset of this report, the ESP consulted several technical and content experts. Broad expertise and perspectives were sought. Divergent and conflicting opinions are common and perceived as healthy scientific discourse that results in a thoughtful, relevant systematic review. Therefore, in the end, study questions, design, methodologic approaches, and/or conclusions do not necessarily represent the views of individual technical and content experts.

Operational Partners

Operational partners are system-level stakeholders who have requested the report to inform decision-making. They recommend TEP participants; assure VA relevance; help develop and approve final project scope and timeframe for completion; provide feedback on draft report; and provide consultation on strategies for dissemination of the report to field and relevant groups.

Carolyn Turvey, PhD

Office of Rural Health
Rural Health Resource Center, Iowa City

Technical Expert Panel (TEP)

To ensure robust, scientifically relevant work, the TEP guides topic refinement; provides input on key questions and eligibility criteria, advising on substantive issues or possibly overlooked areas of research; assures VA relevance; and provides feedback on work in progress. TEP members are listed below:

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Peer Reviewers

The Coordinating Center sought input from external peer reviewers to review the draft report and provide feedback on the objectives, scope, methods used, perception of bias, and omitted evidence. Peer reviewers must disclose any relevant financial or non-financial conflicts of interest. Because of their unique clinical or content expertise, individuals with potential conflicts may be retained. The Coordinating Center and the ESP Center work to balance, manage, or mitigate any potential nonfinancial conflicts of interest identified.

EXECUTIVE SUMMARY

INTRODUCTION

The onset of the COVID-19 pandemic led to an unprecedented growth in synchronous virtual care via phone and video encounters as a means to mitigate the risk of viral transmission to both patients and clinicians. The impact of COVID-19 on ambulatory care was such that outpatient visits across the United States decreased by nearly 60% by the end of March 2020. In response, many health systems rapidly converted 70% or more of their outpatient visits to phone or video delivery. Even after the pandemic recedes, it is likely that synchronous virtual care will remain a larger part of usual ambulatory care and longitudinal chronic disease management than ever before.

As both the largest integrated health system and largest provider of virtual care in the country, the Veterans Health Administration (VHA) has a particular interest in understanding how best to implement and utilize virtual care or the management of chronic conditions. VHA has a robust and widespread virtual care infrastructure including services such as MyHealtheVet secure messaging, Home Telehealth, and the VA Video Connect (VVC) video platform for synchronous visits within both specialty and primary care among other digital innovations. Given the importance that virtual care will likely retain following the COVID-19 pandemic, understanding the strengths and limitations associated with synchronous virtual care for chronic conditions will be critical in shaping how VHA utilizes this approach going forward.

Particularly important within VHA is the chronic management of congestive heart failure (CHF), chronic obstructive pulmonary disease (COPD), and type 2 diabetes mellitus (T2DM), as these are among the most common and costly conditions, affecting nearly 5%, 10%, and 25% of all Veterans, respectively. Our systematic review examined the use of synchronous virtual care as a substitute for in-person care in the context of chronic management for CHF, COPD, and T2DM.

At the request of the VA Office of Rural Health (ORH) leadership, we conducted a systematic review to address the following key questions (KQ):

KQ 1a: Among adults, what is the effect of synchronous virtual care (*ie*, phone and/or video) compared to in-person care (or compared to phone if synchronous video care) for chronic management of *congestive heart failure (CHF)* on key disease-specific clinical outcomes and health care utilization (*ie*, hospital admission, hospital re-admission, ER visits)?

KQ 1b: Does this effect differ by race/ethnicity, gender, age, and rural status?

KQ 2a: Among adults, what is the effect of synchronous virtual care (*ie*, phone and/or video) compared to in-person care (or compared to phone if synchronous video care) for chronic management of *chronic obstructive pulmonary disease (COPD)* on key disease-specific clinical outcomes and health care utilization (*ie*, hospital admission, hospital re-admission, ER visits)?

KQ 2b: Does this effect differ by race/ethnicity, gender, age, and rural status?

- KQ 3a:** Among adults, what is the effect of synchronous virtual care (*ie*, phone and/or video) compared to in-person care (or compared to phone if synchronous video care) for chronic management of *type 2 diabetes mellitus (T2DM)* on key disease-specific clinical outcomes and health care utilization (*ie*, hospital admission, hospital re-admission, ER visits)?
- KQ 3b:** Does this effect differ by race/ethnicity, gender, age, and rural status?
- KQ 4:** What are the adverse effects of synchronous virtual care for chronic management of CHF, COPD, and T2DM as compared to in-person care (or compared to phone if synchronous video care) on patients (*ie*, hypoglycemic events), clinical team members (*ie*, burnout), and clinics (*ie*, increase in resource costs)?

METHODS

We developed and followed a standard protocol for this review in collaboration with operational partners and a technical expert panel (PROSPERO registration number CRD42021239756).

Data Sources and Searches

We searched MEDLINE (via Ovid), Embase (via Elsevier), and Cochrane Central Register of Controlled Trials (via Ovid) from inception through February 7, 2021. We also examined the bibliographies of recent reviews for additional relevant studies.

Study Selection

In brief, the major eligibility criteria were randomized or quasi-experimental studies that evaluated the effect of synchronously delivered care (*ie*, virtual care) for relevant chronic conditions that occurred over ≥ 2 encounters and in which some or all in-person care is supplanted by care delivered virtually (*ie*, phone or video). The virtual care must have been delivered remotely by a clinician with a scope of practice that included independent prescribing, diagnosis, and/or chronic management (*ie*, physician, nurse practitioner, physician assistant, clinical pharmacist) for a patient who was not physically present in the same clinic (*ie*, teleconsultation, video conferencing) and which was administered within the context of longitudinal care provision (even if individual visits are for acute concerns). Interventions were not required to deliver all care virtually; rather, virtual visits could be combined with other asynchronous virtual care tools (*eg*, remote monitoring systems), virtual care manager support, or in-person visits with a prescribing clinician as long as there were virtual visits which replaced in-person visits. Remote monitoring that triggers synchronous care was eligible if remote monitoring occurred in both treatment and comparison arms and visits were with a prescribing clinician. We did not include studies that tested virtual care interventions in which the virtual care component was care provided in addition to regular in-person care rather than as a substitute. Using these prespecified inclusion/exclusion criteria, our team of investigators screened titles and abstracts to identify potentially eligible studies. Studies that met all eligibility criteria at full-text review were included for data abstraction.

Data Abstraction and Quality Assessment

Data elements included descriptors to assess applicability, quality elements, intervention details, and outcomes including adverse events. For included studies, study risk of bias (ROB) was assessed using the Cochrane Effective Practice and Organisation of Care (EPOC) ROB tool.

Data Synthesis and Analysis

We summarized the primary literature using relevant data abstracted from the eligible studies. Summary tables describe the key study characteristics of the primary studies: study design, patient demographics, and details of the intervention and comparator. We considered quantitative synthesis (meta-analysis) in cases where identified study interventions had sufficient conceptual homogeneity; otherwise, we described findings narratively, focusing on identifying patterns in efficacy and safety of the interventions across conditions and outcome categories.

Analysis of Subgroups or Subsets

We considered variations of effect by subgroup of interest as described in the KQs. Prespecified potential effect modifiers included study design characteristics (*eg*, allocation concealment), disease context (*ie*, CHF, COPD, T2DM), and intervention type (*eg*, virtual care modality). Regarding patient-level characteristics of interest (*ie*, race/ethnicity, gender, age, rural status), we looked for analyses conducted within the primary literature that sought to identify effect modification (*eg*, subgroup analyses, regression model explanatory variables). We narratively considered the representation of subgroups within identified studies in comparison to the VA population.

RESULTS

Results of Literature Search

The literature search identified 8,662 citations, of which 129 were reviewed at the full-text stage. Five articles relevant to KQs 1, 3, and 4 were retained for data abstraction, all of which were randomized trials. No articles were identified for KQ 2 (COPD). No quantitative syntheses were performed due to the conceptual heterogeneity of the identified interventions

Summary of Results for Key Questions

KQ 1: Synchronous virtual care for chronic management of congestive heart failure

Only 1 study met the inclusion criteria for synchronous virtual care for chronic management of CHF. This study by Hansen et al was conducted in Germany and enrolled 210 patients with CHF and a recent implantation of either an implanted cardioverter defibrillator (ICD) or cardiac resynchronization therapy-defibrillator (CRT-D) and randomized them to receive quarterly automated asynchronous web-based review and follow-up of telemetry data versus synchronous personal follow-up (in-person vs phone based) for 1 year. This study was found to have a high ROB due to low numbers of patients enrolled, an unclear randomization method, and poor description of both patient dropout and how primary outcomes were assessed.

KQ 1a: Among adults, what is the effect of synchronous virtual care (ie, phone and/or video) compared to in-person care (or compared to phone if synchronous video care)

for chronic management of congestive heart failure (CHF) on key disease-specific clinical outcomes and health care utilization (ie, hospital admission, hospital re-admission, ER visits)?

A 3-way comparison across study arms found no significant differences in a composite CHF score or other clinical outcomes such as mortality, CHF-related admissions, New York Heart Association (NYHA) class, and change in reported quality of life.

KQ 1b: Does this effect differ by race/ethnicity, gender, age, and rural status?

Hansen et al described the age (overall mean 63.8 years) and gender of their patient population (84.3% male); however, details regarding race/ethnicity and rural status were not reported. Furthermore, the authors did not perform any subgroup analyses examining the effect of age or gender on outcomes.

KQ 2: Synchronous virtual care for chronic management of chronic obstructive pulmonary disease

No studies met inclusion criteria for synchronous virtual care for chronic management of COPD.

KQ 3: Synchronous virtual care for chronic management of Type 2 diabetes mellitus

We identified 4 studies – all of which were randomized trials – that evaluated the provision of synchronous virtual care compared to in-person care for chronic management of T2DM. Two studies were conducted in the United States, 1 in South Korea, and 1 in Denmark. One study was conducted with military patients. Intervention duration varied across studies from less than 8 weeks to 52 weeks. Three studies included 60 or fewer patients and 1 study included 338 patients. Interventions also varied in the way that they incorporated virtual care into chronic T2DM management. Three studies used technology that facilitated synchronous bidirectional communication between the patient and clinician, and 1 study relied on telephone and email. Two studies included remote monitoring as an adjunct virtual care modality.

ROB for patient-reported outcomes was judged low for 1 study, unclear for 1 study, and high for 1 study; 1 study did not examine patient-reported outcomes. For objective outcomes (eg, hemoglobin A1c), ROB was judged low for 2 studies and high for 2 studies. Patterns that led to high ROB included (1) missing or unclear data on randomization methods, data collection, and analysis; (2) unblinded treatment arm; (3) no predetermined intervention assessment patterns in the protocol; (4) unclear primary outcomes; and (5) unclear or missing reporting of patient-reported outcomes.

KQ 3a: Among adults, what is the effect of synchronous virtual care (ie, phone and/or video) compared to in-person care (or compared to phone if synchronous video care) for chronic management of type 2 diabetes mellitus (T2DM) on key disease-specific clinical outcomes and health care utilization (ie, hospital admission, hospital re-admission, ER visits)?

For KQ 3a, we present the detailed results ordered by outcome: (1) A1c, (2) hospitalizations, (3) ER visits, and (4) number of contacts and utilization.

A1c

All 4 studies compared change in A1c from baseline to end of study between synchronous virtual care and in-person study arms. The 1 adequately powered, low ROB study by Jeong et al was a 24-week, 3-arm trial that enrolled 338 patients and compared usual care, telemonitoring (remote monitoring and automated clinical-decision support with in-person endocrine follow-up appointments), and telemedicine (remote monitoring and automated clinical-decision support with video-based endocrine follow-up appointments). No difference was seen at baseline for A1c across groups: usual care (8.39% SD 1.10), telemonitoring (8.21%, SD 0.93), and telemedicine (8.39%, SD 1.10). A statistically significant difference was seen for within-group decrease in A1c from baseline to 24 weeks for all groups ranging from -0.66 to -0.81 ($p < 0.001$). However, no statistically significant difference was noted for A1c reduction across groups. Among the smaller trials (all $n < 60$), 2 found greater A1c reductions between virtual care arms versus comparator; 1 trial only reported a significant within group difference.

Hospitalizations

Two studies examined hospitalizations. In the study by Jeong et al, only 1 patient in the telemonitoring arm experienced a diabetes complication-related hospitalization, and no patients in the control or telemedicine arms experienced diabetes-related hospitalizations at 24 weeks. In the second study, by Klingeman et al, 3 out of 30 patients in the experimental arm and 7 out of 30 patients in the control arm experienced a diabetes-related hospital admission.

ER Visits

Two studies examined emergency room (ER) visits. In the first study by Jeong et al, across the 3 study arms, no patients experienced diabetes-related visits to the ER out of the 338 patients enrolled in the study. In the second study, by Klingeman et al, no patients in the experimental arm and 1 patient in the control arm experienced a diabetes-related emergency-room visit.

Number of Contacts and Utilization

Three studies reported collecting data on number of contacts and utilization among patients receiving in-person or virtual care. The study by Klingeman et al designed the experimental arm for variable frequency of contact using a specialty clinic model. Pre-planned contacts (via email, phone call, or visit) were determined at baseline and amended over time; contact was tailored upon each patient's outcomes, adverse reactions, and changes in disease state; the control arm received usual endocrine care. Klingeman et al reported that when diabetes education visits were combined with clinician diabetes-related visits in the endocrinology clinic, the experimental group had fewer overall visits than the control group. Specifically, the experimental group had 1.5 (SD 0.7) visits versus 3.6 (SD 4.0) visits over 12 months ($p = 0.0001$). However, the experimental group had significantly more email contacts than in the control arm with 11.1 (SD 6.4) email interactions in the experimental group and 1.8 (SD 3.5) email interactions in the control group ($p < 0.0001$). (Note: email communication was a focus in the experimental arm.)

The study by Rasmussen et al, which compared standard care and video consultation for home treatment of T2DM, reported on (1) number of visits and missed visits, and (2) consultation time. The video consultation group had 4.1 visits on average with no missed visits; however, the usual-

care group had on average 3.8 visits with 13% missed visits. In regards to consultation time, the video consultation group averaged 18 minutes and the usual care group averaged 23 minutes.

The study by Whitlock et al did not report results on number of contacts and utilization despite describing collecting the number of clinic visits before and during the study in the methods.

KQ 3b: Does this effect differ by race/ethnicity, gender, age, and rural status?

Only 1 of the included studies reported on subgroup analysis by patient characteristics. Jeong et al analyzed 2 subgroups of interest: (1) gender and (2) age. No statistically significant difference was found between men and women or by age groups (< 55 years of age, ≥55 years of age).

KQ 4: What are the adverse effects of synchronous virtual care for chronic management of CHF, COPD, and T2DM as compared to in-person care (or compared to phone if synchronous video care) on patients (ie hypoglycemic events), clinical team members (ie, burnout), and clinics (ie, increase in resource costs)?

Two studies reported adverse events. The study by Jeong et al described 4 groups of adverse events: (1) general events, (2) diabetes-related events, (3) serious events, and (4) biochemical events. General adverse events were noted in the control (n = 33 or 29.2%, in-person appointments at 8, 16, 24 weeks), telemonitoring (n = 30 or 26.5%, in-person appointments at 8, 16, 24 weeks with remote monitoring of blood glucose data), and telemedicine (n = 23 or 20.5%, video visits at 8 and 16 weeks, in-person visit at 24 weeks) arms. Diabetes-related events were noted in the control (n = 7 or 6.2%), telemonitoring (n = 7 or 6.2%), and telemedicine (n = 3 or 2.7%) arms. Serious reported adverse events were noted in the control (n = 2 or 1.8%), telemonitoring (n = 2 or 1.8%), and telemedicine (n = 1 or 0.9%) arms, and included angina pectoris, rotator cuff syndrome, malignant hepatic neoplasm, skin ulcer, and hematuria. Biochemical parameters for serum alanine aminotransferase (ALT), aspartate aminotransferase (AST), and creatinine levels were measured and samples obtained at baseline and 24 weeks; each value was classified as normal or abnormal. Subgroup analyses indicated that ALT was the only biochemical parameter showing a significant difference between the telemonitoring (n = 0) and telemedicine (n = 7, 6.3%) arms (p = 0.014) and that 5 (4.4%) patients in the control arm had worsening ALT from a normal baseline. The study by Klingeman et al described 2 types of adverse events: (1) severe hypoglycemia and (2) foot ulcers. Severe hypoglycemia was noted in the experimental (n = 1 or 0.9%) arm but not in the control (n = 0) arm. Foot ulcers were noted in the experimental (n = 1 or 0.9%) and control (n = 3 or 2.6%) arms.

DISCUSSION

Key Findings

The COVID-19 pandemic precipitated a rapid massive shift from in-person to virtual health care delivery without an understanding about the impact of virtual care on important health outcomes. In this review, we evaluated the impact of real-time, virtual care in lieu of face-to-face care for the chronic management for CHF, COPD, and T2DM. Our review is notable in its use of a clear definition of virtual care, consideration of disease-specific clinical needs, focus on high-quality study designs, and rigorous analysis of studies that address synchronous virtual care. Overall, we found very few studies evaluating the effect of synchronous virtual care compared to in-person

care for chronic T2DM, COPD, and CHF management (only 4 in T2DM 1 in CHF, and none for COPD). Among the included studies, there was significant heterogeneity related to the structure, purpose, and delivery of virtual care visits. The findings from this small number of studies have limited generalizability as all included studies took place in specialty care clinics while much of the long-term management for chronic conditions such as T2DM, CHF, and COPD occurs within the context of primary care. Primary care teams provide care for multiple conditions simultaneously, which may not support the single-disease-focused care described in the included studies.

Prior Systematic Reviews

Previous systematic reviews have examined various ways of utilizing virtual care modalities in the context of chronic conditions, but none focused on *replacing* in-person care with virtual visits as has been the case during the COVID-19 pandemic. For example, a 2016 Agency for Healthcare Research and Quality (AHRQ) evidence map found 58 existing systematic reviews supporting the use of telehealth interventions for communication/counseling or remote monitoring for chronic conditions. Our review sought to extend the existing literature by addressing telehealth as a replacement for in-person care in chronic disease management. We found scant evidence examining chronic disease management delivered by synchronous virtual care compared to in-person delivery for T2DM, COPD, and CHF.

Horizon Scan

Given the limited existing literature addressing our key question, we sought to assess ongoing studies that might add relevant findings in the near future. We applied our previously developed search terms to the Cochrane Central Register of Controlled Trials and found 1,787 unique studies. However, we only found 3 potential studies that might meet our inclusion criteria based on disease of interest and virtual care intervention. All 3 are randomized controlled trials that were designed before the COVID-19 pandemic. Two of the studies focus on T2DM while the third concerns CHF. Thus, it appears that there is little trial-based research currently in the pipeline to inform our key questions in this review.

Applicability

While none of the included studies were conducted explicitly with Veterans, 1 study occurred in a military setting. Two studies were conducted in countries with nationalized health care (*ie*, South Korea, Denmark), which may increase relevance to VHA. Identified studies included primarily older participants, which is similar to the population of Veterans who have chronic disease.

Research Gaps/Future Research

Overall, there are 5 key areas in which future research on this topic could fill existing gaps and/or could improve the approach. First, and perhaps most critical, virtual care interventions should be thoroughly described in order to maximize reproducibility and generalizability in other clinical contexts. Guidance exists on mobile and web-based interventions, which may provide indirect suggestions about key characteristics for virtual care intervention description. Second, there is a need to evaluate how best to integrate virtual care as a replacement for in-person care, or as an adjunctive technology (*eg*, remote monitoring); further, there is a need to evaluate which

clinical settings are best suited to the virtual environment (eg, primary care vs specialty care settings). Approaches to integrating virtual care can be expected to vary across settings with different workflow patterns, clinical resources, and competing clinical demands, which emphasizes the need for solid evidence. Third, outcomes varied across included studies and some important outcomes were not addressed by any study (eg, impact on clinical workflow, patient satisfaction with virtual care experience, and subsequent utilization). Fourth, investigators should be encouraged to consider *a priori* subgroup evaluations or make individual patient-level data available, so that future reviews can identify patient-level characteristics associated with better outcomes with virtual care. Such information could guide clinics and health care systems to offer optimal patient-centered virtual care delivery and support efforts to ensure equitable benefit and access to virtual care. Finally, investigators should consider utilizing non-inferiority analytic approaches when hypotheses center on whether virtually delivered care is *equally effective to* in-person care.

Conclusions

Virtual modalities such as video or telephone have increasingly been used to replace in-person clinic visits for managing chronic conditions, particularly during the COVID-19 pandemic. However, currently there is scant evidence of the effect of virtual care as a replacement for in-person visits in the context of chronic management of T2DM or CHF, and no evidence for COPD. Health care systems need evidence-based guidance about the effect of well-described virtual care interventions in order to deliver high-quality care using the right modality for the right patients with the right clinical condition at the right time.

ABBREVIATIONS TABLE

| | |
|----------|--|
| A1c | Hemoglobin A1c |
| AHRQ | Agency for Healthcare Research and Quality |
| ALT | Alanine aminotransferase |
| AST | Aspartate aminotransferase |
| CHF | Congestive heart failure |
| COPD | Chronic obstructive pulmonary disease |
| CRT-D | Cardiac Resynchronization Therapy-Defibrillator |
| EPOC | Effective Practice and Organization of Care |
| ER | Emergency room |
| ESP | Evidence Synthesis Program |
| GRADE | Grading of Recommendations Assessment, Development and Evaluation |
| ICD | Implanted Cardioverter Defibrillator |
| KQ | Key question |
| NYHA | New York Heart Association |
| OECD | Organization for Economic Co-operation and Development |
| ORH | Office of Rural Health |
| PICOTS | Population, intervention, comparator, outcome, timing, setting |
| PRESS | Peer Review of Electronic Search Strategies |
| PRISMA | Preferred Reporting Items for Systematic Reviews and Meta Analyses |
| PROSPERO | The International Prospective Register of Systematic Reviews |
| RFA | Request for applications |
| RM | Remote monitoring |
| ROB | Risk of Bias |
| T2DM | Type 2 diabetes mellitus |
| TEP | Technical Expert Panel |
| VHA | Veterans Health Administration |
| VVC | VA Video Connect |