NATIONAL QUALITY FORUM

Creating a Framework to Support Measure Development for Telehealth

DRAFT REPORT FOR COMMENT

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Executive Summary

Telehealth offers tremendous potential to transform the healthcare delivery system by overcoming geographical distance, enhancing access to care, and building efficiencies.[1] The Health Resources and Services Administration (HRSA) defines telehealth as "the use of electronic information and telecommunications technologies to support and promote long-distance clinical healthcare, patient and professional health-related education, public health and health administration."[2] Although no standard definition exists for this important area of health information technology (health IT) across both the private and public sectors,[3] there is general consensus that telehealth supports a range of clinical activities, including:

- Enhance interactions among providers to improve patient care (e.g., consultation with distant specialists by the direct care provider);
- Support provider-to-provider training
- Enhance service capacity and quality (for example, small rural hospital emergency departments and pharmacy services);
- Enable direct patient-provider interaction (such as follow-up for diabetes or hypertension); or urgent care services);
- Manage patients with multiple chronic conditions from a distance; and
- Monitor patient health and activities (for example, home monitoring equipment linked to a distant provider).[4]

The U.S. Department of Health and Human Services (HHS) called upon the National Quality Forum (NQF) to convene a multistakeholder Telehealth Committee to recommend various methods to measure the use telehealth as a means of providing care. The Committee was charged to develop a measurement framework that identifies measures and measure concepts and serves as a conceptual foundation for new measures, where needed, to assess the quality of care provided using telehealth modalities.

This report and the conceptual framework herein serve as the foundation for future efforts by measure developers, researchers, analysts, and others in the healthcare community to advance quality measurement for telehealth. By identifying some of the highest-priority areas for measurement, this report may support the development of measures that incorporate into a telehealth environment as part of an iterative development process. Measurement based on iterative and continuous learning will successfully inform future telehealth quality improvement efforts, including emerging areas such as patient empowerment and care coordination.

Introduction

Telehealth offers tremendous potential to transform the healthcare delivery system by overcoming geographical distance, enhancing access to care, and building efficiencies.[5] Telehealth is a different method of healthcare delivery that provides similar or supplemental services to in-person encounters. The Health Resources and Services Administration (HRSA) defines telehealth as "the use of electronic information and telecommunications technologies to support and promote long-distance clinical healthcare, patient and professional health-related education, public health and health administration."[6] Although no standard definition exists for this important area of health information technology (health IT) across both the private and public sectors,[7] there is general consensus that telehealth supports a range of clinical activities, including:

- Enhance interactions among providers to improve patient care (e.g., consultation with distant specialists by the direct care provider);
- Support provider-to-provider training
- Enhance service capacity and quality (for example, small rural hospital emergency departments and pharmacy services);
- Enable direct patient-provider interaction (such as follow-up for diabetes or hypertension); or urgent care services);
- Manage patients with multiple chronic conditions from a distance; and
- Monitor patient health and activities (for example, home monitoring equipment linked to a distant provider).[8]

These activities are especially useful in communities where access to appropriate healthcare services is limited. Compared to residents of urban communities, residents of rural and frontier communities are more likely to be older and to have more risk factors associated with their health conditions. The supply of healthcare professionals to treat these conditions can be scarce in many of these areas, and existing providers may have more limited training in specialized areas of care. To address these challenges, some rural hospitals and other healthcare settings have adopted telehealth, including video communication between providers and the sharing of information, such as radiological and imaging reports.[9] Similar strategies adopted in urban and suburban settings, especially for specialties where there are significant workforce shortages and/or maldistribution (e.g., dermatology, neurology, clinical genetics, and psychiatry) or long delays to schedule new patient appointments show improvement in these areas.

Telehealth can provide needed services in a variety of settings, including home and community-based settings, schools, hospitals, post-acute and long-term care settings, office-based settings, and community health centers.[10] The most significant needs in home and community-based care relate to chronic care management.[11] Traditionally, chronic diseases managed through an episodic, office-based approach require frequent patient contact and regular physiologic measurement. The use of telehealth for chronic disease care management has been associated with reductions in hospitalizations, readmissions, and lengths of stay, as well as improvements in some physiologic measures such as pulmonary function or body temperature.[12] Incorporating telehealth into a care management program that offers remote monitoring and feedback at home by a chronic care management team (like one program instituted by the Department of Veterans Affairs (VA) over a decade ago) shows improvements

in chronic disease management. This includes the management of hypertension, congestive heart failure, and diabetes.[13]

The types of care delivery that are facilitated via telehealth continue to expand, and Medicare currently reimburses for a number of telehealth-provided services in rural settings, such as consultations, office or other outpatient visits, and diabetes self-management training and individual psychotherapy, among others.[14] However, while the use of telehealth in the Medicare program has grown rapidly in recent years, particularly in rural areas, its overall use by Medicare providers in the treatment and management of their patients remains relatively low. In part, this is due to restrictions in how telehealth is reimbursable.[15] The Medicaid program allows states to reimburse providers for telehealth as long as the service satisfies federal requirements for efficiency, economy, and quality of care. States have more flexibility to use their own laws, rules, regulations, and policies to reimburse for telehealth as appropriate.[16]

This report is a project initiated by the U.S. Department of Health and Human Services (HHS) for the National Quality Forum (NQF) to convene a multistakeholder Committee to recommend various methods to measure the use telehealth as a means of providing care. The Committee was charged to develop a measurement framework that identifies measures and measure concepts and serves as a conceptual foundation for new measures, where needed, to assess the quality of care provided using telehealth modalities. This project followed previous work completed by the Agency for Healthcare Research and Quality (AHRQ) described in, *Telehealth: Mapping the Evidence for Patient Outcomes from Systematic Reviews*.[17] This AHRQ report created an evidence map of systematic reviews that assess and examine the impact of telehealth on clinical outcomes, utilization, and cost. The report summarized the distribution and diversity of findings on telehealth by clinical area and telehealth modality. This NQF report describes a measurement framework that should inform future evaluation work on the impact of telehealth on cost and quality of care, as well as create a foundation for the measurement of outcomes attributable to the use of telehealth.

Methodology

NQF conducted a comprehensive environmental scan to inform the development of the telehealth framework. The primary purpose of the environmental scan was to identify existing measures and potential measure concepts related to telehealth. Information was gathered through a multitude of sources such as PubMed, JSTOR, and Academic Search Premier. Grey literature and web searches through Google identified reports, white papers, and other documentation related to telehealth. These include documents published by operating divisions within HHS and other federal departments, such as the VA and Department of Defense (DoD). These also include vendor-based white papers and reports issued by nonprofit organizations such as the American Telemedicine Association (ATA), the National Association for Community Health Centers, the National Association of Rural Health Providers (NARHP), and the Health Information Management and Systems Society (HIMSS). Papers reviewed from various divisions of HHS, such as the Assistant Secretary for Planning and Evaluation (ASPE), AHRQ, HRSA, and the Office of the National Coordinator for Health Information Technology (ONC) as lead agencies for telehealth published documents, such as ASPE's 2016 Report to Congress on eHealth and Telemedicine

and the 2016 Federal Telehealth Compendium appear in the report. NQF reviewed over 390 titles and abstracts from an electronic search, as well as other briefings and reports from the grey literature. NQF identified and used 68 studies on the impact of the various modalities of telehealth (e.g., mobile health, remote monitoring, store-and-forward telehealth, and videoconferencing) on specific clinical areas.

The environmental scan included an assessment of specific telehealth modalities and their impact on access, cost, and quality. The four modalities of telehealth NQF examined are:

- Live video (synchronous): A live two-way interaction with a patient and provider using audiovisual telecommunications technology.
- Store-and-forward (SFT) (asynchronous): Transmission of videos and digital images through a secure electronic communications system.
- Remote patient monitoring (RPM): Personal health and medical data from an individual in one location, transmitted to a provider in a different location.
- Mobile health (mHealth): Smartphone apps designed to foster health and well-being.[18]

After a thorough review, NQF classified the varying types of information gathered in the environmental scan into five domains listed in Table 1.

Table 1. Classification Areas of Information for the Environmental Scan

Domains	Potential Information
Access to Care	Timely receipt of health services; access to health services for those living in rural and urban communities; access to health services for those living in medically underserved areas; access to appropriate health specialists based on the need of the patient; increased provider capacity; access to patients that need specialized healthcare services.
Cost	The costs of telehealth for public and private payers; efficient use of services for the patient; difference in cost per service and/or episode of care.
Cost Effectiveness	Effect of telehealth on patient self-management; reduction in medical errors; reduction in overuse of services; cost savings to patient, family. and caregivers related to travel and time away from work.
Patient Experience	Appropriateness of services; increase in patient's knowledge of care; patient compliance with care regimens; difference in morbidity/mortality among specific clinical areas; shared decision making; whether the care provided is safe, effective, patient-centered, timely, efficient, and equitable.
Clinician Experience	Diagnostic accuracy of telehealth applications; ability to obtain actionable information (enough to inform decision making); comfort with telehealth applications and procedures; quality of communications with patients; satisfaction with delivery method; impact on practice patterns.

NQF classified each study it reviewed by the type of telehealth modality and domain of information. Appendix A includes a full description of the methodology NQF used, including the scoring rubric and criteria for selecting articles to include in the report. Appendix B includes the environmental scan findings.

Development of the Measurement Framework

The breadth of the literature, which covered numerous randomized studies and use cases in the areas of mental and behavioral health, dermatology, care coordination, stroke, intensive care, chronic disease management, and other conditions, provided a foundation to develop the framework. The framework is a conceptual model for organizing ideas that provides high-level guidance and direction on priorities for what is important to measure in telehealth and how measurement should take place in order to assess its impact on healthcare delivery and outcomes. The Committee developed this conceptual framework beginning with three distinct categories:

- **Domains** – a categorization/grouping of high-level ideas and measure concepts that further describes the measurement framework;
- **Subdomains** – a smaller categorization/grouping within a domain; and
- **Measurement Concepts** – an idea for a measure that includes a description of the measure, including planned target and population.

The measurement concepts identified in this report are intended to inform future work that all health IT stakeholders may undertake.

The Committee reached consensus that a four-domain model provided the best combination of utility, simplicity, and accuracy in identifying and covering the main components of telehealth. This model framed the Committee's thoughts and ideas about the measurement and evaluation of key telehealth elements.

The central organizing principle of the framework developed by the Committee was that the use of various telehealth modalities provides healthcare services to those who may not otherwise receive it in a timely, effective manner. The use of telehealth does not represent a different type of healthcare, but rather a different method of healthcare delivery that provides services that are either similar in both scope and outcome or supplemental to those provided during an in-person encounter. Continual assessment of access to clinical services, the effectiveness of the telehealth technology, the overall experience of receiving care through a mediated electronic environment, and the financial impact and cost of telehealth services ensures that various modalities of telehealth provide effective, efficient, and essential care. Encounters between a patient or family member and a provider or care team member through telehealth potentially enables the integration of telehealth services into a healthcare setting in a way that minimizes impact on workflow. Quality of care appears in each of the framework's domains and subdomains, as each of these affect the quality of a health outcome or process. For example, an individual who is unable to receive healthcare services because of geographical constraints would have a poor quality outcome. Table 2 summarizes the domains and subdomains determined by the Committee.

Table 2. Domains and Subdomains of the Telehealth Measurement Framework

Domain	Subdomain(s)
Access to Care	• Access for patient, family, and/or caregiver • Access for care team • Access to information

Financial Impact/Cost	• Financial impact to patient, family, and/or caregiver • Financial impact to care team • Financial impact to health system or payer • Financial impact to society
Experience	• Patient, family, and/or caregiver experience • Care team member experience • Community experience
Effectiveness	• System effectiveness • Clinical effectiveness • Operational effectiveness • Technical effectiveness

Domain 1: Access to Care

The first domain of the framework addresses access to care: it addresses whether the use of telehealth services allows remote individuals to obtain clinical services effectively and whether remote hospitals can provide specialized services such as emergency and intensive care. The Committee stated that the domain itself as well as the proposed subdomains should consider five components:

1. Affordability – Are both patients and members of the care team willing to accept the potential costs of telehealth as opposed to the alternative of not receiving or delivering traditional care at all, or receiving delayed care? For providers, what is the cost of providing telehealth services, and what is its effect on other practices?
2. Availability – Does a telehealth modality provide expanded access to a provider that specializes in the type of care required by the patient, when it is required or desired by the patient?
3. Accessibility – Is the technology necessary for a telehealth consultation accessed and used by members of the care team?
4. Accommodation – Do the various modalities of telehealth accommodate the diverse needs of patients? Are patients able to access members of the care team through telehealth when requested?
5. Acceptability – Do both patients and members of the care team accept the use of telehealth as a means of care delivery?

With these overarching guidelines, the Committee developed three subdomains for 'access to care,' including access for patient, family, and/or caregiver, access for care team, and access to information:

- Access for the patient, family, and/or caregiver refers to the ability of patients to receive services from providers they could not access otherwise because of geographical barriers and other logistical difficulties (such as transportation and travel costs). These limitations lead to potential underutilization of necessary services and attrition among those patients who do not have enough visits with an appropriate provider or do not initiate treatment at all.
- Access for the care team means that the providers and other clinical staff have appropriate access to telehealth technologies to provide treatment when needed. For example, in specialties such as behavioral health, the access to a modality such as video-teleconferencing provides a method for the care team to assess and provide specific treatment to patients with conditions

such as post-traumatic stress disorder (PTSD). Access to information refers to both patient and the care team having access to information pertaining to care. For patients, it means access to clinical information which allows them to be active and informed in their care, and for the care team, it means access to sufficient "actionable information" to aid them in decision making and management, such as images of specific skin conditions, electronic health records (EHRs), health information exchanges (HIEs), and direct secure messaging (DSM). Through this subdomain, the care team uses the information they receive or other relevant data to diagnose a patient and develop a treatment protocol.

Domain 2: Financial Impact/Cost

The second domain of the framework addresses the financial impact/cost of telehealth services. While the literature base on telehealth overall has grown over the last few years, the amount of specific research on financial impacts/costs is still sparse. Therefore, the Committee divided this domain into four distinct subdomains: financial impact to patient, family, and/or caregiver; financial impact to care team; financial impact to health system or payer; and financial impact to society.

- The financial impact to a patient, family, and/or caregiver accounts for the potential cost savings and benefits of telehealth such as less travel time to see a provider, less time lost at work, and less out-of-pocket cost, as well as the financial costs such as investment in specialized equipment and internet access if the patient does not have it.
- The financial impact to the care team and individual providers includes the opportunity costs as well as the direct and indirect costs associated with providing care using a telehealth modality.
- The financial impact to payers and health systems is the net financial impact including cost avoidance and opportunity costs. The financial impact to society includes the impact of telehealth on healthcare workforce shortages, the impact on hospitals because of services provided at a distance, the overall health status of a community, economic productivity, patient-provider convenience, and averted care.

Domain 3: Experience

The third domain focuses on the experience of telehealth, which represents the usability and effect of telehealth on patients, care team members, and the community at large, and whether the use of telehealth resulted in a level of care that individuals and providers expected. The Committee divided this domain into three separate subdomains: patient, family, and/or caregiver experience; care team member experience; and community experience.

- For patients, family, and/or caregivers, experience refers to their ability to use the technology, the provision of a mechanism to connect with their providers, and whether the care delivered through various telehealth modalities is comparable to the quality of the care services they would receive during an in-person encounter.
- The care team subdomain reflects the use of telehealth services to facilitate teamwork and the ongoing care of a patient, as well as the utility of the technology to provide necessary information to assist in the provision of care.

- For the community at large, the acceptance and consistent use of telehealth as provided to patients and their families, administrators, and executive leaders is critical to its ongoing use.

Domain 4: Effectiveness

The fourth domain focuses on effectiveness, which represents the system, clinical, operational, and technical aspects of telehealth.

- System effectiveness refers to the ability of a telehealth modality and the overall system to assist in the coordination of care across various healthcare settings; to assist providers in reaching targets for population-based care; and to facilitate the sharing of information between providers to aid in decision making.
- Clinical effectiveness refers to the impact of telehealth on health outcomes or process measures of quality (e.g., confirmed diagnosis of melanoma or improved control of anxiety or depression using cognitive behavioral therapy through telehealth) as well as the comparative effectiveness to in-person provision of services.
- Operational effectiveness revolves around how clinically integrated telehealth is within a hospital, provider practice, community health center, or other care settings.
- Technical effectiveness refers to the ability of the telehealth system to record and transmit images, data, and other information accurately to patients and members of the care team, as well as the system's ability to exchange information between stakeholders seamlessly.

Because of the complex interactions between the implementation and use of various telehealth modalities, multiple aspects of this framework likely apply to multiple issues around telehealth. The assessment, evaluation, and effectiveness of telehealth is multidimensional, and thus quality measurement of telehealth requires multidimensional approaches. For example, the assessment of a measure concept regarding travel time saved per patient by using telehealth services likely affects multiple domains, including access to and availability of care to a patient, financial impact to the patient, and system effectiveness of the telehealth modality to meet the patient's needs.

Prioritizing the Measure Concepts

A measure concept describes the idea for a measure, including the planned target and population. The Telehealth Committee engaged in a process of identifying and then prioritizing measure concepts over a two-day in-person meeting in Washington DC, as well as through several conference calls and webinars, which also included opportunities for public comments.

The in-person meeting to delineate domains, subdomains, and measure concepts was held on March 7-8, 2017 and included a presentation of the environmental scan, a general discussion of the significant concepts around telehealth, and a discussion of how to translate those ideas into specific measure concepts. The Committee discussed how the measurement framework could assist in both the development and categorization of measure concepts, which would ultimately serve as the foundation for the development of measures objectively assessing telehealth. The Committee engaged in a brainstorming exercise to identify potential measure concepts. This process yielded 67 initial measure

concepts, which NQF refined and combined where appropriate, to yield a list of 53 final measure concepts (included in Appendix C).

The Committee worked collectively to identify measure concepts that aligned to each of the domains and subdomains they created as part of the framework. Through consolidation, refinement, and modification of the concepts under consideration, the Committee initially identified 10 key measurement areas, each of which included several measure concepts that could reflect performance in those areas. Each Committee member identified the measure concepts they judged were of the highest priority and provided additional feedback about measurement issues and challenges for each area. NQF staff reviewed this information along with additional written comments provided by the Committee and consolidated the measure concepts into a final list of six key areas for measurement:

1. Travel
2. Timeliness of Care
3. Actionable Information
4. Added Value of Telehealth to Provide Evidence-Based Best Practices
5. Patient Empowerment
6. Care Coordination

The Committee recommends these six areas as having the highest priority overall for measurement in telehealth, but the Committee does not suggest that the order of presentation implies a ranking of importance. Details of the Committee's discussion of each area are included below. At the end of each section, tables demonstrate the domains and subdomains that each key area would fall under, as well as some potential measure concepts that may provide the foundation for future measure development related to this area.

Travel

The Committee stated that one of the primary benefits of telehealth is avoiding travel by patients, their caregivers, and members of their care team because of geographical distance. The Committee also expressed that the use of telehealth can reduce the cost and time of any travel required; reduce the amount of time taken off from work, school, or other commitments; and lead to faster delivery of medical services. A team of researchers at the University Of California Davis, Division of Pediatric Critical Care Medicine, looked at data from the years when the organization has offered telehealth options for specialty care. Its telehealth program offers services across 30 specialties, with centers in 150 locations in 56 out of California's 58 counties. For individual patients who received care through these services, the use of telehealth resulted in an average 278 fewer miles travelled and $156 in travel cost savings per individual patient.[19]

The element of patient preferences is an important consideration in measurement. Assessing decreases in travel time and overall cost savings would need to take account the type of care provided through telehealth and the availability of specialty services. For example, synchronous video communication between a patient and a provider measures and evaluates peak flow and spirometry readings. The results of these readings may indicate that the patient is not experiencing an acute asthma

exacerbation, and therefore existing medications would provide enough control; alternatively, the readings may indicate that the asthma is severe enough that an in-person visit is essential. Measures should provide a basis on which a patient and care team can make informed decisions.

Finally, the Committee emphasized that measurement of travel should not be considered as just an accrued benefit for cost savings and convenience, but also be used to determine if the use of telehealth led to the correct diagnosis and appropriate follow-up care, which mitigated the need for further travel. The time that the patient saves on the initial visit is measured, but should factor in the results, as a negative diagnosis would eliminate the need for an in-person second visit.

Primary Framework Domains	• Effectiveness • Financial Impact/Cost
Applicable Framework Subdomains	• System effectiveness • Financial impact to health systems or payers
Measure Concepts	• The duration of the visit through telehealth compared to in-person care • The amount of time for a patient to check in for a visit

Timeliness of Care

Numerous studies demonstrate the association between timely care and health outcomes. Some of the factors that lead to worse survival rates with conditions such as cancer included delayed diagnosis and treatment, missed abnormalities that showed on a screening, and patients with correctly identified abnormalities who did not attend a follow-up with a physician. Furthermore, delayed diagnosis after an initial screening leads to worse survival rates among patients with specific types of cancer (e.g., lung cancer) and complications because of chronic disease. One study focused on efforts to improve communication between specialists and thoracic surgeons with respect to the care of cancer patients by using multidisciplinary meetings via videoconferencing.[20] This led to a significant improvement in timeliness for both diagnosis and interventions.

Because reducing the time between an initial request for care and a consultation is an important area for telehealth, the Committee agreed that timeliness of care is an important area for measurement. In the past, NQF has also recognized this as a crucial concept, having endorsed measures that discuss the need for timeliness of care in the areas of neonatal care, stroke, heart failure, and chronic disease.

The Committee suggested that the measure concepts focus on timeliness for appropriate decision making in that the use of telehealth services may provide a quicker diagnosis, which leads to faster delivery of interventions and better outcomes. One example provided was that of stroke, comparing telestroke patients in their likelihood of timely access to an expert assessment of the need for tissue plasminogen activator (tPA), the delivery of which may help to avoid a poor outcome.[21]

Primary Framework Domains	• Access • Effectiveness • Experience • Financial Impact/Cost
Applicable Framework Subdomains	• Access for patient, family, and/or caregiver • System effectiveness • Experience of patient, family, and/or caregiver • Cost to patients, families, and/or caregivers
Measure Concepts	• What is the availability of information delivered using telehealth for those specialty providers that consult with the primary care provider? • What is the overall amount of a patient's time spent during a telehealth consultation not directly related to care?

Actionable Information

The use of telehealth technologies must provide actionable information for members of the care team to use during an initial encounter. This information may include data that allow a provider to diagnose and treat the patient, as well as provide any needed follow-up care. Furthermore, the Committee pointed out that understanding this area may assist in redefining a visit through telehealth. Current quality measures assess structure, process, or outcomes based on an in-person encounter. This encounter constitutes a visit, as a member of the care team can obtain and view information to provide a diagnosis and treatment. If a telehealth visit provides actionable information through a specific modality, then the care team member can still ascertain the health status of the patient and provide a diagnosis and treatment, which would then also constitute a visit. Therefore, for each of the quality measures that may pertain to a clinical area that employs telehealth services, there is little need to modify the measure if a telehealth modality provides the same actionable information gathered through an in-person visit.

Primary Framework Domain	• Effectiveness
Applicable Framework Subdomains	• Clinical effectiveness • System effectiveness
Measure Concepts	• The instructions for care were clear to the patient • The system was able to effectively provide the care that was recommended

	• Comparative effectiveness of telehealth vs. in-person provision of care

Added Value of Telehealth to Provide Evidence-Based Best Practices

For some telehealth modalities, the patient uses the equipment to both self-monitor and maintain consistent communication with providers. This active collaboration may enhance active management of symptoms and possible reduction in emergency department visits and hospitalizations. Specifically, the use of telehealth demonstrates the ability to reduce costs, hospitalizations, and readmission rates in the area of chronic disease.[22] For example, heart failure is one of the most prevalent chronic illnesses; it affects more than six million Americans and costs approximately $39.2 billion annually in the United States, with hospitalization accounting for 70 percent of those costs. Readmission rates at 30 days for heart failure patients are 24 percent nationwide and rise to 50 percent by 90 days, though half of those may be preventable. One systematic review to assess the effectiveness of telehealth in managing patients with chronic heart disease found that the use of telehealth led to reductions in hospitalizations and readmissions, and improvements in mortality and cost-effectiveness.[23]

Using telehealth devices within the home allows more visits by nurses or other members of the care team, and increases patient access to care through remote monitoring, and working with patients to transmit data on a regular basis. A study conducted by the University of Pennsylvania School of Nursing showed that patients using telehealth at home to allow nurses to monitor their conditions remotely and to have patients send in consistent data were readmitted to the hospital 3 percent less often than usual care patients.[24] After 60 days, the overall readmission rate was 6 percent less for telehealth patients. Cost estimates based on these findings showed that decreasing readmissions by just 5 percent could save Medicare over $5 billion annually. Among heart failure patients, the use of telehealth monitoring decreased the rate of readmission from 46 to 21 percent.

The Committee determined that one of the major measures of telehealth should be the ability to access healthcare services, through one or more telehealth modalities, compared to the inability to receive needed care. Other related significant areas for measurement include the use of telehealth services to deliver appropriate and needed care at the time of the encounter and the avoidance of adverse outcomes.

Primary Framework Domains	• Effectiveness • Financial Impact/Cost
Applicable Framework Subdomains	• Clinical effectiveness • Financial impact to patients, families, and/or caregivers • Financial impact to health systems or payers
Measure Concepts	• Decrease in the length of stay in the hospital

	• Telehealth services prevented urgent or emergency care being delivered to a patient • Avoidance of an adverse outcome and subsequent medical malpractice lawsuits

Patient Empowerment

As the telehealth field expands across the healthcare spectrum, it can potentially affect patient engagement. Patients can track their medical conditions, outcomes, and overall wellness through a variety of tools, and remain in contact with their physicians to engage more fully with their medical status. The Committee articulated that the use of telehealth, particularly specific modalities such as remote monitoring, assists with adult learning and cognitive behavioral theories to promote patient self-efficacy with disease management. Patients can empower themselves to learn about improving health-related behaviors, and providers can learn how to use these technologies to improve communication with their patients as well as their patients' overall satisfaction with care.

As an example of efforts to improve communication and disease management, Banner Health, an Accountable Care Organization in Arizona, allows patients to use telehealth to connect to a series of providers and to view their own data.[25] The ability of the care team to interact with patients to communicate their diagnosis and treatment plans helps improve compliance and overall outcomes.

In addition, a recent study of hip and knee replacement patients at a hospital in Virginia found that the patients who participated in the telehealth program experienced improved benefits. This included shorter hospital stays, discharging directly to their home, and responses to post-discharge surveys at a higher rate (79 percent as opposed to 18 percent) as compared to those who did not participate in the program. Additionally, there were no hospital readmissions of the telehealth program participants within 30 days of their surgeries, and 90 percent stated that telehealth improved their episode-of-care experiences, assisted them in better understanding their care and setting their expectations, and improved their satisfaction with the care they received.[26]

Primary Framework Domain	• Experience
Applicable Framework Subdomain	• Patient, family, and/or caregiver experience
Measure Concepts	• Patients demonstrated increased confidence in care plan • Patients demonstrated increased understanding of care plan • Patients demonstrated compliance with their care plan

Care Coordination

The Committee viewed the coordination of care for patients with complex care needs (e.g., patients with multiple chronic conditions, patients in need of rehabilitative services, and patients in need of specialty care) as a vital component of care. Telehealth may facilitate communication, information sharing, and joint decision making in the transition of care from the outpatient to inpatient setting, from the inpatient setting to a long-term nursing facility, and between other clinical settings. An objective assessment of telehealth's ability to facilitate such coordination would be a precursor to determine the success of a telehealth program and its impact on health outcomes.

As articulated in the literature review, the VA uses telehealth services and leverages a variety of tools to coordinate care among different healthcare providers.[27] One of the areas in which the VA uses telehealth to strengthen care coordination is with traumatic brain injury (TBI) patients. With this population, there is ongoing and consistent communication among families, caregivers, patients, and medical experts. The use of telehealth modalities to support telerehabilitation involves TBI screening, assessment, consultation, and care to patients and remote military medical centers, as well as sites in which demand for specialized care fluctuates with mobilizations. Additionally, the use of video and remote monitoring technologies assists in identifying TBI through electronic cognitive assessment systems; provides real-time video visits with family members; shares information among clinical care teams to collaborate on TBI care; and provides interactive video programs and web-based courses to train medics, physician assistants, nurses, and other providers in both civilian and military settings.[28]

Primary Framework Domains	• Experience • Effectiveness
Applicable Framework Subdomains	• Patient, family, and/or caregiver experience • Care team member experience • Patient, family, and/or caregiver effectiveness • Community effectiveness • Clinical effectiveness
Measure Concepts	• The amount of care coordination needed due to the use of telehealth services • Overall number of multidisciplinary visits • Overall improvement in quality of life because services are received at home via telehealth

Case Studies Illustrate Proposed Measure Concepts

One of the points that the Committee wanted to emphasize within the framework was the usefulness of case studies to help provide context for the proposed measure concepts, and demonstrate how to turn these into measures in the future. In this manner, the patient's journey using telehealth incorporates the ability to discern whether the use of telehealth services differs markedly from that of an in-person

patient encounter. The Committee put forth the following case studies to illustrate the use of telehealth for both provider-to-patient interactions, as well as provider-to-provider interactions.

One: Managing Mild to Moderate Heart Failure Symptoms

Frances is a 63-year-old retired teacher with mild to moderate heart failure. She notices one morning that she is a little more winded than usual and texts her doctor's office. The office responds with a text link to 10 different time slots for a video visit later that day. She selects one and later that day has a 10-minute video chat with her doctor, who suggests some alterations to her medications. She feels reassured and goes to bed, but awakens in the middle of the night with shortness of breath. She gets frightened, and uses a mobile health application on her phone where she connects with an emergency physician within minutes. The emergency physician assesses her respiratory rate and recommends that she take an additional dose of diuretic. The on-demand doctor schedules an early-morning visit by the community paramedicine team who check her blood pressure, heart rate, oxygenation, and weight. She then participates in a 5-minute check-in to review her medication plan with her primary care physician (PCP). They leave her a Bluetooth-enabled scale that communicates with the office of her PCP, and they discuss a plan for diuresis to achieve a 5-pound weight loss over the next few days.[29]

Primary Framework Domains	• Experience • Effectiveness • Access • Financial Impact/Cost
Applicable Framework Subdomains	• Patient, family, and/or caregiver experience • Clinical effectiveness • Technical effectiveness • Access for patients, families, and/or caregivers • Financial impact to health plans or payers
Potential Measure Concepts	• Patients demonstrated increased understanding of care plan • Technologies were in a satisfying condition for providers to do their job • The instructions for care were clear to the patient • Able to provide care without admission into the ER

Two: Resuscitation and Transfer

Bill presents as hypotensive and febrile when he arrives at a community emergency department (ED) where he meets an emergency physician who recognizes that Bill is septic. The physician orders several tests including laboratory blood tests, blood cultures, and a chest x-ray; establishes large-bore intravenous access; orders a fluid bolus and antibiotics; and then asks the nurse to have the virtual

resuscitation service engaged so that they can maximize Bill's resuscitation while the single coverage provider maintains control over the rest of the busy department. After about an hour, Bill's condition worsens despite aggressive resuscitation, and he starts on vasopressors ordered by the resuscitation service. The resuscitation expert and the ED doctor agree on a plan to intubate Bill and transfer him to the referral center. The resuscitation expert travels virtually with Bill and smoothly transitions his care into the intensive care unit at the receiving hospital by giving a virtual face-to-face report to the receiving team.[30]

Primary Framework Domains	• Effectiveness • Access • Financial Impact/Cost • Experience
Applicable Framework Subdomains	• System effectiveness • Clinical effectiveness • Financial impact to patients, families, and/or caregivers • Access for patient, family, and/or caregiver • Access for care team members • Financial impact to health system or payer • Financial impact to society • Patient, family, and/or caregiver experience • Care team member experience
Potential Measure Concepts	• Telehealth services allowed urgent or emergency care to be delivered to a patient • The system was able to effectively provide the care that was recommended • Avoidance of an adverse outcome and subsequent medical malpractice lawsuit

Three: Knee Surgery and Related Health Encounters

After suffering from chronic knee pain for years, Mike decides to have the bilateral knee replacement his doctor recommended. Because of his comorbid conditions, the local providers suggest that the orthopedic team at the downtown referral center should perform the procedure. Mike is reluctant to travel downtown but calls the orthopedic team to ask about logistics. They report that his primary medical doctor can do the blood and stress tests, that the anesthesia team will interview him using a video chat, and that he can have a virtual postoperative visit from his home. Going to the referral facility only once for the surgery itself makes it easy for him to move forward with the surgery at the more appropriate site of care.[31]

Primary Framework Domains	• Effectiveness • Access

	• Financial Impact/Cost • Experience
Applicable Framework Subdomains	• System effectiveness • Access of patients, families, and/or caregivers • Cost to patients, families, and/or caregivers • Cost to society • Experience of patients, families, and/or caregivers
Potential Measure Concepts	• Patients can conduct visits using a telehealth modality on their own • Providers were able to see complex patients more efficiently • Was travel eliminated or travel time reduced for a specific patient encounter because of telehealth services? • Amount of patient's time spent during a telehealth consultation

Impact of MACRA on the Telehealth Framework

Each of the case studies above demonstrates the use of various modalities of telehealth in healthcare delivery and the potential ways in which it may be measured. This is significant as the Medicare Access and CHIP Reauthorization Act (MACRA) represents a new mechanism of reimbursement for telehealth services for Medicare providers. The repeal of the sustainable growth rate (SGR) led to the streamlining of multiple quality reporting programs into the new Merit-based Incentive Payment System (MIPS), which is part of the overall Quality Payment Program (QPP). A major component of MIPS is an improvement activity (IA), defined as improving clinical practice or care delivery.

The proposed activities for each IA divide into nine subcategories corresponding to CMS' stated goals:[32]

1. Expanded practice access: IAs include expanded practice hours, telehealth services, and participation in models designed to improve access to services.
2. Population Management: IAs include participation in chronic care management programs, participation in rural and Indian Health Services programs, participation in community programs with other stakeholders to address population health, and use of a Qualified Clinical Data Registry (QCDR) to track population outcomes.
3. Care coordination: IAs include use of a QCDR to share information, timely communication and follow-up, participation in various CMS models designed to improve care coordination,

implementation of care coordination training, implementation of plans to handle transitions of care, and active referral management.

4. Beneficiary engagement: IAs include use of EHR to document patient reported outcomes, providing enhanced patient portals, participation in a QCDR that promotes the use of patient engagement tools, and use of QCDR patient experience data to inform efforts to improve beneficiary engagement.
5. Patient safety and practice assessment: IAs include use of QCDR data for ongoing practice assessments and patient safety improvements and use of tools such as the Surgical Risk Calculator.
6. Participation in an alternative payment model (APM) including a Medical Home Model: An APM can be an innovative payment model, a Medicare Shared Savings Program under an Accountable Care Organization (ACO), or a Medicare Demonstration Model. In all three cases, providers are eligible for bonus payments as long as they use quality measures under MIPS, use certified EHR technology, and assume more than a "nominal financial risk" or they are a medical home expanded under the Center for Medicare and Medicaid Innovation (CMMI). Only certain APMs qualify for full credits, whereas certain other APMs only give half credit.
7. Achieving health equity: IAs include seeing new and follow-up Medicare patients in a timely manner and use of QCDR for demonstrating performance of processes for screening for social determinants.
8. Emergency response and preparedness: IAs include participation in disaster medical teams or participation in domestic or international humanitarian volunteer work.
9. Integrated behavioral and mental health: IAs include tobacco intervention and smoking cessation efforts, and integration with mental health services.

The statute requires the incorporation of telehealth in coordinating patient care and includes telehealth use in scoring for MIPS. The MIPS score determines payment adjustments to clinicians based on performance. By statutory definition, telehealth encompasses "professional consultations, office visits, and office psychiatry services" and any additional service specified by the Secretary of HHS. Telehealth was included in the final rule in two ways:

1. Expanded practice access: The use of telehealth services and data analysis for quality improvement, such as participation in remote specialty care consults or teleaudiology pilots. The weight of this subcategory in the MIPS overall score lists as "Medium."
2. Population management: MIPS eligible clinicians prescribing warfarin must attest that 60 percent or more of their ambulatory care patients receiving the medication are managed by one or more clinical practice IAs. One of these activities will be telehealth that involves systematic and coordinated care for rural or remote beneficiaries. The weight of this subcategory in the MIPS overall score lists as "High."

Additionally, the use of APMs also facilitates the use of telehealth through new models such as Next Generation ACO.[33] These models will have the flexibility to waive "originating site" coverage restrictions as well as the requirement that beneficiaries be located in a rural area for telehealth services. For example, Medicare's originating site restrictions require that beneficiaries be located at specific settings,

such as a rural health center, critical access hospital, or a physician's office, when receiving telehealth services. The telehealth waiver gives Next Generation ACOs the flexibility to allow patients to be at other settings, including their home. For the Medicare beneficiary, this opens up new ways of engaging with his/her care team that would not require travel. Furthermore, another APM model is the Medicare Shared Savings Program (MSSP), which recognizes telehealth services as a clinical practice improvement activity (CPIA) and allows physicians who provide patients with equipment for remote patient monitoring to be eligible for fraud and abuse waivers.[34]

Initial Measure Selection

The Committee examined a list of initial measures include in the framework, including ones identified in the literature that demonstrate a positive effect on a specific clinical condition with the use of telehealth, as well as ones that could potentially be used in CPIAs under the MIPS regulation and potentially an APM. The scan reviewed measures from the AHRQ National Quality Measures Clearinghouse (NQMC), the NQF Quality Positioning System (QPS), and those proposed measures used to evaluate physicians under MIPS. Table 3 identifies the total number of measures per clinical area identified in the environmental scan.

Table 3. Total Number of Quality Measures per Clinical Area

Category	Number of Measures
Mental and behavioral health	13
Dermatology	2
Chronic disease	26
Rehabilitation	15
Care coordination	17

The Committee determined that the initial selection of measures for inclusion into the framework should be limited to NQF-endorsed measures. This ensures that each measure has gone through a rigorous evaluation process, has a strong evidence base indicating its need, and has been independently assessed by a committee of experts in that clinical area to be feasible, reliable, and valid. Appendix D shows the initial measures that the Committee chose.

Relationship to Other NQF Projects

NQF also reviewed two prior projects related to providing care to both adults and children across clinical specialties. These projects highlight the potential use of telehealth to capture individuals' and providers' goals, preferences, and desired outcomes.

In Essential Attributes of a High-Quality System of Care: How Communities Approach Quality Measurement, NQF examined methods used by communities to ensure a high-quality healthcare system

for adults with complex care needs. This project developed case studies based upon a SCAN Foundation report, What Matters Most: Essential Attributes of a High-Quality System of Care for Adults with Complex Needs, which described the four essential attributes of a well-functioning system of care. In this system, individuals are able to live their lives with services and support reflecting their values and preferences in the least restrictive, most independent setting possible. The four essential attributes are:

1. Each individual has identified a range of needs and goals, both medical and nonmedical, as well as for family/caregivers, that drive care plans while undergoing consistent review and evaluation.

2. Each individual's needs characterize a compassionate, meaningful, and person-focused method and incorporate into a care plan that is tailored, safe, and timely.

3. Individuals have a cohesive, easily navigable delivery system so that they can get the services and information they want by themselves or with support when needed, and avoid the services they do not need or want.

4. Individuals and their family/caregivers continually inform the structure of the delivery system to ensure that it is addressing their needs and providing resources tailored to them.

These attributes align with the benefits of telehealth, particularly in the area of care coordination, as telehealth provides a means of delivering care to individuals where access to specific services may not be readily available. In addition, family members and/or other caregivers can be included to document the appropriate medical information and patient preferences and ensure that they inform the prescribed care plan.

NQF's report Performance Measurement for Rural Low-Volume Providers highlights the challenges that rural providers face when delivering care and engaging in performance measurement. The report states that geographically isolated areas have fewer healthcare settings and providers than less isolated areas, and patients in these very rural areas may experience difficulties accessing care due to lack of transportation and lack of information technology capabilities. Furthermore, the report shows that rural areas have a disproportionate number of vulnerable residents and often do not have enough patients to participate in performance improvement activities. As the literature review highlights, the use of telehealth has increased access to care for individuals living in rural or underserved areas. Each one of the modalities of telehealth effectively provides services and treatment for a variety of conditions and helps coordinate care between providers. The use of telehealth can potentially increase the number of patients seen and included within specific quality measures. This can improve performance and quality improvement activities within rural communities and improve individual health.

Future Considerations for the Development of the Framework

It is important to consider the following points as the development and identification of measures related to telehealth commences.

1. **The use of various telehealth modalities demonstrates a positive effect on quality health outcomes, processes, and costs.** The use of telehealth (across a variety of clinical conditions) may have a positive impact on quality outcomes and processes of care; can lead to increased access to services; may provide a cost-effective means of delivering care; and has generally been well-received by both providers and individuals.
2. **Existing quality measures to evaluate the effectiveness and benefits of telehealth must be widely accepted and impactful.** While a number of measures identified by AHRQ, NQF, and CMS relate to telehealth, it is difficult to ascertain which measures would suffice to assess whether telehealth is comparable to, or an improvement over, in-person care. Additionally, the use of existing measures to assess telehealth should not add any additional burden to the collection and reporting of data from providers, and should contain data that match the specifications of the measure.
3. **Consistent definitions through proposed measure concepts and existing measures.** Consensus to define terms and measures for proposed measure concepts or existing measures for which there are no common definitions remains essential. Without a standard, uniform definition for measures, it will be difficult to synthesize findings and assess telehealth's impact.

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Appendix A: Methodology

The primary purpose of the environmental scan was to identify issues applicable to telehealth through literature to facilitate consideration of what measure concepts should be included in the measure framework, and how to classify telehealth through specific domains. NQF used resources such as PubMed, JSTOR, and Academic Search Premier, as well as grey literature and web searches through Google to identify reports, white papers, and other documentation related to telehealth.

Additionally, NQF constructed the environmental scan to use the following literature and information to inform pertinent stakeholders:

- Reports issued from the AHRQ (such as the Evidence Map, a 2016 Report to Congress issued by the Department of Health and Human Services on E-Health and Telemedicine) and reports from HRSA.
- Reports developed by organizations such as the American Telemedicine Association (ATA) and the NARHP to provide information on different facets of telehealth and its benefits to those in rural health areas, medically underserved areas, and general patient populations.
- Published studies by researchers who have examined the utility and benefits of telehealth on outcomes of care. These reports focus on the use of various delivery methods of telehealth and their effect on clinical processes and outcomes.
- A review of reports published by NQF on rural health, care coordination, population health, home and community-based services, and health and well-being to discuss how telehealth can intersect in both the measurement framework and measures considered for endorsement.
- A review of the legislation and proposed rules under the Medicare and Children's Health Insurance Program Reauthorization Act (MACRA) and the parameters that define a clinical practice improvement activity so that a multistakeholder Telehealth Committee can determine how telehealth could fit within the framework.
- An analysis of the Merit Incentive Payment System (MIPS) to examine those activities as compared to those of Alternative Payment Models (APMs) and APMs in general, given that telehealth is included in these models by statute.

NQF used an initial set of key search words that were both general and specific to a modality of telehealth such as telehealth, telemedicine, mobile health (mHealth), electronic health (eHealth), telepathology, teleradiology, telestroke, eICU, telepsychiatry, teledermatology, teleophthalmology, telemental health, quality of care, home health monitoring, telecommunications, rural health, and others. NQF formulated the aforementioned key terms into simple queries to generate the largest number of results, such as "telehealth" and "quality of care." Given the need to keep the information as current as possible, NQF excluded all articles older than the year 2000. NQF reviewed the titles, keywords, and abstracts of the identified articles to determine if the information aligned with the key

domains listed above. Numerical scoring assisted in the classification and ranking of the papers using the following criteria:

1. The content of the paper aligned with one of the domains listed in Table 1.

2. Results followed from vigorous and scientifically sound methodologies with a strong evidence base that generated the analysis. (i.e., statistical analysis, case studies, interviews with experts, randomized controlled studies, mixed method analysis). Studies that were descriptions of telehealth in general, broad descriptions of telehealth modalities, or telehealth studies not yet concluded were not included.

3. The degree to which the study helped address one of the aforementioned research questions.

4. The paper had a well-articulated scientific method and well-defined research scope and did not broadly discuss telehealth or undertake any study to determine its impact on outcomes.

5. The published results validated the research study.

If the research study completely satisfied an identified criterion, NQF gave a score of 2; semi-satisfactory agreement with criteria[a] incurred a score of 1; absence of study content meeting criteria led to a score of 0. All papers that had a score below 7 were excluded from this study. The results were documented in a chart similar to the one in Table A1.

Table A1. An Example of the NQF Scoring Matrix for Evaluating Telehealth Literature

Domain	Paper	C1	C2	C3	C4	C5	Total
Access to Care	A Review of Telehealth in Rural Areas Daigle, Azara, et al. (2008)	2	1	2	0	2	7

From the selected papers, NQF extracted general data such as the title, authors, publication year, keywords, and other publication criteria. NQF abstracted any other information that assisted in rating the study by quality assessment metrics such as research methodology definition, contributions of the

[a] Semi-satisfactory results were those that met most of the criteria, but not did not fully satisfy each of the objectives (e.g., the study had articulated a comprehensive research method, but their research scope was perhaps too broad).

study, research questions, and the overall discussion. NQF staff reviewed and scored each of the papers, with a second review from the project senior director.

Because of the variability in modalities of telehealth, outcomes, and the clinical setting in which telehealth was assessed, NQF determined that a meta-analysis was inappropriate. Instead, an evidence table displayed the study characteristics and the outcomes, and how they aligned to both the appropriate research question, the telehealth modality, the nature of the intervention, and the primary/secondary outcomes for each study. NQF summarized findings for each modality to determine general themes or ideas to incorporate into the measure framework, as well as guide the initial selection of existing quality measures. This varied slightly from the AHRQ Evidence Map, which developed a guiding framework that focused on the current research on the effectiveness of telehealth interventions, as well as current gaps in the research. The information gathered for the NQF report did not focus on the breadth and detail of the research, but rather on how each individual study informed the development of measure concepts to assess telehealth on outcomes of care.

NQF reviewed over 390 titles and abstracts from the electronic search, as well as other briefings and reports from the grey literature. From this, NQF identified 180 papers that scored a seven or above based on the scoring model and alignment with the research criteria and telehealth modalities. It was possible for a paper to address more than one criterion or apply to more than one modality. All of the papers NQF reviewed focused on the use of telehealth and its relationship to patient's outcomes with an emphasis on specific study types, such as randomized controlled trials (RCTs), in order to understand the relationship between telehealth and patient care. Further review of the articles after scoring indicated that some articles were not appropriate for inclusion in this report because:

- Some discussed the methodology for the initiation of studies that had not been concluded;
- Several did not present enough conclusive evidence to appropriately evaluate the effectiveness of telehealth on a clinical condition;
- A few articles did not discuss a specific modality of telehealth; or
- The articles presented a general discussion of telehealth that provided limited value to this report.

As a comparison, the AHRQ Evidence Map identified 1,494 citations of which 58 met their inclusion criteria for the study.

Appendix B: Environmental Scan Findings

The environmental scan focused on several different telehealth modalities including mobile health (mHealth), remote monitoring, store-and-forward communication, and videoconferencing/Internet-based technologies. Further, the scan examined the impact of each of the modalities on the process and outcomes of care, access to care, cost efficiencies and the experience of care for both patients and clinicians. NQF focused on the type of study conducted, the results of the study, and how it could inform the development of concepts for use in measure development.

Access to Care

Three studies examined the impact of mHealth on patients' increased access to healthcare services through mobile technology to monitor, self-assess, and report their findings back to providers. One six-month study[1] recruited patients with moderate to severe psoriasis to use mobile monitoring to increase compliance with psoriasis therapy. All of the 155 adverse events to therapy reported by patients came through feedback text messages or with an additional phone call. More than 88 percent of patients assessed this system as a "very good idea" and would use their own mobile phones for this procedure in the future. Another one-year study involved children and adults with atopic dermatitis receiving care in medically underserved areas, outpatient clinics, and the general community. Through a randomized controlled trial (RCT), patients would receive either in-person care or direct-access care using an online model.[2] The investigator found the online model resulted in improvements in clinical outcomes equivalent to in-person care. Other advantages to this approach included direct and expedient clinical interactions as well as removing the need to travel to a facility.

Researchers at the Children's University Hospital in Dublin, Ireland, developed a smartphone application to address adolescent obesity[3]. Children participating in the 12-month study that were between 12 and 17 years of age with a body mass index (BMI) greater than the 98th percentile. Those in the mHealth group had a smartphone application that incorporated evidence-based behavioral change tools such as self-monitoring, goal setting, and peer support. Patients were also encouraged to set daily goals and monitor their progress. The study results demonstrated improvements in self-management habits using mHealth.

Six studies described the use and impact of remote monitoring on increasing access to care for cancer, diabetes, asthma, and stroke. Three of the six studies described the use of remote monitoring among United States veterans. One study examined the utility of the VA's inpatient and outpatient Care Coordination/Home-Telehealth (CCHT) program to provide remote management of symptoms using home-telehealth technologies.[4] The CCHT consisted of 43 patients, while the control group that received regular in-person treatment consisted of 82 patients. After a six-month period, patients in the CCHT had significantly fewer preventable complications, bed days of care for hospitalization (all-cause), chemotherapy-related hospitalizations, and bed days of care for chemotherapy. The program demonstrated successful management of complex cancer symptoms in the CCHT without using in-person inpatient or outpatient services. A study of CCHT to support veterans with chronic conditions conducted over a four-year period showed a 25 percent reduction in bed days of care and a 19 percent reduction in the number of hospital admissions.[5] A final study of the CCHT program examined 400

veterans with type 2 diabetes mellitus (DM) who were at high risk for multiple inpatient and outpatient visits.[6] The CCHT group employed a messaging device wherein nurse care coordinators answered patients' questions about DM; if needed, the nurse coordinators would arrange for an additional 15- to 30-minute phone call with a physician. After a two-year period, the analysis demonstrated a statistically significant reduction in the likelihood of all-cause and DM hospitalizations and a lower likelihood of having care-coordinator initiated primary care clinic visits.

Researchers at the University of Edinburgh developed a telemetric monitoring program to assess glycemic control, blood pressure, and weight among individuals with poor diabetes control. Individuals with type 2 DM and a confirmed HbA1c >7.5 percent used wireless technology to transmit blood glucose results, blood pressure readings, and weight to a remote server. Advanced practice nurses accessed these data to develop customized care plans for patients and determine if an in-person visit to a physician or hospital was necessary.[7] Similarly, a telehealth program developed in Australia known as Management of Asthma with Supportive Telehealth of Respiratory Function in Pregnancy (MASTERY) used a mobile application (*Breathe-easy)* to monitor lung function twice daily and record asthma symptoms and medication usage on a weekly basis.[8] This intervention allowed for earlier identification of worsening asthma and prevented exacerbations.

Researchers from the University of Pennsylvania and the Philadelphia Department of Public Health examined the use of store-and-forward teledermatology for outpatient diagnosis and management and its impact on access to dermatologic care in a resource-poor primary care setting.[9] A prospective study of 11 underserved clinics in Philadelphia occurred for a period of 10 months in 2013. During the study period, primary care physicians (PCPs) used a mobile store-and-forward platform to send more than 190 consults covering more than 206 dermatologic conditions to dermatologists at the University of Pennsylvania. The results showed the median time to consult completion was 14 hours, and 77 percent of all consults occurred by teledermatology alone. The overall conclusion was that this form of teledermatology was impactful in delivering care to resource-poor primary care settings.

The VA Puget Sound Healthcare System implemented a three-year project using store-and-forward technology for dermatology care and tracked completion of recommendations from dermatologists.[10] Twenty-seven rural outpatient clinics and centers in the Pacific Northwest that did not have access to a full-time dermatologist participated. More than 5,000 veterans participated with an evaluation of approximately 370 major dermatologic cases. The initial consultation involved the PCP taking photographic images and sending them to a teledermatologist at the Teledermatology Coordinating Center (TCC) in Seattle, Washington, who made an evaluation and alerted the PCP to the recommended treatment plan for the patient. Despite the difficulties in effectively using store-and-forward as a means of tracking follow-up procedures, the pilot study eventually led to better patient care and greater quality assurance because of the tracking features of the TCC.[10]

Ophthalmologists at the Albert Einstein Medical Center studied the impact of store-and-forward telehealth, including the quality of imaging, on the accuracy and reliability of a diagnosis of retinopathy of prematurity (ROP). This team of doctors examined 67 infants over a one-year period. Initially, a trained neonatal nurse used wide-angle retinal imaging on infants between 31 to 37 weeks

postmenstrual age (PMA).[b] A web-based telemedicine system uploaded the data as three retinal experts examined it to determine the risk and/or presence of ROP and to prescribe treatment. The researchers concluded that the diagnostic accuracy using telehealth for infants between 35 and 37 weeks PMA was consistent with the diagnostic accuracy of an in-person assessment, and the reliability of the ROP diagnosis for infants between 35 and 37 weeks PMA was 89 percent.[11]

Several articles identified during the environmental scan illustrate the impact of videoconferencing on access to services for hepatitis C, COPD, mental health, stroke, and HIV/AIDS. The University of New Mexico (UNM) created the Extension for Community Health Outcome (ECHO) model to improve care for underserved populations with health problems such as hepatitis C virus (HCV) infection.[12] Despite the advances in treatment and improvements in cure rates, the number of patients receiving needed treatment or medications has been decreasing since 2002. The ECHO program assisted in training remote providers to treat complex diseases. Using a prospective cohort study, researchers compared treatment for HCV infection at 21 ECHO sites in rural areas and prisons against treatment provided at a UNM HCV clinic. The study cohort included 407 patients who had received no previous treatment. The major outcome measure was a sustained virologic response. At the end of the study, 58.2 percent of patients who received treatment at the ECHO sites saw a sustained viral response, and only 6.9 percent of the patients had an adverse event.

Patients in rural areas continue to face significant barriers in accessing appropriate and needed mental health treatment.[13] Individuals who present to critical access hospital emergency departments (EDs) with mental health conditions often do not receive timely evaluations and are, at times, unnecessarily admitted for observation or discharged before a trained professional is able to see them. Researchers at the University of Indiana conducted retrospective data collection to study patients presenting in the ED for 212 days prior to telemedicine interventions and for 184 days after. The intervention was the use of interactive videoconferencing between nurses at the hospital and trained mental health staff in community health centers. After a 13-month study period, the use of telehealth led to significant reductions in length of stay and time to initial consultation.

Another study at the Oregon Health and Sciences University used Skype videoconferencing to deliver behavioral health services to rural adolescents who had poorly controlled type 1 DM. Seventy-one patients received up to 10 sessions of a family-based behavioral health intervention through Skype, and the results demonstrated overall adherence to DM regimens. Additionally, the therapeutic relationship between the patient and the therapist was similar to that of in-person care.[14]

The VA Medical Center in Charleston, South Carolina, used telehealth to reach veterans in rural areas suffering from post-traumatic stress disorder (PTSD). The concept was to use videoconferencing as a modality for evidence-based psychotherapy (EBS), which has been shown to be an effective treatment for PTSD. After studying 59 combat veterans over an eight-week period in which they received EBS, their symptoms of both PTSD and depression decreased significantly.[15] A similar VA study in the Pacific Islands

[b] Postmenstrual age – gestational age plus chronological age.

Healthcare System used videoconferencing to deliver cognitive processing therapy—cognitive only version (CPT-C)[16]—to a group of rural veterans with PTSD. Over a period of four years, 62 veterans each received 12 sessions of CPT-C with assessments taken at baseline, mid-treatment, immediately after post-treatment, and at three- and six-month intervals. Clinical and process outcomes demonstrated no noticeable differences to in-person treatment, while reductions in PTSD symptoms occurred immediately after post-treatment.

Thrombolytic therapy for patients with stroke can be effective in reducing stroke disability if there is rapid and appropriate use of the therapy. One study evaluated whether telehealth assisted with quicker decision making in the use of thrombolytics in the time-pressured circumstances of acute stroke.[17] Over a three-year period, a randomized distribution 234 patients occurred—stratified to either a telehealth program or a telephone consultation—to assess suitability for thrombolytics. The telehealth group more often experienced a higher incidence of correct decisions, and patient data were more complete. Additionally, those in the telehealth group had a lower rate of intracerebral hemorrhage, low technical complications, and favorable time requirements to support the efficacy of making treatment decisions.

The delivery of comprehensive care for individuals with HIV infection in rural and low prevalence settings has consistently posed a challenge. Researchers at the Veterans Rural Health Resource Center in Iowa developed a telehealth collaborative care (TCC) program for persons with HIV in a rural area.[18] This program integrated videoconferencing with specialists for the provision of HIV care by primary care providers in seven Community Based Outpatient Clinics serving rural areas. The design of the TCC was to delineate roles between specialists and generalists in the care of the patient; to create processes to improve care coordination between specialty and primary care teams; and to use a patient registry for population management across sites. The performance measures used for this study were care for HIV infection and common comorbidities, patient travel time to obtain care, and patient satisfaction. Among the 24 patients who used the TCC program within a one-year period, 90 percent of all patients met each of the performance measures. Travel time decreased from 320 minutes per patient on average to 170 minutes, and there were high satisfaction rates among participants. Additionally, researchers from the University of Minnesota found that the use of videoconferencing could help develop a model of care coordination for children with chronic conditions who also have medical complexity.[19] This model included family-centered care with high use of telehealth services to coordinate care with children across providers and caregivers.

Cost/Cost-Effectiveness

Two studies demonstrated the value of mobile technology by showing overall reductions in transportation costs and reducing the number of in-person visits to a physician. One study conducted by the Medical University of Graz in Austria[20] examined the feasibility and acceptance of teledermatology for wound management among home care patients with leg ulcers. Specifically, the focus was on evaluating the reduction of costs and the acceptance of the technology by both patients and home care nurses. Sixteen patients submitted weekly digital images to a secure website that included 45 leg ulcers including images of the wound and surrounding skin. Expert physicians then made an assessment and provided therapeutic recommendations. At the conclusion of the study, more than 89 percent of the images graded as excellent or sufficient with enough data and information for experts to provide

recommendations. Additionally, there was a reduction of 46 percent in transportation costs for both insurance companies and patients due to a significant decrease in the number of visits to general physicians or wound care centers.

Another study examined the real-time use of teledermatology through mobile phones for the diagnosis and management of skin conditions in the emergency department (ED).[21] Over a two-year period, physicians in the ED used mobile phones to take images of more than 100 patients transmitted to a dermatologist through a secure text. The ED physician would make an initial recommendation, and the dermatologist would review and call the physician to determine the appropriate course of action. This type of videoconferencing improved the diagnostic performance in more than 68 percent of the cases seen, and the remote expertise of the dermatologists invalidated, enhanced, or clarified the ED physician's original diagnosis in 75 out of 110 cases. Given that the smartphones came with videoconferencing hardware installed, there was a reduction in overall costs and general practitioner investment time.

Three studies identified cost-benefits as well as the cost-effectiveness of remote monitoring by ensuring both the provision of appropriate services to patients and the reduction of inpatient visits and/or hospitalizations. The Health Buddy Program was a care coordination approach that integrated a telehealth tool to provide care management for chronically ill Medicare beneficiaries.[22] A cohort of high-risk, high-cost patients with COPD, congestive heart failure, and DM who received care at two clinics in the Northwestern U.S. participated in a two-year study. The Health Buddy Device was a handheld device with four buttons and a high-resolution color screen located in a patient's home and linked via telephone to a case manager. On a daily basis, patients received questions tailored to their diagnosis that asked about symptoms, vital signs, knowledge, and health behavior. Patient responses were uploaded to a web-based application that risk-stratified responses to identify those who had deteriorating vital signs and symptoms. Patients at high risk were contacted by care managers to ensure they received appropriate services. Upon the conclusion of the study, there were significant savings per beneficiary for those who used the Health Buddy Program. Spending decreased between 7.7 and 13.2 percent per quarter ($312 to $542) per beneficiary.

In another study, researchers at the London School of Economics implemented a remote monitoring telehealth program for individuals with social care needs. More than 550 participants obtained a telecare system that included personalized sensors, home environment sensors, and other stand-alone devices for monitoring. The primary outcome was reduced incremental cost of services provided per quality-adjusted life year, with secondary outcomes including improved physical and mental health status, psychological well-being, and state-trait anxiety. The conclusion of the study indicated that the overall outcomes in care increased and that the cost-effectiveness of the telehealth intervention did not vary from traditional health and social care services.[23]

Another study conducted by the VA examined the CCHT program's impact on preventable hospitalizations for veterans with DM at four VA medical centers.[24] Using a matched-treatment control design, the researchers reviewed ambulatory-care sensitive conditions by applying criteria from the AHRQ to inpatient databases from the VA to determine preventable hospitalization. Patients in the CCHT program procured a home telehealth device in which they answered scripted questions about

their symptoms and health status. During the study, patients in the CCHT program were less at risk for a preventable hospitalization than their nonenrollee counterparts.

Several studies described the cost savings and cost-effectiveness of store-and-forward technology by describing the use of the technology in increasing productivity, removing the need for in-person referrals, and reducing travel costs. A study by the Department of Defense (DoD)[25] examined cost minimization of store-and-forward teledermatology as compared to a conventional dermatology referral process. By focusing on healthcare utilization over a four-month period, the researchers examined variables such as clinic visits, teledermatology visits, laboratories, preparations, procedures, radiological tests, and medications. They estimated the direct medical care costs by combining utilization data with Medicare reimbursement rates and wholesale drug prices, and factored in productivity loss for seeking treatment as an indirect cost. Teledermatology patients incurred greater than $103,000 in total direct costs as compared to usual care patients, who incurred just over $98,000 in total direct costs. However, the indirect costs were much more significant. Teledermatology patients incurred $16,359 in lost productivity costs, while usual care patients cost almost twice as much ($30,788). The DoD concluded that the store-and-forward teledermatology was a cost-saving strategy for care delivery when it accounted for productivity loss. A case study from King's College in Canada described the encounter of a PCP with a Caucasian male in his fifties who had an enlarged nevus on his chest.[26] The PCP used store-and-forward teledermatology to send several images to a specialist who determined that the nevus was benign and required no further treatment. Given that the patient lived in a remote area, the use of the technology removed the need for a logistically difficult and expensive in-person referral.

Researchers at both the Alaska Native Medical Center and the Alaska Native Tribal Health Consortium conducted a study using store-and-forward electronic consultations with an otolaryngologist.[27] An audiologist traveled to remote parts of Alaska and took images of the appropriate parts of the otolaryngology exam to create telemedicine case studies. These studies included clinical histories, images, audiograms, tympanograms, optoacoustic emission testing and/or other documents. The otolaryngology consultants received these case studies, and made treatment and triage recommendations. Within a -period of almost five years, the study generated 1,458 patient encounters. Approximately 26 percent of the cases were referred for surgery or special diagnostic testing, 23 percent were referred for monitoring, 15 percent were referred to a regional ear/nose/throat clinic (ENT), and 27 percent did not need to see an otolaryngologist and were triaged out of the specialty clinic. Because of this technology, 85 percent of the encounters required no travel for the patient, resulting in a cost avoidance of $496,420.

A retrospective, noncomparative consecutive case series conducted by researchers at the University of Alberta evaluated the clinical outcomes of a teleopthalmology program linking optometrists to retina specialists in Alberta, Canada.[28] Over a two-year period, more than 170 patients underwent stereoscopic, mydriatic digital photography in which a secure web server captured digital images to transfer over to a retinal specialist. The study period included 190 patients in which the wait time between a telehealth referral and a teleophthalmology review of the images was 1.9 days, as opposed to the wait time between a telehealth referral and an in-person evaluation, which was 25.1 days. This

form of teleophthalmology also reduced travel distance and time, and reduced office visits to the retina specialist by 48 percent while improving the efficiency of clinical examination, testing, and treatment.

One study discussed depression as a common and significant health problem among older adults, with few of them accessing treatment, which affects their long-term health and adds cost to the healthcare system.[29] Researchers at Macquarie University conducted an RCT to examine the efficacy, long-term outcomes, and cost-effectiveness of Internet-based cognitive behavioral therapy. Within a cohort of 54 patients aged 60 or older with symptoms of depression, 27 patients used Internet therapy, while others formed the control group. Over an eight-week period, with five sessions of Internet therapy and weekly contact with a clinical psychologist, the participants in the Internet group had significantly lower scores on the Patient's Health Questionnaire 9-item (PHQ-9), a measure of symptoms and severity of depression. The scores maintained consistency at both three months and 12 months after treatment. The researchers concluded that the treatment was cost-effective according to the commonly used willingness-to-pay threshold of $50,000 in Australia for improved quality of life.

Patient/Provider Experience

Researchers at the Prince Charles Hospital in Australia[30] integrated mobile phones and web services into a comprehensive home-based care model for outpatient cardiac rehabilitation. Sensors would measure physical exercise and an accessible web-based wellness diary collected information on a patient's physiological risk factors and other health information. The built-in video and teleconference features of the phone allowed "mentors" to talk to patients about behavior modifications and to develop weekly and monthly goals. Patients also viewed educational multimedia content on cardiac rehabilitation on demand.

Investigators designed a pilot study in which there was sharing of medical data between a patient and a health professional for use in treatment during chemotherapy for skin cancer.[31] Specifically, the focus was on patients with cancer receiving chemotherapy at infusion centers in the metropolitan area of New York City. An offsite center provided easier access for patients and allowed them to reduce commuting time to the city, as well as avoid parking fees. Staff implemented an information system designed with a wireless telemedicine cart that placed at the offsite center. In particular, the study looked at patients who had a dermatologic condition resulting from chemotherapy or biotherapy identified during a pre-chemotherapy nursing assessment. Nursing staff submitted images of these skin assessments to the main center in New York City, where a dermatologist was able to see the images of the affected area in real time and recommend treatment. Overall, both patients and clinicians were very satisfied with the use of the technology; all of them agreed that it made it easier to get medical care, and they would not have received better care in person at the dermatologist's office.

Researchers at Maastricht University in the Netherlands developed the *It's LiFe* feedback and monitoring tool as part of a self-management support program (SSP) to stimulate physical activity in people with COPD or type 2 DM.[32] Random placement of 24 family practices using a three-armed cluster randomized trial included those that used the tool and the SSP, used the SSP only, or received care as usual. The tool consisted of a three-dimensional activity monitor, a mobile application, and a web application. Patients wore the activity monitor on a daily basis so that they could see their progress on the web or mobile

application and measure it against a personal goal. Patients participated in "diary sessions," and answered questions on a dialogue session built into the mobile application. Participants received regular feedback messages and tailored recommendations through the web and mobile application. After nine months, the group that used the tool plus the SSP had higher levels of physical activity directly after the intervention, and that increased level of physical activity remained consistent at three months after the intervention concluded.

An additional study discussed the satisfaction of providers with the use of store-and-forward telehealth in the area of dermatology. Researchers in Spain conducted a three-year study to determine the level of provider satisfaction with store-and-forward telehealth by comparing the concordance rates for the use of the technology and in-person consultations to ascertain a diagnosis.[33] Dermatologists performed more than 120 teleconsultations during the study period, with concordance rates of 76 percent for pediatric patients with inflammatory dermatoses and 75 percent for adults with infections and infestations. Overall, physicians were very satisfied with the high degree of diagnostic accuracy with the use of store-and-forward telehealth, as well as the ability to filter patients for necessary dermatological referrals.

A similar study occurred over a four-year period in California, with 17 teledermatology participants from a variety of practices.[34] More than 47 percent of the providers served at least one Federally Qualified Health Center (FQHC), and more than 75 percent of the patients seen during the study were at or below the 200 percent federal poverty level and lived in rural regions without dermatologist access. While providers varied in their views on image quality of the store-and-forward system as well as the system's ability to obtain a detailed medical history of the patient, most agreed that it increased access to specialty care for those patients.

Several studies discussed patient satisfaction with mental health services provided through video, a greater motivation for self-management and engaging in healthier behaviors, and increased satisfaction with the quality of services. The Northern Regional Behavioral Health Authority (NARBH) conducted a satisfaction survey[35] of telepsychiatry patients at a rural community mental health clinic that had been providing these services through telehealth for 10 years. The survey focused on individuals who had been using the services over multiple sessions with an emphasis on the quality of the services. Over a four-month period, 230 patients were surveyed and 76 responded (33 percent return rate). Among respondents, satisfaction was very high with the belief that mental health services mediated through telehealth were no different from services provided in person. Another study out of Arizona examined the effectiveness and satisfaction rate of telepsychiatry among underserved Hispanics. Patients reported a significant improvement in depression symptoms and stated that the technology helped close the gap in access to linguistically and culturally congruent specialists.[36]

Finally, both physicians and researchers view comprehensive multidisciplinary pulmonary rehabilitation as vital in the management of COPD.[37] A barrier to participating in this type of rehabilitation is the distance from the patient's home to a rehabilitation center and the lack of transportation. One study evaluated patients' acceptance of a home-based online and videoconferencing program for patients who have less severe COPD, but still need of comprehensive rehabilitation services. Ten participants enrolled in a nine-week program, with five patients engaged in exercises and an online self-management

program that included online consultations. The results indicated that the patients using the online platform felt that the program provided an environment that facilitated health-enhancing behaviors and social interactions among similar individuals. Another 14-month study from the North Florida/South Georgia Veterans Health System examined functional outcomes, health-related quality of life, and satisfaction in a group of 26 veterans who received physical therapy via an in-home video telerehabilitation program, the Rural Veterans Telerehabilitation Initiative (RVTRI). Assessment of the veterans occurred through a variety of standardized instruments, including the Functional Independence Measure (FIM), the Montreal Cognitive Assessment (MoCA), and the two-minute walk test. Upon conclusion of the study, the veterans' functional independence and cognitive abilities significantly improved, and they noted increased satisfaction due to the avoidance of travel time and easier access to trained specialists.[38]

Identification of Clinical Areas for Potential Inclusion in the Framework

The literature provided a significant amount of information about how various modalities of telehealth intersect with clinical outcomes or processes of care. Closer examination of the evidence indicates the effect of telehealth on specific clinical areas and functions and provides insight into determining the impact of telehealth on both patient populations and providers. In developing a framework for using and creating measures to assess telehealth, it is important to understand the clinical areas in which the use of this technology has affected outcomes in a positive manner. This understanding informs guidance for selecting current quality measures and identifying the gaps for the future development of measures to evaluate the use of telehealth on a particular clinical area. During the review of the literature, NQF identified the modalities of telehealth and their relationships to different clinical areas, as well as the number of studies found within each clinical area to identify those areas in which telehealth may have had the most significant impact. Based on this analysis, the top five areas in which there was a preponderance of literature as well as a high number of patients studied were:

- Dermatology
- Mental health
- Rehabilitation
- Care coordination
- Chronic diseases (includes asthma, COPD, obesity, hypertension, diabetes, and congestive heart failure)

The next step in determining potential measures to include within the framework was to evaluate the impact of the telehealth intervention on the clinical outcome. For those outcomes associated with a positive impact, the quality measures that correspond to these clinical areas would be under consideration for potential inclusion in the framework. Each study pertaining to the five clinical areas referenced above determines the effect of the telehealth intervention on the outcome. In addition, a multistakeholder Telehealth Committee developed a framework to organize the proposed measure concepts around domains and subdomains that classify the concepts into specific categories; these categories serve as a reference within telehealth for future measure development.

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Appendix C: Initial Measure Concepts

The measure concept tables are arranged based on the proposed domain(s) and subdomain(s).

- **Domain** – A categorization/grouping of high-level ideas developed by the Committee that further describes the measurement framework
- **Subdomain** – a smaller categorization/grouping within a domain
- **Measure Concept** – an idea for a measure that was proposed by the Committee that includes a description, a planned target, and population

Domain	Subdomain	Measure Concept
Experience	Patient, family, and/or caregiver	Patient demonstrated increased confidence in care plan
Experience	Patient, family, and/or caregiver	Patient demonstrated increased understanding of care plan
Experience	Patient, family, and/or caregiver	Patient demonstrated compliance with their care plan
Experience Effectiveness	Care team member including clinical provider Operational effectiveness	Technologies were in a satisfying condition for providers to do their job
Effectiveness Experience	System effectiveness Patient/Family and/or Caregiver	Patients can conduct visits on their own using a specific telehealth modality
Effectiveness Experience	Technical Effectiveness Patient, family, and/or caregiver and Care team member including clinical provider	Connectivity is clear and timely for both the provider and patient
Financial Impact/Cost	Financial Impact to health system or payer	The duration of the visit is measured versus in-home care
Effectiveness Access	System effectiveness Patient, Family, and/or Caregiver	The instructions for care were clear to the patient
Experience	Patient, family, and/or caregiver/care team member	Satisfactory visit for both the patient and provider
Access Effectiveness	Technical Effectiveness Patient, family, and/or caregiver	Increased likelihood for a patient to access the telehealth modality for an encounter

Domain	Subdomain	Measure Concept
Effectiveness	System effectiveness	The amount of time it takes to schedule a visit
Effectiveness	System effectiveness	The amount of time to check-in for a visit
Financial Impact/Cost Effectiveness Experience	Financial Impact to health system or payer Technical Effectiveness Patient, family, and/or caregiver	Increased use of services
Experience	Patient, family, and/or caregiver	Repeat use of services because of satisfaction with the services providers
Effectiveness	System effectiveness	How closely the system meets the scheduled time of the appointment versus the actual appointment time.
Access Financial Impact/ Cost	Access for patients or families Financial Impact to patient, family, and/or caregiver	Able to provide care without admission into the ER
Effectiveness	Clinical Effectiveness	Relationship of the telehealth modality to the therapeutic need of the patient
Effectiveness Financial Impact/ Cost	Clinical Effectiveness Financial Impact to patient, family, and/or caregiver and to health system or payer	Decrease in the length of stay in the hospital
Access	Access for care team	In-person visit was agreed to after a telehealth consultation
Effectiveness	Operational effectiveness System effectiveness	Telehealth services facilitated transitions of care
Access Effectiveness Experience	Access for patients or families System and Technical effectiveness Patient, family, and/or caregiver	Percentage of patients enrolled in a telehealth program for at least three months
Experience Effectiveness	Care team member System effectiveness	Satisfaction in telehealth capturing the appropriate clinical variable

Domain	Subdomain	Measure Concept
Effectiveness	System effectiveness	How many store-and-forward touches were in the technology
Effectiveness Financial Impact/Cost	Clinical effectiveness Financial Impact to patient, family, and/or caregiver and to health system or payer	Telehealth services prevented an elevated amount of care to a patient
Effectiveness	Clinical effectiveness	The system was able to effectively provide the care that was recommended
Effectiveness	System and Technical effectiveness	Amount of time it took to log off of the visit
Financial Impact Access	Financial Impact to Society Financial Impact to patient, family, and/or caregiver Access for patient, Family, and/or caregiver	The lack of telehealth led to a delayed diagnosis
Access Effectiveness	Access for care team Clinical effectiveness	Are providers able to see complex patients more efficiently
Effectiveness	Operational effectiveness	Can telehealth offer the same quality of services across a population of similar patients?
Effectiveness	Operational effectiveness	A defined and specific process flow per diagnosis?
Financial Impact	Financial Impact to care team	Decrease in no-show rate
Access	Access to information	What is the data access in telehealth for those who treat the patient?
Access	Access to information	What is the data access in telehealth for those who consult to the primary care provider? What is the data access in telehealth for patients?

Domain	Subdomain	Measure Concept
Access Experience Financial Impact/Cost	Experience for patients, family and/or caregiver Financial impact to society Financial impact to patients, family, and/or caregiver	Was travel eliminated for a specific patient encounter because of telehealth services?
Access Financial Impact/Cost	Access for patients or families Cost to patients, family, and/or caregiver	Was there any travel to a medical facility because of a telehealth diagnosis?
Access Financial Impact/Cost	Access for patients or families Cost to patients, family, and/or caregiver	Was there any travel involved because telehealth facilitated transitions of care?
Access Experience Effectiveness	Access for care team Access to patient, family, and/or caregiver Experience for members of care team Clinical effectiveness	Removing geographic limitations increased the volume of specialty providers
Financial Impact Effectiveness	Financial impact to society Clinical effectiveness	Increase in diabetic exams with retinal screens
Financial Impact Effectiveness	Financial impact to society Clinical effectiveness	Increase in preventive visits
Experience	Patient, Family, and/or caregiver	Patients are able to interpret diagnosis and treatment instructions through the telehealth modality
Experience Effectiveness	Community Clinical effectiveness	The amount of care coordination needed due to the use of telehealth services
Effectiveness Experience	Technical effectiveness Experience of patient, family, and/or caregiver	Initial visit is connected to the appropriate provider
Effectiveness Experience Financial Impact/Cost	System effectiveness Experience of patient, family, and/or caregiver Cost to patient, family, and/or caregiver	Amount of patient's time used during a telehealth consultation
Effectiveness	Operational effectiveness	Amount of provider's time used during a telehealth consultation

Domain	Subdomain	Measure Concept
Experience	Patient, family, and/or caregiver	Decrease in wait times for patients
Access	Access to care team and to patient,family, and/or caregiver	Overall number of multidisciplinary visits
Access	Access for care team	Frequency of remote visits a provider imports
Experience	Community, care team and patient, family, and/or caregiver	Impact of telehealth services on the workforce shortage
Effectiveness	Operational effectiveness	Time interval from when information is received to when it is acted upon
Experience	Patient, family, and/or caregiver	Overall improvement in quality of life because services are received at home
Financial Impact Effectiveness	Financial impact to health system or payer Clinical effectiveness	Increase in medication adherence
Experience Effectiveness Financial Impact	Patient, family, and/or caregiver; and community Care team member including clinical provider Clinical effectiveness Cost avoidance	Reduction in diagnostic errors and avoidance of an adverse outcome because of telehealth

Appendix D: Initial Measures

The table below presents the initial measures chosen by the Committee to assess the use of telehealth as a means of care delivery and its impact on quality of care. The table is broken down into the following components:

- **NQF Number** (only NQF endorsed measures were considered)
- **Measure Name** – Name of the measure
- **Measure Description** – Description of the measure including intended target and population
- **NQS Domain** – Applicable domain from the National Quality Strategy
- **Measure Type** – Outcome, Process, or Structural
- **Data Submission Methods** – Claims, Registry, EHR, CMS Web Interface
- **Primary Measure Steward** – Organization responsible for the endorsement and maintenance of the measure

NQF #	Measure Name	Measure Description	NQS Domain	Measure Type	Data Submission Method	Primary Measure Steward
0102	Chronic Obstructive Pulmonary Disease (COPD): Long-Acting Inhaled Bronchodilator Therapy	Percentage of patients aged 18 years and older with a diagnosis of COPD (FEV1/FVC < 70%) and who have an FEV1 less than 60% predicted and have symptoms who were prescribed an long-acting inhaled bronchodilator	Effective Clinical Care	Process	Claims, Registry	American Thoracic Society
0091	Chronic Obstructive Pulmonary Disease (COPD): Spirometry Evaluation	Percentage of patients aged 18 years and older with a diagnosis of COPD who had spirometry results documented	Effective Clinical Care	Process	Claims, Registry	American Thoracic Society
0018	Controlling High Blood Pressure	Percentage of patients 18-85 years of age who had a diagnosis of hypertension and whose blood pressure was adequately controlled (<140/90mmHg) during the measurement period	Effective Clinical Care	Intermediate Outcome	Claims, CMS Web Interface, EHR, Registry	National Committee for Quality Assurance

NQF #	Measure Name	Measure Description	NQS Domain	Measure Type	Data Submission Method	Primary Measure Steward
0066	Coronary Artery Disease (CAD): Angiotensin-Converting Enzyme (ACE) Inhibitor or Angiotensin Receptor Blocker (ARB) Therapy - Diabetes or Left Ventricular Systolic Dysfunction (LVEF < 40%)	Percentage of patients aged 18 years and older with a diagnosis of coronary artery disease seen within a 12 month period who also have diabetes OR a current or prior Left Ventricular Ejection Fraction (LVEF) < 40% who were prescribed ACE inhibitor or ARB therapy	Effective Clinical Care	Process	Registry	American Heart Association
0089	Diabetic Retinopathy: Communication with the Physician Managing Ongoing Diabetes Care	Percentage of patients aged 18 years and older with a diagnosis of diabetic retinopathy who had a dilated macular or fundus exam performed with documented communication to the physician who manages the ongoing care of the patient with diabetes mellitus regarding the findings of the macular or fundus exam at least once within 12 months	Communication and Care Coordination	Process	Claims, EHR, Registry	Physician Consortium for Performance Improvement
0576	Follow-Up After Hospitalization for Mental Illness (FUH)	The percentage of discharges for patients 6 years of age and older who were hospitalized for treatment of selected mental illness diagnoses and who had an outpatient visit, an intensive outpatient encounter or partial hospitalization with a mental health practitioner. Two rates are reported: The percentage of discharges for which the patient received follow-up within 30 days of discharge. The percentage of discharges for which the patient received follow-up within 7 days of discharge	Communication and Care Coordination	Process	Registry	National Committee for Quality Assurance

NQF #	Measure Name	Measure Description	NQS Domain	Measure Type	Data Submission Method	Primary Measure Steward
2624	Functional Outcome Assessment	Percentage of visits for patients aged 18 years and older with documentation of a current functional outcome assessment using a standardized functional outcome assessment tool on the date of the encounter AND documentation of a care plan based on identified functional outcome deficiencies on the date of the identified deficiencies	Communication and Care Coordination	Process	Claims, Registry	Centers for Medicare & Medicaid Services
0427	Functional Status Change for Patients with Elbow, Wrist or Hand Impairments	A self-report outcome measure of functional status (FS) for patients 14 years+ with elbow, wrist or hand impairments. The change in FS assessed using FOTO (elbow, wrist and hand) PROM (patient reported outcomes measure) is adjusted to patient characteristics known to be associated with FS outcomes (risk adjusted) and used as a performance measure at the patient level, at the individual clinician, and at the clinic level to assess quality	Communication and Care Coordination	Outcome	Registry	Focus on Therapeutic Outcomes, Inc.

NQF #	Measure Name	Measure Description	NQS Domain	Measure Type	Data Submission Method	Primary Measure Steward
0424	Functional Status Change for Patients with Foot or Ankle Impairments	A self-report measure of change in functional status (FS) for patients 14 years+ with foot and ankle impairments. The change in functional status (FS) assessed using FOTO's (foot and ankle) PROM (patient reported outcomes measure) is adjusted to patient characteristics known to be associated with FS outcomes (risk adjusted) and used as a performance measure at the patient level, at the individual clinician, and at the clinic level to assess quality	Communication and Care Coordination	Outcome	Registry	Focus on Therapeutic Outcomes, Inc.
0428	Functional Status Change for Patients with General Orthopaedic Impairments	A self-report outcome measure of functional status (FS) for patients 14 years+ with general orthopaedic impairments (neck, cranium, mandible, thoracic spine, ribs or other general orthopaedic impairment). The change in FS assessed using FOTO (general orthopaedic) PROM (patient reported outcomes measure) is adjusted to patient characteristics known to be associated with FS outcomes (risk adjusted) and used as a performance measure at the patient level, at the individual clinician, and at the clinic level to assess quality	Communication and Care Coordination	Outcome	Registry	Focus on Therapeutic Outcomes, Inc.

NQF #	Measure Name	Measure Description	NQS Domain	Measure Type	Data Submission Method	Primary Measure Steward
0423	Functional Status Change for Patients with Hip Impairments	A self-report measure of change in functional status (FS) for patients 14 years+ with hip impairments. The change in functional status (FS) assessed using FOTO's (hip) PROM (patient- reported outcomes measure) is adjusted to patient characteristics known to be associated with FS outcomes (risk adjusted) and used as a performance measure at the patient level, at the individual clinician, and at the clinic level to assess quality	Communication and Care Coordination	Outcome	Registry	Focus on Therapeutic Outcomes, Inc.
0422	Functional Status Change for Patients with Knee Impairments	A self-report measure of change in functional status for patients 14 year+ with knee impairments. The change in functional status (FS) assessed using FOTO's (knee) PROM (patient-reported outcomes measure) is adjusted to patient characteristics known to be associated with FS outcomes (risk adjusted) and used as a performance measure at the patient level, at the individual clinician, and at the clinic level to assess quality	Communication and Care Coordination	Outcome	Registry	Focus on Therapeutic Outcomes, Inc.

NQF #	Measure Name	Measure Description	NQS Domain	Measure Type	Data Submission Method	Primary Measure Steward
0425	Functional Status Change for Patients with Lumbar Impairments	A self-report outcome measure of change in functional status for patients 14 years+ with lumbar impairments. The change in functional status (FS) assessed using FOTO (lumbar) PROM (patient reported outcome measure) is adjusted to patient characteristics known to be associated with FS outcomes (risk adjusted) and used as a performance measure at the patient level, at the individual clinician, and at the clinic level to assess quality	Communication and Care Coordination	Outcome	Registry	Focus on Therapeutic Outcomes, Inc.
0426	Functional Status Change for Patients with Shoulder Impairments	A self-report outcome measure of change in functional status (FS) for patients 14 years+ with shoulder impairments. The change in functional status (FS) assessed using FOTO's (shoulder) PROM (patient reported outcomes measure) is adjusted to patient characteristics known to be associated with FS outcomes (risk adjusted) and used as a performance measure at the patient level, at the individual clinician, and at the clinic level to assess quality	Communication and Care Coordination	Outcome	Registry	Focus on Therapeutic Outcomes, Inc.

NQF #	Measure Name	Measure Description	NQS Domain	Measure Type	Data Submission Method	Primary Measure Steward
0650	Melanoma: Continuity of Care - Recall System	Percentage of patients, regardless of age, with a current diagnosis of melanoma or a history of melanoma whose information was entered, at least once within a 12 month period, into a recall system that includes: A target date for the next complete physical skin exam, AND A process to follow up with patients who either did not make an appointment within the specified timeframe or who missed a scheduled appointment	Communication and Care Coordination	Structure	Registry	American Academy of Dermatology
0028	Preventive Care and Screening: Tobacco Use: Screening and Cessation Intervention	Percentage of patients aged 18 years and older who were screened for tobacco use one or more times within 24 months AND who received cessation counseling intervention if identified as a tobacco user	Community/ Population Health	Process	Claims, CMS Web Interface, EHR, Registry	Physician Consortium for Performance Improvement