NATIONAL QUALITY FORUM
Driving measurable health improvements together

www.qualityforum.org

Leveraging Electronic Health Record (EHR)-Sourced Measures to Improve Care Communication and Coordination

Literature Review - September 24, 2021

This report is funded by the Centers for Medicare & Medicaid Services under contract HHSM-500-2017-00060I 75FCMC20F0004.

Contents

Executive Summary

This literature review and measure scan provide an overview of current issues regarding the use of electronic health records (EHRs) for care communication and care coordination activities and how EHR data are used for quality measurement.

The report includes several definitions of care communication and care coordination found in the literature and develops consensus definitions of care communication and care coordination based on these existing definitions and input from the EHR Care Coordination Committee. This literature review also explores the relationships between care communication and care coordination and improved health outcomes as well as the impact of social determinants of health (SDOH) on care communication and care coordination performance measurement. The advantages and challenges of using EHRs to both conduct and measure care communication and care coordination activities are also included. Lastly, this report includes a scan of existing quality measures related to care communication and care coordination. The measure scan includes a broad array of quality measures that are both directly and indirectly related to care communication and care coordination. Both the literature review and measure scan informed the development of a high-level Environmental Scan Report designed to educate key healthcare stakeholders, including healthcare providers, healthcare leadership, policymakers, measure developers, researchers, financial professionals, and patients and caregivers, on leveraging EHR-sourced measures to improve care communication and care coordination.

Introduction

The goal of care communication and care coordination efforts is to ensure that patient care delivered across multidisciplinary settings is both synchronized and efficient.

Effective care communication and care coordination involve seamless communication between clinician and patient, as well as their families and caregivers, and between clinicians caring for the same patient to harmonize the care received throughout the healthcare system. Care communication and care coordination are particularly relevant as clinicians collaborate over time and across settings to care for the same patient as well as during transitions in care between clinicians (e.g., during handoffs from primary care physicians [PCPs] to specialists, specialists to other specialists, between clinicians in different health systems, or to connect to community services) and settings (e.g., when patients move from the hospital to home or to a post-acute care [PAC] facility). In addition, care communication and care coordination are vital when healthcare providers interact with social service professionals and/or entities to address SDOH for vulnerable populations.

The lack of effective health information transfer can result in suboptimal care. This may lead to care that is discordant with a patient's overall goals of care, has directly conflicting treatments (e.g., unrecognized potentially harmful medication interactions), or unnecessarily duplicative care (e.g., repeat imaging or laboratory testing).[1] It may also lead to missed opportunities to diagnose or treat a patient if information is not communicated across longitudinal clinicians who care for a patient across settings (e.g., a need for follow-up imaging or follow-up in treatment as a patient transitions from the hospital to outpatient care). In some studies and contexts, effective care communication and care coordination with patients have been shown to improve clinical outcomes. For example, improved care communication and care coordination may reduce the rate of medical errors, duplicative care, and readmissions, as well as lower the costs of care by providing resources to manage transitions in care and improve handoffs as patients move within and across different healthcare settings and clinicians.[2] Improving care communication and care coordination also reduces the burden of navigating a fragmented healthcare system on patients and their families.[3] Building a data and workflow infrastructure for effective care communication and care coordination requires significant investment in health information technology (IT) and stakeholder engagement. Such investment has been seen when there is alignment between hospitals, physicians, and payers in integrated healthcare systems and payers, such as Kaiser Permanente.[4,5] For example, Kaiser's insurance arm justified the $4 billion investment in an interoperable health IT EHR infrastructure. These interoperable systems were seen to be vital to delivering integrated care, and without such systems, it would be more challenging to deliver high value care.

Despite the benefits of effective care communication and care coordination, measuring these concepts and linking care communication and care coordination activities to improved health outcomes in a generalizable way have been challenging. This is due to the heterogeneity of approaches and interventions: Similar interventions may be deployed differently across sites and settings. For example, the presence of a care plan does not necessarily mean that it is accessible to all clinicians at the point of care. This makes it difficult to generalize care communication and care coordination interventions and program success outside of the specific setting and context in which it is implemented and tested.[6] This issue threatens the validity of recommendations to perform specific sets of coordination processes or to be the basis of process-based quality metrics.[7] In addition, difficulties at times arise in measuring whether specific care communication and care coordination activities occurred. Care communication and care coordination activities may be performed (e.g., communication with a patient or family) yet not documented, or alternatively, documented yet not performed effectively. For example, a box in an EHR clinical note may be checked to indicate that a service such as medication reconciliation was conducted, but it may not have been thoroughly performed.[8] It is also difficult to link the performance of specific care communication and care coordination processes to more general outcomes that may be affected by many factors.[9] For example, in addition to care communication and care coordination, patient, clinical, and system factors can all contribute to a general outcome, such as hospital readmissions rates, which should conceptually be improved through more coordinated care.[10]

To deliver coordinated care across clinicians and settings, it is vital that clinicians and patients have interoperable access to patient healthcare data. The concept of being *interoperable* means that data from multiple EHR systems (either from the same EHR vendor or another EHR vendor) can be shared across settings, such as between hospitals or clinicians. Patient data may also exist in patient health records (PHRs). PHRs are distinct from EHRs due to their additional, or different, data sources and because the data is controlled by the patient rather than by providers. These records include EHR data and/or other data sources (e.g., data from wearable health technology, such as fitness tracking watches) and are managed by the patient.[9]

This report specifically focuses on using quality measures based on data from an EHR to measure care communication and care coordination, which are separate yet related concepts. EHRs aim to capture and record care delivery as well as some care communication and care coordination processes and outcomes. EHR data elements related to care communication and care coordination may be used to define measure specifications for performance measures. These data elements may be housed in a variety of places within EHRs or PHRs as well as within health information exchanges (HIEs), or less commonly, paper medical records.[9] EHR-sourced measures are quality measures that rely on EHR data elements for defining a denominator population of interest as well as a numerator for a performance measure.[6] The EHR data elements may be structured with dedicated fields to record data systematically or unstructured fields, such as open-note text boxes.[7] These measures may be evaluated outside of the original EHR system in which the data was collected (e.g., data registry, data warehouse).[8] A subset of EHR-sourced measures consists of electronic clinical quality measures (eCQMs), which are specified to use data electronically extracted from EHRs and/or health IT systems to measure healthcare quality and are specifically used by the Centers for Medicare & Medicaid Services (CMS) for a variety of quality reporting and value-based purchasing programs.[9]

EHRs can also be used as tools to communicate and coordinate care directly (Table 1). One EHR-based tool is clinical decision support (CDS), which consists of algorithms within the EHR that support the delivery of care communication and care coordination processes and can assist in the remediation of care communication and care coordination problems (e.g., through data-mining techniques).[8] In addition, electronic trigger (e-trigger) tools can mine patient data and identify signals that can mitigate a potential error or adverse event related to ineffective care communication and care coordination.[10] For example, e-trigger tools could identify whether a patient with a diagnosis of a concerning finding that requires follow-up imaging, such as a pulmonary nodule, has actually had the follow-up imaging required to differentiate a benign nodule from lung cancer. Another example is EHR-based patient portals, which seek to give patients the ability to see their test results and plans of care directly. Portals can also be used to survey patients using validated tools to gain information about their health status, identify care gaps, and improve outcomes. However, patient portals may be difficult to use or access for some patients, and other mechanisms need to be in place to ensure that these patients can similarly participate in their care. Additionally, HIEs can enable providers to share a patient's information via electronic means and are formed at the regional, local, or state level by the government or nonprofit organizations.[11] While these EHR-based tools have been effectively deployed to help facilitate care communication and care coordination, there have been challenges in linking the use of these tools to improved patient outcomes, similar to other types of care communication and care coordination acitvities.[13]

Table 1. Examples of EHR-Based Tools to Improve Care Communication and Care Coordination

EHR-BASED TOOL	DESCRIPTION
DECISION SUPPORT AND ELECTRONIC TRIGGER (E-TRIGGER) TOOLS	Tools or applications within or available to EHRs that deliver clinical insights at the point of care or population level. These tools may use artificial intelligence, predictive analytics (e.g., risk assessment), or natural language processing to create structured fields from unstructured data. This also may include dashboards or tools that integrate other data sources (i.e., community-level data) with EHR data.[8] E-trigger tools are an example that may help to identify medical errors or gaps in care.[10] For example, CDS hooks are application programming interfaces (APIs) that assist the provider by triggering suggestions and additional information based on the inputted data.[12]
PATIENT PORTALS	Tools that allow patients to have secure access to their data, including test results, medication lists, care plans, discharge summaries, and appointment summaries. For example, OpenNotes® allows sharing of clinician notes directly with patients.[13]
HEALTH INFORMATION EXCHANGES (HIES)	Centralized databases that combine EHR data from multiple sources to assist in data standardization and information sharing across settings.[14] For example, the Chesapeake Regional Information System for our Patients (CRISP) is the designated HIE for providers to share information in Maryland and the District of Columbia.[15]

Despite the challenges in linking processes to outcomes, EHR data and EHR-based tools designed to improve care communication and care coordination have several advantages over other data sources, such as claims data, which have historically been used to measure care communication and care coordination activities.[16] In a claims-based quality measure, the development of an advanced care plan may be measured through examining billing codes. By contrast, EHRs include more granular data, direct physiologic measurement, and data that are both structured and unstructured. EHR data allow for a more detailed examination of patients who require care communication and care coordination, care process performance that is indirectly billed, and outcomes. There is also little-to-no lag time between collecting data and calculating measures, thus creating an opportunity to not only measure care communication and care coordination but also to identify gaps in care in real time. Despite this broad potential of EHR-based measures more generally, they are in their infancy, and eCQMs constitute about 6 percent of the National Quality Forum's (NQF) 540-measure portfolio.

Background

With funding from CMS, NQF will identify best practices to leverage EHR-sourced measures to improve care communication and care coordination quality measurement in an all-payer, cross-setting, and fully electronic manner.

This extends the work of NQF and other entities that have advanced the science of quality measurement for care communication and care coordination over the past 15 years. Several broader trends make this work particularly timely. Over the last decade, there has been a dramatic increase in the use of EHRs. According to data from the Office of the National Coordinator on Health Information Technology (ONC), 96 percent of all nonfederal, acute care hospitals had certified health IT in 2017.[17] In addition, with the promulgation of value-based models that reward value over volume of care, there has been an increased number of tools within EHRs to enhance communication and facilitate care coordination across settings.[18] There has also been a movement towards increased interoperability of data across settings and increased standardization of data elements, particularly through the efforts of ONC and groups such as Health Level Seven (HL7) International.[19] Lastly, over the past decade, several provisions within the **Health Information Technology for Economic and Clinical Health (HITECH) Act** of 2009, the **Patient Protection and Affordable Care Act (ACA)** of 2010, the **Improving Medicare Post-Acute Transformation (IMPACT) Act** of 2014, the **21st Century Cures Act** of 2016, and regulations from ONC have promoted the increase in EHR adoption and enhanced interoperability in ways that facilitate care communication and care coordination measurement via EHRs.

NQF has been deeply involved in care coordination measurement for more than a decade. In 2006, NQF developed definitions and a **measurement framework** for care coordination that identified five key domains that remain relevant today:

1. **Healthcare “Home”:** a source of usual care selected by the patient (e.g., medical group, single provider [PCP or specialist], community health center, outpatient clinic, or patient-centered medical home) that functions as the central point for coordinating care regarding the patient’s needs and preferences

2. **Proactive Plan of Care and Follow-Up:** an established and current care plan that anticipates routine needs and actively tracks progress toward patient goals

3. **Communication:** information sharing that is available to all care team members, including patients and family/caregivers

4. **Information Systems:** use of standardized, integrated electronic information systems with functionalities essential to care coordination that is available to all providers and patients

5. **Transitions or Handoffs:** a focus on safe, coordinated transitions between care settings[20]

A 2010 NQF report titled **Preferred Practices and Performance Measures for Measuring and Reporting Care Coordination** identified 25 preferred practices surrounding how organizations can operationalize care coordination.[26] In the 10 years following the publication of that report, many of those preferred practices remain relevant and can now be better facilitated through EHRs and with EHR-based tools. For example, Preferred Practice #11 recommended that “The patient’s plan of care should always be made available to the healthcare home team, the patient, and the patient’s designees.” Such information is now available within patient portals that have since become widely available. As another example, Preferred Practice #22 recommended that “Healthcare organizations should develop and implement a standardized communication template for the transitions of care process, including a minimal set of core data elements that are accessible to the patient and his or her designees during care.” Today, such transitions of care documentation can be facilitated with EHRs. Additionally, the communication data elements from EHRs can potentially serve as data elements for quality measurement and as a trigger for clinicians to perform these processes in patient care.

A 2012 NQF-commissioned report on health IT data needs for care coordination titled **Health Information Technology to Support Care Coordination and Care Transitions: Data Needs, Capabilities, Technical and Organizational Barriers, and Approaches to Improvement** described technical barriers as well as proposed strategies in electronic measurement of care coordination.[21] NQF also convened Committees in **2012**, **2014**, and **2016-2017** to review and endorse a variety of care coordination measures, including transfer of information and communication across care settings, medication reconciliation, and length of stay in emergency departments (EDs). Despite this work, there are still only a small number of endorsed care coordination measures due to data availability, data quality, and scientific acceptability (i.e., validity and reliability) issues. Care coordination measure development is also a challenge due to the difficulty of linking specific care coordination processes to outcomes. This is important because NQF's **standard evaluation criteria** require sufficient quantity, quality, and consistency in the evidence that links any process measure to an outcome. This is a difficult hurdle to overcome in care coordination measurement due to the variability of evidence in specific care coordination processes. With the increasing quality of EHR data as well as expanded capabilities of EHRs to support care communication and care coordination activities, many of these issues may be increasingly surmountable, thus allowing for the development of a broader range of care communication and care coordination measures.

Environmental Scan Goals and Objectives

NQF has developed an environmental scan of the literature and existing measures of care communication and care coordination.

The goal is to create a clear summary of the current use of EHR-sourced measures to improve care communication and care coordination quality measurement in an all-payer, cross-setting, and fully electronic manner. To complete the scan, NQF convened a Committee to provide input and expertise. The Committee includes a variety of healthcare stakeholders, such as clinicians, measure developers, EHR vendors, payers, and patients and caregivers. Additionally, NQF conducted interviews with experts with a deep understanding of care communication and care coordination measurement to ensure the scan is complete and accurate. The goals of the scan are as follows:

- Identify consensus definitions of care communication and care coordination
- Explore how care communication and care coordination relate to improved health outcomes and the role of SDOH in care communication and care coordination
- Review the advantages and challenges of measuring provider performance for care communication and care coordination activities and outcomes in EHRs across settings and payers
- Develop a comprehensive list of existing measures relevant to EHR-based care communication and care coordination processes as well as outcomes

Environmental Scan Methodology

NQF conducted the environmental scan using three interrelated approaches:

(1) a literature review to assess the body of literature related to leveraging EHRs to improve care communication and care coordination and identify those articles most relevant to this initiative; (2) a scan of existing measures related to care communication and care coordination; and (3) discussions with experts in fields related to EHR-sourced measures and care communication and care coordination, including one-on-one expert interviews and targeted discussions during the web meetings with the Committee. Each of these approaches is outlined in more detail below.

Literature Review

To support the goals and objectives of this project, NQF conducted a literature review to provide the Committee with an overview of current care communication and care coordination quality measurement and the use of EHRs to improve it.

NQF conducted a targeted search within PubMed using relevant combinations of keywords related to EHRs and care communication and care coordination as well as general terms to capture broader, relevant literature (**Appendix A**). To maintain focus on current recommendations and practices, NQF confined the search to English-language work published between 2015 and present day unless an older source was a foundational piece of literature directly related to the topic.

The literature review also included grey literature as well as papers and websites from government, not-for-profit, and corporate organizations. NQF performed additional focused searches using Google with the intent of identifying grey literature that did not appear in the database searches. These searches were based on Committee feedback for topics such as care communication and care coordination related to patient engagement/patient-centered care, PAC and other specialties, cost, and utilization.

NQF screened the literature for relevance based on the following inclusion and exclusion criteria and coded it by a single reviewer:

Inclusion Criteria:

- Literature published during or after 2015
- Literature focused on the United States (U.S.) healthcare system rather than outside the U.S.
- Literature focused on care communication and care coordination and outcomes as well as the role of EHRs in care communication and care coordination within the context of quality measurement

Exclusion Criteria:

- Literature published prior to 2015 unless it was foundational to the topic area
- Literature not focusing on or not inclusive of the U.S. healthcare system
- Literature not written in the English language
- Literature not focused on care communication and care coordination outcomes as well as the role of EHRs in care communications and coordination within the context of quality measurement

Measure Scan

NQF also conducted a scan for existing care communication and care coordination measures that could be adapted to use EHR data or are measuring the use of EHR-based tools (**Appendix B**). The purpose of the environmental scan was to identify existing care communication and care coordination measures, both EHR-sourced and non-EHR-sourced measures. NQF scanned for measures in repositories such as NQF's **Quality Positioning System (QPS)** (including measures both endorsed by NQF and no longer endorsed by NQF), the **CMS Measures Inventory Tool (CMIT)**, peer-reviewed literature, grey literature, and expert interviews. The project team reviewed measures for relevancy to care communication and care coordination and excluded non-applicable measures.

Expert Input

NQF gathered expert input from the Committee during web meetings and conducted interviews with experts in care communication and care coordination, measure development, and other fields across the spectrum of EHR-sourced measures (**Appendix C**). These experts' perspectives supplement findings from the literature and measure searches, address gap areas identified through early research, and help to ensure this report accurately reflects the current state of care communication and care coordination quality measurement and the ability to leverage EHR-sourced measures for improvement. Within this literature review, information was gathered from the Committee and synthesized by NQF unless explicitly attributed to a specific source.

Environmental Scan Findings

Structured searches led to the identification of 463 articles from 2015 to 2021 to review for potential relevance.

NQF eliminated 121 articles due to irrelevance, language, or country of focus. Of the remaining articles, 202 were relevant to the measurement of care communication and care coordination in EHRs. Among the articles, populations of interest included primary care patients, oncology patients, older adults, and veterans. Care communication and care coordination interventions in the reviewed articles included medication management, general communication, and referrals.

Definitions of Care Communication and Care Coordination

Using the literature review, NQF sought to identify a consensus definition for care communication and care coordination. NQF identified a common definition of care communication but did not find a universal definition of care coordination. Care communication is the sharing of information between stakeholders (e.g., clinicians, patients, families, and caregivers) through various modes, such as verbal, written, fax, person-to-person, or electronic. Effective communication is central to improved care coordination.[22] The topic of care coordination has been discussed at length in literature since 1979; however, there is still no universal definition due to many factors, including policy, authority, and others. The lack of consensus in this space may be due to the considerable number of stakeholders, which play a role in coordinating care.[23]

Major stakeholders in care coordination might interpret the meaning of successful care coordination differently depending on the unique lens of their experience and priorities. These stakeholders include patients and families/caregivers, clinicians, affiliated healthcare professionals (e.g., pharmacists, care managers), social service professionals and agencies, and healthcare systems. Patients and their families may view care coordination as meeting the patient's health-related preferences, values, and needs. Clinicians may view care coordination as communicating effectively within teams and across transitions, communicating accurate information to the patient and all team members, directing them to the correct point of care in the healthcare system, and ensuring care is delivered in an integrated, patient-centered, and safe manner. For patients and many healthcare professionals, the patient's preferences play a vital role in addressing the gaps in the patient's medical and nonmedical needs. Healthcare systems, which include hospitals and clinics, focus on care coordination through collaboration of personnel, information, and other resources to carry out all required patient care activities between and among care participants.[23] Equity issues, such as a patient's personal resources, where they live, and their insurance status, can also influence how they view care coordination, particularly as limitations in transportation, access to technology resources, and health literacy; specific providers may also serve as barriers to coordinated care.[24]

Historically, there has been considerable discussion on what care coordination entails and how to define it. An overview of existing definitions from seminal literature follows below.

2007 STANFORD UNIVERSITY REPORT

A 2007 report developed by Stanford University and funded by the Agency for Healthcare Research and Quality (AHRQ) reviewed 40 definitions of care coordination, spanning from 1979 to 2005. The final definition given in the report was "care coordination is the deliberate organization of patient care activities between two or more participants (including the patient) involved in a patient's care to facilitate the appropriate delivery of health care services. Organizing care involves the marshalling of personnel and other resources needed to carry out all required patient care activities and is often managed by the exchange of information among participants responsible for different aspects of care."[13] The authors also identified five key elements of care coordination based on the review[21]:

1. Many participants are commonly involved in care coordination.

2. Coordination is necessary when interdependent activities are required in patient care.

3. To be coordinated, each participant needs adequate

knowledge about each other's roles, responsibilities, and resources.

4. To manage patient care, participants rely on information exchange.

5. Care integration facilitates appropriate care delivery.

2013 SCHULTZ SYSTEMIC REVIEW

In 2013, Schlutz et al published "A systematic review of the care coordination measurement landscape."[25] This review built on the AHRQ/Stanford work to identify 96 measurement instruments related to care coordination and to classify these instruments into a measurement framework that includes perspective (i.e., patient/family, healthcare professional, and system representative) and domains. Specifically, the measurement framework identified instruments to measure coordination activities, including the following:

- Establish accountability or negotiate responsibility
- Communicate
- Interpersonal communication
- Information transfer
- Facilitate transitions across settings
- Facilitate transitions as coordination needs change
- Assess needs and goals
- Create a proactive plan of care
- Monitor, follow up, and respond to change
- Support self-management goals
- Link to community resources
- Align resources with patient and population needs

Additionally, the measurement framework identified instruments to measure broad approaches potentially related to care coordination, including teamwork focused on coordination, healthcare home, care management, medication management, and health IT-enabled coordination.

2014 NQF REPORT

The 2014 NQF report titled *Priority Setting for Healthcare Performance Measurement: Addressing Performance Measure Gaps in Care Coordination* defined care coordination as "a multidimensional concept that encompasses the effective communication between patients and their families, caregivers, and healthcare providers; safe care transitions; a longitudinal view of care that considers the past, while monitoring delivery of care in the present and anticipating the needs of the future; and the facilitation of linkages between communities and the healthcare system to address medical, social, educational, and other support needs, in alignment with patient goals."[26] The report also included a shortened definition: "Care coordination is the deliberate synchronization of activities and information to improve health outcomes by ensuring that care recipients' and families' needs and preferences for healthcare and community services are met over time." Additionally, this report established a measurement framework with three broad care coordination concepts:

1. Joint Creation of a Person-Centered Plan of Care includes a comprehensive assessment that captures all information relevant for supporting holistic wellness as well as a collaborative process for patient goal setting with shared accountability.

2. Utilization of the Health Neighborhood to Execute the Plan of Care includes linking/synchronizing patient care across settings as well as evaluating the quality of services.

3. Achievement of Outcomes includes evaluating the patient experience and their progression towards their goals as well as the efficiency in care.

2018 NEW ENGLAND JOURNAL OF MEDICINE CATALYST REPORT

The *New England Journal of Medicine (NEJM) Catalyst Care Redesign Insight Report* also identified elements for successful care communication and care coordination[28]:

1. Easy access to a range of healthcare services and clinicians

2. Good communication and effective care transitions between clinicians

3. Focus on the total healthcare needs of the patient

4. Clear, simple, and understandable information

NQF examined the literature to identify and compile definitions of care coordination in use since the 2007 AHRQ report, as shown in Table 2.

Table 2. Definitions of Care Coordination

CITATION	DEFINITION
AGENCY FOR HEALTH-CARE RESEARCH AND QUALITY (AHRQ)/ STANFORD, 2007[27]	"Care coordination is the deliberate organization of patient care activities between two or more participants (including the patient) involved in a patient's care to facilitate the appropriate delivery of health care services. Organizing care involves the marshalling of personnel and other resources needed to carry out all required patient care activities and is often managed by the exchange of information among participants responsible for different aspects of care."
NATIONAL QUALITY FORUM (NQF), 2014[26]	"Care Coordination is a multidimensional concept that encompasses the effective communication between patients and their families, caregivers, and healthcare providers; safe care transitions; a longitudinal view of care that considers the past, while monitoring delivery of care in the present and anticipating the needs of the future; and the facilitation of linkages between communities and the healthcare system to address medical, social, educational, and other support needs, in alignment with patient goals."
NQF, 2014[26]	"Care coordination is the deliberate synchronization of activities and information to improve health outcomes by ensuring that care recipients' and families' needs and preferences for healthcare and community services are met over time."
NEW ENGLAND JOURNAL OF MEDICINE (NEJM) CATALYST, 2018[28]	"Care coordination synchronizes the delivery of a patient's health care from multiple providers and specialists."
WORLD HEALTH ORGANIZATION (WHO), 2018[17]	"A proactive approach to bringing together care professionals and providers to meet the needs of service users to ensure that they receive integrated, person-focused care across various settings."
FAMILIES USA, 2019[29]	"At its core, care coordination is just what the name implies: a mechanism through which teams of health care professionals work together to ensure that their patients' health needs are being met and that the right care is being delivered in the right place, at the right time, and by the right person."

NQF found that the definition of care coordination has not changed in a meaningful way since the seminal literature described above was published. For example, the American Academy of Pediatrics, the American Nurses Association, the Substance Abuse and Mental Health Services Administration, and many other organizations reference the AHRQ definition of care coordination, one of the foundational definitions of care coordination.[23,29,3031]

The Committee discussed the existing definitions of care coordination from the literature review to develop a consensus definition. The Committee then decided to modify the shorter definition from the 2014 NQF report to represent the concept of care communication and care coordination. The Committee modified the definition to be more patient focused and added specific examples of care communication and care coordination activities. The consensus definition is as follows: **Care coordination is the deliberate synchronization of activities and information to improve health outcomes to ensure patients' and families' needs and preferences for healthcare and community services are met over the course of their treatment and care.**

The examples of care communication and care coordination activities include the following:

- Improving patient and caregiver engagement in the coordination of their care by using activities that facilitate patients and clinicians working together to make decisions that allow for the best possible health outcomes
- Developing and implementing care plans that describe a patient's care needs and how cross-disciplinary clinicians can best help to meet those needs to help meet specific goals
- Enhancing transitions in care to improve care communication and care coordination during periods in which information may be lost as patients move from one setting to another (e.g., hospital to home or a PAC facility)
- Promoting cross-disciplinary coordination to integrate and improve care between clinicians from different settings (e.g., different medical or surgical specialties or with other allied health professionals, such as social workers or physician therapists)
- Using closed-loop communication to reduce misunderstandings regarding critical clinical information by having the recipient of the information acknowledge receipt and clarify their understanding of the message[33,32]
- Deploying risk assessments and stratifications to identify and analyze factors (e.g., SDOH) that have the potential to cause harm or place individuals at differential risk (social risk factors) for specific outcomes (e.g., readmissions) and then deploying specific tactics to those identified as higher risk to improve outcomes
- Participating in case management to assess, plan, implement, coordinate, monitor, and evaluate options and services required to meet a patient's health and human services needs
- Encouraging patients and caregivers to use navigation resources to assist guiding patients and caregivers through the complex healthcare system to ensure needs are addressed. This is particularly relevant for patients with barriers to healthcare, such as SDOH or multiple chronic conditions.
- Using shared decision making for clinicians and patients to collaborate when making decisions for tests, treatments, and care plans to balance the risks and expected outcomes along with the patient's preferences and values
- Delivering team-based care to involve the patient and their caregivers as active members of the healthcare team in addition to physicians, nurses, pharmacists, community health workers, nutritionists, and members from community-based resources (e.g., multidisciplinary care for children with special needs and disabilities should include not only hospital-based clinicians but also coordinating care with schools and therapists)

Relationships Between Care Communication and Care Coordination, Electronic Health Records, and Improved Healthcare Outcomes

CARE COMMUNICATION AND CARE COORDINATION OUTCOMES

Care communication and care coordination activities and programs contribute to a variety of observable clinical, efficiency, experience, and utilization outcomes. More specifically, health outcomes can and have been used to measure the effectiveness of care communication and care coordination activities and programs.

Reduction of unplanned hospital readmissions is a classic outcome of an effective care communication and care coordination activity. When a patient's care is not well coordinated during and after a hospital discharge, there may be gaps in follow-up care, poor communication among clinicians, or poorly executed plans of care. This can lead to a patient returning and requiring additional inpatient care, termed a *readmission*. However, readmissions measures are also limited as a measure because they can be associated with other issues outside of care coordination, particularly the progression of disease. A 2014 systematic review synthesized the evidence from randomized trials of the efficacy of interventions to reduce unplanned hospital readmissions. In the 42 trials reviewed, care coordination interventions were associated with fewer readmissions within 30 days of discharge. More effective interventions tended to have more components, involve more individuals in care delivery, and specifically supported patient capacity for self-care.[33]

Other outcomes of care communication and care coordination include the reduction of specific healthcare utilization, such as ED visits and overall unplanned hospitalizations; potentially avoidable clinic care, including the need for specialist care; or potentially avoidable hospitalizations.[35,36] Broadly speaking, ED visits and hospitalizations, and particularly potentially avoidable hospitalizations, should occur less frequently when care is better coordinated. For example, better-coordinated primary care may result in a patient being treated early for a urinary tract infection (UTI) as an outpatient rather than the UTI worsening into symptoms of pyelonephritis or urosepsis that may require hospitalization.[35]

Improved patient experience with healthcare in general or patient experience with a focus on the level of care integration is another potential outcome of effective care communication and care coordination.[36] Similar to care communication and care coordination, care integration is described as "care that is coordinated across professionals, facilities and support systems; continuous over time and between visits; tailored to the patients' needs and preferences; and based on shared responsibility between patient and caregivers for optimizing health."[37] Using surveys such as the Patient Perceptions of Integrated Care and the Pediatric Integrated Care Survey can provide feedback on the impact of integrated care interventions, both for research purposes and quality improvement.[37,38] Overall quality of life, condition-specific functional outcomes (e.g., Barthel Index in stroke),[37] or general functional outcomes (e.g., independence and/or the ability to complete activities of daily living)[38] may also serve as more indirect measures of the quality-of-care coordination. Cost as an outcome measure, such as total cost of care, may also be used to assess care communication and care coordination activities, particularly because both ED visits and hospitalizations are costly and may be prevented through more coordinated care.[39] Another approach observed in the literature is that an outcome of care communication and care coordination may focus on a specific clinical action occurring, such as a follow-up visit taking place within a specific period of time after a hospitalization. However, evidence shows that the most beneficial timing of the follow-up visit after discharge may depend on risk assessment at discharge. For example, one study of state Medicaid claims data found that an outpatient follow-up within 14 days after discharge for patients in the highest risk group resulted in a 19.1 percent reduction in readmissions compared with those without a follow-up. In contrast, there was only a 1.5 percent reduction of readmissions for the lowest risk group with a follow-up within 14 days compared to those without a follow-up.[24] Several studies found that care communication and care coordination and related interventions, including the use of EHRs, can result in a reduction of ED visits.

Several studies found that care communication and care coordination and related interventions, including the use of EHRs, can result in a reduction of ED visits, inpatient admissions, and length of stay in an acute-care hospital. A few examples include the comprehensive development of care plans and a redesign of a surgery delivery care process. In one study, a multidisciplinary team developed individualized care plans in the EHR for 24 medically and psychosocially complex patients who had high rates of inpatient admissions and ED visits. Following the implementation of the care plans, hospital admissions decreased by 56 percent at six months and 50.5 percent at 12 months, and 30-day readmissions decreased by 66 percent at six months and 51.5 percent at 12 months.[40] In another study, a hospital conducted a care delivery redesign for vascular surgery processes that included clarifying responsibilities using a mobile app and tracking patients. The redesigned processes resulted in a 23 percent decrease in length of stay, a decrease in variable costs, and an increase in hospital revenue. However, 30-day unplanned readmissions rates did not change after implementation of the care redesign.[26] This suggests that care communication and care coordination interventions can have variable effects at various stages across an episode of care and may not affect one particular outcome, such as an unplanned readmission.[41]

Another example of an outcome of care communication and care coordination is medication errors, which may be addressed through a common care coordination process: medication reconciliation.[42] Yet similar to other care communication and care coordination interventions, a 2018 Cochrane review of the evidence of medication reconciliation on outcomes found uncertain effects with low evidence on identifying medication discrepancies and uncertain evidence of the effect of medication reconciliation on improving objective clinical outcomes, including medical errors.[43]

In quality measurement, there has been a broader push towards the use of outcome measures over process measures. This is because the overall goal of care is to improve outcomes, which can be achieved through different processes across settings, and these processes may differ slightly yet achieve the same outcome. However, measuring outcomes for care communication and care coordination is complex. Care communication and care coordination outcomes can be attributed to numerous factors, some of which are outside of the control of an individual clinician or hospital, and some of which are intrinsic to the patient and their condition and comorbidities. Such complexity makes it difficult to meaningfully measure and compare outcomes across entities without robust risk adjustment, which can be challenging to accomplish.[44] For example, although unplanned hospital readmissions are associated with poorly implemented care coordination practices, many other factors can contribute to hospital readmissions, including clinical factors (e.g., progress of disease), patient factors (e.g., SDOH, insurance status), system factors (e.g., participation in an HIE, payer policies, state/local policies, and interoperability), and community factors (e.g., availability of follow-up care). However, certain care communication and care coordination outcomes may be more inherently measurable. For example, information on actual medical errors that a patient experiences is becoming increasingly more accessible with detailed data found in EHRs.

USES OF ELECTRONIC HEALTH RECORDS FOR CARE COMMUNICATION AND CARE COORDINATION

EHRs are primarily designed to facilitate clinical documentation and reimbursement. Specifically, EHRs are used as a communication platform, decision support tool, location to document specific activities, and location to keep test results and clinical notes. However, EHRs can also be used to coordinate care and facilitate communication, specifically between patients and the broader healthcare team: patients, families/caregivers, clinicians, and affiliated healthcare staff. Sources of EHR data that may be useful for care communication and care coordination could include not only the data entered by clinicians, but also data from mobile devices, wearables, and other sources.

One national study that used a literature review as well as interviews of staff from EDs, acute care hospitals, nursing homes, skilled nursing homes, and home health agencies identified nine care coordination activities that EHRs could either facilitate or document. The nine care coordination activities included the following:[25]

- Establish accountability or negotiate responsibility
- Communication, including interpersonal and information transfer
- Facilitate transitions
- Assess needs and goals
- Create a proactive plan of care
- Monitor, follow up, and respond to changes
- Support self-management goals
- Link to community resources
- Align resources with patient and population needs

These activities can be conducted directly with patients as well as families and caregivers. To use the EHR effectively for care communication and care coordination, individuals within the healthcare team must use the EHR (i.e., document correctly) and EHR tools appropriately and communicate well as a team both within and across settings. The study also found that while EHRs have the potential to facilitate many of these care coordination activities, a lack of interoperability (i.e., the ability of clinicians and staff at each facility to see the data from another EHR) limits the ability to deliver care effectively because the EHRs often lack complete and easily accessible information about the patient. Without interoperable EHR data, clinicians must sometimes rely on hard copies and faxes to transfer and receive data, particularly when information is housed in electronic systems that cannot communicate with other systems. Alternatively, they may deliver care without having complete information. Additionally, the researchers found that some activities that are facilitated by the EHR still require interpersonal communication between providers, such as establishing accountability or responsibilities. The authors also found high potential for future health IT to support care coordination in the following areas: "information transfer, monitor, follow-up, and respond to change, support self-management goals, link to community resources, and align resources with patient and population needs."[7] This suggests that some of these areas could be further automated with oversight by clinicians. In addition, the use of EHRs and health IT could potentially support clinicians in "facilitating transitions," "access[ing] needs and goals," and "creat[ing] a proactive plan of care."[7]

During the current coronavirus 2019 (COVID-19) pandemic, the use of telehealth rapidly increased with the need for social distancing, quarantines, and isolation to reduce the spread of the virus. Telehealth facilitated the delivery of care as well as care coordination and communication. As outbreaks of COVID-19 occurred in nursing homes and other long-term care (LTC) facilities, healthcare partners looked for ways to leverage EHRs and telehealth to manage the patient population. The University of Virginia developed a model that included early identification of patients, monitoring and treating patients with telehealth visits and staff communications, coordinated transfers for residents needing to be hospitalized, and a daily check-in regarding facility needs.[46] The authors concluded that the model worked well and produced lower hospitalizations and mortality rates compared with similar facilities. [38]

An important function of EHRs is the potential ability to share patient information across multiple providers that work in different settings and for different organizations. For example, to coordinate care effectively, physicians need three types of health information from the patient: (1) results of a consultation for patients referred to outside providers, (2) a patient's history and reason for referral from outside providers, and (3) hospital discharge information.[47] For patients who have not recently been in the hospital, this would include information from recent clinic notes. Because a patient's healthcare team may work in different settings and for different organizations, their data may be stored in several different, unconnected EHR systems. One solution to providing access to data across dispersed EHRs was the development of regional HIEs. HIEs are separate systems that connect data from participating providers and organizations that would otherwise not be able to connect to each other. This enables healthcare providers to obtain patient data (both inpatient and outpatient) from other EHRs. One study found that the national average for the sharing of patient data by hospitals at discharge via an HIE was at 88 percent but was only 56.3 percent for psychiatric units in acute-care hospitals, suggesting that incentives to implement health IT and share information may vary across care settings.[48]

In addition to HIEs, data sharing can occur through direct interoperability platforms, such as Epic's Care Everywhere, in which data across multiple systems are displayed within the EHR directly when the software platform is used. In PHRs, which are a newer concept, patients are the owners of their own data and can share data across clinicians or settings. Data sharing is an essential element of care coordination and communication, and several studies have shown that EHRs are effective in facilitating transitions. For example, a tertiary referral center with over 500 beds and 57,000 annual ED visits studied the ability to use electronic handoffs (i.e., transfer of patient care responsibilities) rather than verbal handoffs between the ED and inpatient units. In the first year, 77.5 percent of admissions were accepted electronically, which increased to 87.3 percent by year four. This demonstrated that electronic handoffs were effective in sharing the information most of the time but that verbal handoffs were still sometimes necessary. The tool for electronic sign-off allowed the receiving physicians and nurses to request verbal sign-off when questions arose about the patient's needs or whether the patient was being transferred to the appropriate unit. The use of the electronic handoff reduced burden on the hospital team, as they did not have to communicate in real time, which resulted in an 18-minute average reduction time for sign-off from the ED to an inpatient admission. The tool included multiple reminders to the receiving team, including automatic escalation to a more senior physician and lead nurses if a response was not completed within a certain period.[39]

In addition to sharing data with other providers, many EHRs include patient portals that allow for patients and their families (parents for minors and patient permissions for adults) to have ownership over their own data and consent to securely sharing these data with providers.[50] Patients and their families can review appointment summaries as well as laboratory and imaging test results. Patient portals have been found to increase patient engagement with their own care and facilitate patient-provider communication. Some portals allow for secure messages (i.e., text) for nonurgent questions or for providers to send notes about test results and the next steps (e.g., change in prescription, schedule follow-up visits). Secure messaging also allows patients to ask a question to their providers at any time of day or night when the question arises and in between visits.[51] Patient portals may also be used for patients to request prescription refills, update prescription lists, and other health information. One study found that while some providers have been reluctant to encourage older patients to use the patient portal, patients over 85 years of age and their informal caregivers are able to access information.[52] Specifically, the study found that individuals ages 85 years or older and their caregivers successfully used secure messaging for a variety of reasons, including clinical issues, medication questions and refill requests, care transitions, scheduling, appreciation, billing, telephone requests, and death notices. Patients were more likely to initiate messages related to scheduling and medication refills, while caregivers were more likely to initiate messages related to transitions of care.[52] This is an important finding as the population of older adults in the U.S. continues to increase and the healthcare community continues to increase their use of EHRs and other internet-based applications.

For EHRs to be effective in the sharing of information between healthcare professionals, users must understand their functionality (i.e., to prevent or reduce mistakes in data entered by clinicians), and EHRs must be usable (i.e., navigating and searching information is seamless). For example, after an initial round of cancer treatment is concluded, an oncologist may develop a survival care plan and transition long-term, follow-up care to the patient's PCP. This survival plan is important for care coordination because it provides the PCP with details about the treatment course and what is needed to monitor for recurrence or long-term health issues related to the cancer that might be unfamiliar to the PCP.[53] However, the care plan is only useful to the PCP if the data are accurate, the PCP knows that the data are there, and they can easily access the data. A program at one health system found that a 15-minute training was useful in teaching providers that the EHR has a specific location for storing and accessing such plans.[54]

There is also a movement towards having patients provide access to electronic health data across their care team rather than relying on their clinicians to share it. During an expert interview, the importance of patients being able to share their healthcare data across multiple settings was discussed, as many providers still have interoperability issues.[55] For example, the U.S. Department of Veterans Affairs (VA) has instituted a patient portal that allows veterans to share their VA Continuity of Care Document (CCD) with their non-VA providers. The VA studied patient portal use by surveying community providers with access to the CCD.[55] A total of 97 percent reported confidence in the accuracy of the information received, and 96 percent wanted to continue to receive the information. Additionally, 90 percent said that it helped with medication decisions, and 50 percent did not order an unnecessary test or procedure due to the information reviewed.[55] In 2013, the VA added the Blue Button to their patient portal, which provides patients with easy access to view, download, or print their CCD with trusted others, including health professionals outside of the VA Health Care System. A study found that veterans enrolled in Medicare who were trained and used the Blue Button feature to download their information were successfully able to share their VA healthcare data with non-VA providers. The sharing of the data resulted in significantly fewer duplicate hemoglobin A1C tests compared with veterans who did not share their VA healthcare data with their Medicare providers.[56]

Impact of Social Determinants of Health on Care Communication and Care Coordination and Measurement

Health equity is when all people are able to attain the highest level of health. It can be affected more by population-level factors (e.g., physical, social, and policy environments) than individual-level factors (e.g., race, ethnicity, and disability status).[57] Additionally, SDOH are nonmedical risk factors, such as discrimination, lack of access to healthy food, exposure to crime and violence, and access to housing and transportation. SDOH factors can have a major impact on an individual's overall health and well-being and can also serve as barriers to care communication and care coordination as people move within and across clinicians and healthcare settings. This is because SDOH can lower access to care, reduce the likelihood of an individual completing a treatment plan (e.g., filling prescriptions), directly cause medical conditions (e.g., metabolic syndrome, diabetes, and obesity), and increase risks of injury through exposure to violence. Healthy People 2030 identified addressing SDOH as one of its five overarching goals; specifically, the goal is to "Create social, physical, and economic environments that promote attaining the full potential for health and well-being for all."[58]

This report will refer to the World Health Organization's (WHO) and the Centers for Disease Control and Prevention's (CDC) definitions of SDOH. WHO defines SDOH as "non-medical factors that influence health outcomes. They are the conditions in which people are born, grow, work, live, and age, and the wider set of forces and systems shaping the conditions of daily life. These forces and systems include economic policies and systems, development agendas, social norms, social policies and political systems."[59] CDC defines SDOH as "conditions in the places where people live, learn, work, and play that affect a wide range of health risks and outcomes."[60] The negative results of SDOH are referred to as health-related social needs (HRSN).[61]

Healthy People 2030 highlights the key domains of SDOH[58]:

1. Healthcare access and quality
2. Education access and quality
3. Social and community context
4. Economic stability (e.g., enough resources to meet all needs)
5. Neighborhood and built environment

One of the factors that limits the ability of clinicians to address SDOH is that they are often not part of standard medical evaluations. For example, traditional "social history" in medical charts focuses on substances (i.e., smoking, alcohol, and illicit drug use) but does not commonly capture more traditional SDOH (e.g., poverty) that have large impacts on health outcomes. EHRs present an opportunity to better capture SDOH into medical records and in more standardized ways. Better EHR capture of SDOH has three potential benefits: (1) improving medical care through better recognition of SDOH by clinicians, (2) serving as standard variables for use in performance measurement and risk adjustment, and (3) serving as data for EHR-based tools to help risk-stratify patients and direct the delivery of social service resources. Notably, all of these goals would serve to improve care communication and care coordination across settings.[56] For example, along with standardization of SDOH data for improved sharing and more uniform research, SDOH data could be used for social risk assessment, recommendations for coordinating specific services (e.g., social services or housing assistance), directly sharing EHR data with social service providers to communicate issues, or using EHR triggers to directly include social services as part of the healthcare team. Risk assessments could also be performed at the population level through "hot spotting" or targeting patients with high-care utilization who are at higher risk for poor health outcomes and high cost of care. This has been effectively performed by the Camden Coalition to help coordinate care for high-risk patients.[62]

Despite efforts to encourage the collection of more nonmedical data, there are still many challenges and barriers to collecting SDOH data for these purposes, including a lack of standardization of data elements to capture the full spectrum of SDOH. For example, patient race and ethnicity are not always captured in the same way across EHRs. These data are also frequently inaccurate.[63] Digital infrastructure deficiencies in rural settings are a further challenge in addressing SDOH, such as poverty, as not every system has the technological resources to implement data collection. For the 15 percent of Americans living in a rural area, heart disease, cancer, and respiratory problems pose a greater risk compared with Americans living in urban areas. Furthermore, rural Americans face additional barriers to accessing care due to the distance from the ED or specialists.[64] Improved health IT capabilities can connect rural providers to each other as well as to nonrural providers, and while there has been widescale adoption of EHRs, rural providers and hospitals still lag behind their urban counterparts.[65] Even when rural providers do have an EHR system, there are factors that contribute to the patient's ability to use their online medical record or patient portal for more patient-centered care, such as access to reliable broadband infrastructure, access to a usual source of care, and provider encouragement of online record use.[65] The CMS Accountable Health Communities Model seeks to address HRSN through screenings, referrals, and alignment of services. The program began in 2019 and will conclude in 2022. Initial results show promise, as the model is able to identify those Medicare beneficiaries with HRSN that have higher cost and utilization; however, it does not yet show that addressing those needs can result in savings.[66]

ONC currently encourages EHR vendors to incorporate SDOH data collection in their EHR systems through certifications, policies, and collaboration with other government agencies. The 2020 **Interoperability Standards Advisory (ISA)** is a series of standards that ONC uses to "coordinate the identification, assessment, and determination of 'recognized' interoperability standards and implementation specifications for industry use to fulfill specific clinical health IT interoperability needs." In relation to SDOH, the ISA outlines interoperability standards related to exposure to violence, financial resource strain, food insecurity, housing insecurity, level of education, social connection and isolation, and transportation insecurity.[52] Although the standards in the ISA are not mandated, ONC encourages the use of the standards outlined in it to facilitate interoperability in clinical, public health, or research settings. ONC's Health IT Certification Program outlines standards for social, psychological, and behavioral data for health IT product development.

Such standards can facilitate the creation of value sets, which are a list of specific values, terms, and their codes, and are used to describe clinical and administrative concepts in quality measures.[67] A key element of EHR-sourced measures is the value sets and data elements that can be mapped to EHR-sourced measure specifications. Standardized value sets can be used to create quality measures for care communication and care coordination through specifying a denominator of patients (i.e., those with food insecurity) for the deployment of targeted interventions and for, if effective, holding organizations accountable for deploying interventions to specific populations through performance measurement.

The **United States Core Data for Interoperability (USCDI)** is an initiative adopted and funded by ONC in the **21st Century Cures Act Final rule** to create a standard set of health data classes and data elements for nationwide, interoperable HIE.[68] The current version of USCDI, Version 1, covers topics such as allergies and intolerances, assessment and plan of treatment, care team members, structured and unstructured clinical notes, patient goals, medications, patient demographics, vital signs, and other common fields in EHRs. Standards proposed for future iterations of USCDI include SDOH assessments, goals, interventions, outcomes, and problems/health concerns. In addition, work information, such as combat zone period, employment status, farmworker status, job, retirement data, usual work, and veteran status, is also proposed.[68] Work conditions can be a major indicator of an individual's health, as poor working conditions can lead to chronic health conditions.[69]

The SDOH standards proposed for USCDI were submitted by the **Gravity Project**, a medical-coding collaborative funded through HL7 and various sponsors that aims to identify coded data elements and associated value sets to represent SDOH data documented in EHRs. Guided by a group of over 800 stakeholders, the project seeks to address the social risk domains of food insecurity, housing instability and quality, and transportation access across the clinical activities of screening, diagnosis, planning, and interventions. In addition to providing input on initiatives such as USCDI, the Gravity Project will develop an HL7 Fast Healthcare Interoperability Resources (FHIR) SDOH implementation guide.[70]

Data in unstructured fields could also increase collection of SDOH data. Natural language processing (NLP) is a tool that can translate clinical notes into valuable data points. In a 2018 retrospective study, researchers analyzed data from unstructured EHR notes using NLP and compared it to claims data to determine whether unstructured data were useful in identifying geriatric syndrome. In addition to examining data about physical and mental conditions, NLP enabled the researchers to identify rates of lack of social support, a critical indicator of physical and mental well-being.[71]

Advantages and Challenges of Measuring Care Communication and Care Coordination in Electronic Health Records

Care communication and care coordination entail intentional and strategic facilitation and communication of patient information between all stakeholders to ensure the best possible patient outcomes. Leveraging EHRs for care communication and care coordination presents a vast number of advantages; however, the challenges are also numerous. For care communication and care coordination to be as effective as possible, all challenges must be addressed and countered with solutions preventing inefficient patient care. Foundational and systemic gaps present pivotal opportunities in redesigning a multidisciplinary approach that is inclusive of specific technological advances needed to support care communication and care coordination activities. Although clinical data may be exchanged in various ways, EHR systems promote and facilitate patient health information across health settings and are easier for data retrieval.[47] With the implementation of the HITECH Act, ambitious goals were set forth for the adoption and effectiveness of EHRs, with some being more successful than others and many lacking functionalities and the needed platforms to support effective exchange of information. HITECH's introduction of **Meaningful Use** quickly increased EHR adoption rates; however, HITECH's measure of success also presents significant barriers, including a lack of cooperation among stakeholders, burdensome regulations, and physician burnout tied to the technology.[14]

ADVANTAGES OF USING EHRS FOR MEASUREMENT

According to O'Malley et al, EHRs remain at the forefront of strengthening interprofessional care teams, along with promoting coordinated collaboration among PCPs and key primary care staff.[72] Leveraging the EHR for care coordination has enhanced communication by improving access to patient information for all team members. This includes examples such as instant messaging, interdisciplinary notes, customized phone templates routed to team members' inboxes, and task assignments to delegate additional duties to other members within the care team. Huddle sheets have also been a vital benefit to care communication and care coordination within the EHR. Furthermore, clinical decision support systems (CDSSs) within an EHR continue to support care communication and care coordination activities, encourage collaboration with shared decision making among the patient and provider, and are targeted specifically for each patient at touchpoints within the health system. Developed under the HITECH Act, CDSSs are designed to encourage utilization of EHRs in a comprehensive manner to implement collaborative care communication and care coordination activities. Promoting Interoperability (formerly known as Meaningful Use) requirements remains instrumental in encouraging efficient communication. For example, Objective 6 Core Measure 2-Secure Messaging focuses on interoperability that allows patients direct access via messaging to their provider or care team, respectively.[73] Apart from secure messaging, care communication and care coordination activities occurring within the same EHR and health system fail to function with adequate communication across settings.

BARRIERS OF USING EHRS FOR MEASUREMENT

Despite substantial effort and investment in health information systems and technology as well as many years of widespread availability, EHRs present many challenges and barriers for quality measurement. For example, barriers to interoperability persist, including the limitations of efficient communication across a diverse set of largely private providers and care settings. Because EHRs are developed by private entities, there has been insufficient incentive to build systems that effectively share data and are interoperable with one another. New regulations promulgated by ONC may change this situation in the near future, although this literature review found that the lack of interoperability appears to be the most common barrier. However, other barriers such as non-standardization within structured fields, lack of industry-wide standards, resistance to new technology, and difficulty in quantifying care communication and care coordination efforts are key barriers to coordination of care and communication across care settings.

Interoperability Challenges

Interoperability enables the exchange of health information electronically from one user to another.[74] For two EHR systems to be truly interoperable, they must not only be able to exchange but also convert data into usable information.[63] Furthermore, the owners of the data need to give permission to share data, which itself can hinder interoperability efforts that are technically feasible. For care communication and care coordination, interoperability is a large, complex, and ongoing undertaking that involves the interest of a range of stakeholders both within and across care settings. However, care communication and care coordination successes have been documented based upon the ability to have electronic data readily available and flowing electronically across care settings.

Although interoperability has been a challenge in clinical care as well as care coordination, new ONC rules will help to transform EHRs and enhance interoperability over the next three to five years. This will benefit care communication and care coordination with regard to where successes have been documented based upon the ability to have electronic data readily available and flowing electronically across care settings. These bidirectional interfaces can allow for information to flow to and from clinicians and nonintegrated laboratories, pharmacies, and diagnostic services and can assist with the ability to exchange data. NQF's expert interviewees noted that advancement of interoperability would make care communication and care coordination activities more quantifiable, which would allow for measurement of care communication and care coordination activities.[47] However, while interoperable information is key to coordination and communication, it is also important to note that interoperability does not guarantee information accuracy. Sharing inaccurate information in the EHR can lead to inaccurate measurement, preventable errors, and potentially worsen outcomes.

Another barrier to interoperability is insufficient incentives for cooperation when EHRs compete for market share.[75] Within a **2012 NQF-commissioned report**, the authors noted that incentives encouraging vendors to work collaboratively to create interoperable platforms were nonexistent.[21] While ONC rules aim to address these incentives, the absence of financial incentives has acted as a hinderance to connectivity between EHR-enabled healthcare practices and those who may care for the patient outside of a hospital setting and do not have EHR systems (e.g., community-based organizations, LTC facilities, and home care organizations). This has led to disjointed and fragmented care.[47,75]

Lack of Industry-Wide Standards and Standardization

A significant barrier to measuring care communication and care coordination is the paucity of comprehensive, industry-wide standards specifying the data elements, data structure, standard models for querying data, and mechanisms for the technical transfer of data.[21] The lack of standardization and variations in standard implementation limits interoperability by increasing the resources required to carry out care communication and care coordination, or in some cases, it limits care communication and care coordination altogether, thus making measurement impractical.[15] The FHIR standards are voluntary for EHR vendors to adopt, but some are incentivized for adoption by ONC through their Health IT Certification Program.[76,77] When it comes to care coordination measurement, new FHIR standards through HL7 are under development, with the intent being to standardize care plans across EHR platforms.[78]

Such standardized structured elements and implementation guidelines will support the broader vision of care communication, care coordination, and patient-centered care, such as the co-management of longitudinal care plans, transitions in care across care settings, and linkages to community resources, which do not yet exist. Additionally, other groups are engaging in efforts to improve standardization of data elements. For example, USCDI is establishing a standardized set of data classes and elements for increased interoperability between health IT systems and serves as the certification criteria for their ONC Health IT Certification Program.[86] USCDI supports Meaningful Use and is aiming to standardize APIs by the end of 2023.[84] For PAC/LTC settings, the IMPACT Act uses the **Date Element Library (DEL)** to set data elements to support interoperability.

Since there is variability in the needs of healthcare providers and processes, new standardization of data elements as well as interoperability will help health IT developers to extend existing resources to become gradually more complex across their entire EHR system rather than rely on custom extensions to improve the EHR at an individual facility.[76,77,80] However, new standards are currently being trialed and are not completely mature. It is typically unlikely for an EHR vendor to start to adopt these standards until they are at a higher maturity level or are incentivized by ONC.[80]

Furthermore, unstructured data, which are typically categorized as free text with no limitations in the format and often without clear specification of the type of information recorded in a particular location, make measurement difficult. A common example of unstructured data is progress notes within EHRs. According to AHRQ, two distinct levels of standardization are vital in the consideration of quality measurement using electronic data: (1) presence of a standard code set and (2) widespread use of the standard. These standardization levels can support a measure being calculated from one site sharing the same meaning as the measure calculated from a different site.[13] Although standard codes exist for laboratory results, medication/drug information, and diagnosis/clinical observations, these are often not used consistently within the health IT industry. Of additional note, other concepts of interest for care communication and care coordination, such as referrals and self-management plans/goals, lack any established standard for how the information should be recorded or coded. Quality measurement using unstructured data is unlikely to be feasible for the near future, as there are no measures that utilize NLP. Additionally, once a specific action or outcome is measured, systems would develop structured data elements to measure it.

Very few quality measures are derived directly from EHR data because the lack of structured fields and inconsistent data capture practices across EHRs hinders measure development.[68] Currently, EHR-based measures tend to focus on specific data that can be easily quantified. For example, the outcomes required for the eCQMs in **Medicare Comprehensive Primary Care Plus (CPC+)**, such as CMS' 122v8-Diabetes measure-Hemoglobin A1C (HbA1c) poor control (>9 percent) and CMS' 165v8-Controlling High Blood Pressure control, are quantifiable in structured EHR data. The other measures required for the CPC+ are patient experience of care measures and claims-based utilization measures.[76,77] Expert interviews held during this environmental scan expound on the difficulties remaining when measuring care coordination: (1) the context sensitivity of care communication and care coordination interventions and difficulty in generalizing the interventions; (2) difficulties in measuring one process in a complex system; (3) trouble with measuring simply outcomes, particularly outcomes of care communication and care coordination that can be influenced by many factors beyond care communication and care coordination; and (4) the advancement of patient-owned/controlled data as a potential solution, at least for the information domain.[54]

Existing Care Communication and Care Coordination Measures

To explore the ability to leverage EHR-sourced measures to improve care communication and care coordination, NQF conducted a measure scan to identify existing care communication and care coordination measures that could be adapted to use EHR data or are measuring the use of EHR-based tools. The measure search resulted in 222 measures related to care communication and care coordination. (A summary is in Table 3 and Table 4.) The full list is in **Appendix B**. NQF categorized the measures into either directly or indirectly measuring a care communication and care coordination activity.

Measures that directly assess care communication and care coordination activities included those related to care plans (e.g., care plan documentation), follow-up, medication review/reconciliation, documentation of communication between providers, sharing of health information (e.g., via medical records upon transfers), and the patient/family experience of care coordination. A total of 117 measures directly assess a care communication and care coordination activity. Measures that indirectly assess care communication and care coordination activities include those related to hospital admissions, readmissions, unplanned hospital visits (e.g., ED visit, observation, or inpatient admission), and mortality. A total of 105 measures indirectly assess a care communication and care coordination activity or outcome.

Of these 222 measures, 137 (62 percent) are currently used in a federal program. Only six (3 percent) are eCQMs, 45 (20 percent) use the EHR as at least one of the data sources to calculate the measure, and 75 (34 percent) are classified as an outcome measure. The most common outcome is readmissions, which is captured in 35 (16 percent) different measures. Of the 117 measures that directly involve a care communication and care coordination activity, 89 (76 percent) are used in at least one federal program, and 30 (26 percent) use EHR data as one of the data sources.

In addition to measures, survey tools, such as the Pediatric Integrated Care Survey and Patient Perception of Integrated Care Survey, seek to measure the experience of patients and families with the coordinated care they receive.[78,79] These surveys can provide accurate feedback on the patient and family experience quickly, allowing healthcare facilities to evaluate the quality of care they are providing.

Table 3. Characteristics of Care Communication and Care Coordination Measures (N=222)

CHARACTERISTIC	NUMBER	PERCENT
MEASURE TYPE		
Process	121	55%
Outcome	75	34%
Patient-Reported Outcome Performance Measure (PRO-PM)	15	7%
Structure	7	3%
Composite	2	1%
Concept	2	1%
MEASURE CLASSIFICATION		
Electronic Clinical Quality Measure (eCQM)	6	3%
Clinical Quality Measure (CQM)	216	97%
NQF ENDORSEMENT STATUS		
NQF-Endorsed	141	64%
NQF Endorsement Removed	32	14%
Never Endorsed by NQF	49	22%
MEASURE DATA SOURCE		
Electronic Health Record (EHR)	45	20%
Non-Electronic Health Record	138	62%
Not Found	45	20%
USAGE IN FEDERAL PROGRAMS		
Used in a Federal Program	137	62%
Not Used in a Federal Program	85	38%

Table 4. Measures Directly or Indirectly Related to Care Communication and Care Coordination (N=222)*

CLASSIFICATION	NUMBER	PERCENT
DIRECTLY MEASURES A CARE COMMUNICATION AND CARE COORDINATION ACTIVITY	**117**	**53%**
Care Plan	25	11%
Communication	24	11%
Follow-Up	20	9%
Patient/Family Experience	17	8%
Screening/Assessment	16	7%
Medication Review	12	5%
Referrals	4	2%
Electronic Data Exchange	2	1%
Engagement With the Electronic Health Record	2	1%
Other (i.e., time to transfer to another facility)	1	<1%
INDIRECTLY MEASURES A CARE COMMUNICATION AND CARE COORDINATION ACTIVITY	**105**	**47%**
Readmissions	35	16%
Screening/Assessment	29	15%
Admissions	19	9%
Mortality	9	4%
Unplanned Hospital Visit (Emergency Department, Inpatient, Observation)	6	3%
Care Plan	3	1%
Emergency Department Visits	3	1%
Rehospitalization	2	1%
Patient/Family Experience	1	<1%
Discharges	1	<1%
Other (i.e., appropriate antibiotic use)	1	<1%

*Note: Some measures are categorized in more than one activity.

NQF endorsement evaluates measures based on the criteria outlined in the **Measure Developer Guidebook for Submitting Measures to NQF**, which includes the importance of measuring and reporting the condition being measured, the scientific acceptability of the measure (i.e., the measure's reliability and validity), the feasibility of using the measure, the use and usability of the measure, and how it compares to related and competing measures. Many care communication and care coordination outcome measures, particularly those related to hospital readmissions, have appeared in federal programs and have been central priorities for improvement by healthcare systems. By contrast, multiple care communication and care coordination process measures have lost endorsement. A general theme from NQF Standing Committee evaluations is that care communication and care coordination process measures lack sufficient evidence to robustly link them to health outcomes. For example, while it is intuitive that care should be improved at the point in which records are transitioned across settings in the process of transferring a patient between one ED to another, there was insufficient evidence to link the presence of this transmission of information to outcomes. In addition, many previously endorsed care communication and care coordination measures were based primarily on less rigorous evidence (i.e., expert opinion on best practices). Over time, however, NQF's evidence standards for endorsement became more stringent, thus making it more difficult to maintain measure endorsement and resulting in fewer endorsed measures. Lastly, there has been a general lack of uptake of care communication and care coordination process measures, resulting in limited or no data for analysis to demonstrate the usability of these measures.[80] Lack of uptake has been a result of difficulties in measurement (i.e. poor feasibility and usability of specified measures) and measurement priorities that have favored outcome measures over process measures.

Conclusion

Effective care communication and care coordination efforts help to ensure patient care is delivered seamlessly across multidisciplinary settings.[81]

Coordination is particularly relevant during transitions in care between clinicians and settings where a lack of effective information transfer can result in suboptimal care. Several measurement challenges exist for care communication and care coordination: (1) variable evidence linking process to outcomes, (2) context dependence of interventions, and (3) care communication and care coordination outcomes being influenced by many factors. EHR data and EHR-based tools may provide some solutions to the measurement issues with care communication and care coordination.

This literature review identified several outcomes of care communication and care coordination that can be measured in the EHR, including readmissions, ED visits, hospitalizations, preventable hospitalizations, and others. Yet while many of these outcomes are related to care communication and care coordination, other factors (e.g., clinical, patient, community, and SDOH) may be greater contributors, thus making it a challenge to isolate the effects of care communication and care coordination efforts.

While EHRs are primarily designed to facilitate clinical documentation and reimbursement, EHRs can also be used by healthcare providers to facilitate care communication and care coordination. Nine care coordination activities that EHRs can facilitate include the following: (1) accountability or negotiated responsibility; (2) communication; (3) interpersonal and information transfer; (4) transitions; (5) needs and goals documentation; (6) care plans; (7) monitoring, following up, and responding to changes; (8) supporting self-management; and (9) linking to community resources and aligning resources with patient and population needs. During the COVID-19 pandemic, telehealth has also been increasingly used as a mechanism to coordinate care, particularly with increased social distancing and stay-at-home orders.

NQF identified several advantages of measuring care communication and care coordination with EHRs and EHR-based tools, including the presence of detailed, real-time, or near –real-time data that can be used for quality measurement. In particular, EHRs provide a richer data set and measure components of care communication and care coordination directly that are not captured in claims data. SDOH data have the potential to be increasingly available in EHRs, not only patient race/ethnicity but also other variables, such as housing insecurity and others in structured and unstructured fields that may be useful in coordinating care with community services as well as in measure development. However, a central issue in EHR-based measurement of care communication and care coordination, as well as care communication and care coordination efforts, is variable interoperability of health IT across platforms. This has improved in recent years, particularly with policies that promote organizational data sharing. Yet interoperability remains a continued challenge. NQF also identified many other technical issues with measuring care communication and care coordination in EHRs, including a paucity of industry-wide standards for data elements, data structure, transfer for information, and handling unstructured data elements. These technical issues make measure creation challenging for developers.

As a result of the measure scan, NQF identified several issues. First, many care communication and care coordination measures have lacked sufficient evidence to link care processes to objective outcomes in a generalizable way. As a result, many previously endorsed care communication and care coordination measures have since lost endorsement, as early care communication and care coordination measures were largely based on best-practice recommendations that were based on weak evidence. There has also been a general lack of uptake of care communication and care coordination measures and little evidence that existing measures are usable or have been used broadly. Key findings from this environmental scan will inform the future creation of consensus-based recommendations for EHR-based care communication and care coordination measurement in an all-payer, cross-setting, and fully electronic manner.

References

1 Abbaszade A, Assarroudi A, Armat MR, et al. Evaluation of the Impact of Handoff Based on the SBAR Technique on Quality of Nursing Care. *J Nurs Care Qual*. June 2020.

2 Hsu J, Price M, Vogeli C, et al. Bending The Spending Curve By Altering Care Delivery Patterns: The Role Of Care Management Within A Pioneer ACO. *Health Aff Proj Hope*. 2017;36(5):876-884.

3 NQF: National Priorities Partnership Input to HHS on the National Quality Strategy. **http://www.qualityforum.org/Setting_Priorities/National_Priorities_Partnership_Input_to_HHS_on_the_National_Quality_Strategy.aspx. Last accessed January 2021**.

4 Selevan J, Kindermann D, Pines JM, et al. What Accountable Care Organizations Can Learn from Kaiser Permanente California's Acute Care Strategy. *Popul Health Manag*. 2015;18(4):233-236.

5 Kaiser Family Foundation, Ranji U, Rosenzweig C, et al. Women's Coverage, Access, and Affordability: Key Findings from the 2017 Kaiser Women's Health Survey. March 2018. **https://www.kff.org/womens-health-policy/issue-brief/womens-coverage-access-and-affordability-key-findings-from-the-2017-kaiser-womens-health-survey/. Last accessed August 2021**.

6 Harvard T.H. CHAN School of Public Health. Electronic vs. personal health record. News. **https://www.hsph.harvard.edu/news/magazine/fall08ehrpersonalvshealth/. Published September 15, 2008. Last accessed May 2021**.

7 The effects of data entry structure on patients' perceptions of information quality in Health Information Exchange (HIE) - ScienceDirect. **https://www.sciencedirect.com/science/article/abs/pii/S1386505619311700?via%3Dihub. Last accessed May 2021**.

8 National Quality Forum (NQF). *Electronic Health Record Data Quality Best Practices for Increased Scientific Acceptability-Final Report*.; 2020. **http://www.qualityforum.org/Publications/2020/12/Electronic_Health_Record_Data_Quality_Best_Practices_for_Increased_Scientific_Acceptability_-_Final_Report.aspx**.

9 eCQMs | eCQI Resource Center. **https://ecqi.healthit.gov/ecqms. Last accessed April 2021**.

10 Murphy DR, Meyer AN, Sittig DF, et al. Application of electronic trigger tools to identify targets for improving diagnostic safety. *BMJ Qual Saf*. 2019;28(2):151-159.

11 Getting Started with HIE | HealthIT.gov. **https://www.healthit.gov/topic/health-it-basics/getting-started-hie. Last accessed May 2021**.

12 CDS Hooks: Overview. **https://cds-hooks.org/. Last accessed June 2021**.

13 Challenges of Measuring Care Coordination Using Electronic Data and Recommendations to Address Those Challenges. **http://www.ahrq.gov/research/findings/final-reports/prospectscare/prospects1.html. Last accessed May 2021**.

14 Reisman M. EHRs: The Challenge of Making Electronic Data Usable and Interoperable. *Pharm Ther*. 2017;42(9):572-575.

15 Chesapeake Regional Information System for Our Patients. Improve Outcomes and Enhance the Patient Experience | CRISP. **https://crisphealth.org/. Last accessed June 2021**.

16 Segal JB, DuGoff EH. Building blocks for measuring care coordination with claims data. *Popul Health Manag*. 2014;17(4):247-252.

17 Office of the National Coordinator for Health Information Technology. Health IT Quick Stats. **https://dashboard.healthit.gov/quickstats/quickstats.php. Last accessed January 2021**.

18 Chee TT, Ryan AM, Wasfy JH, et al. Current State of Value-Based Purchasing Programs. *Circulation*. 2016;133(22):2197-2205.

19 Mandl KD, Gottlieb D, Mandel JC, et al. Push Button Population Health: The SMART/HL7 FHIR Bulk Data Access Application Programming Interface. *NPJ Digit Med*. 2020;3. **https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7678833/. Last accessed February 2021**.

20 NQF. Definition and Framework for Measuring Care Coordination. 2006. **https://www.tnaap.org/documents/nqf-definition-and-framework-for-measuring-care-co.pdf**.

21 Samal L, Hasan O, Volk LA, et al. Health Information Technology to Support Care Coordination and Care Transitions: Data Needs, Capabilities, Technical and Organizational Barriers, and Approaches to Improvement Commissioned Paper. February 2012. **https://www.qualityforum.org/Publications/2012/02/Health_Information_Technology_to_Support_Care_Coordination_and_Care_Transitions.aspx**.

22 Bates DW. Health Information Technology and Care Coordination:The Next Big Opportunity for Informatics? *Yearb Med Inform*. 2015;10(1):11-14.

23 Chapter 2. What is Care Coordination? **http://www.ahrq.gov/ncepcr/care/coordination/atlas/chapter2.html. Last accessed January 2021**.

24 Goldstein JN, Shinwari M, Kolm P, et al. Impact of care coordination based on insurance and zip code. *Am J Manag Care*. 2019;25(6):e173-e178.

25 Schultz EM, Pineda N, Lonhart J, et al. A systematic review of the care coordination measurement landscape. *BMC Health Serv Res*. 2013;13:119.

26 NQF: Priority Setting for Healthcare Performance Measurement: Addressing Performance Measure Gaps in Care Coordination. **https://www.qualityforum.org/Publications/2014/08/Priority_Setting_for_Healthcare_Performance_Measurement__Addressing_Performance_Measure_Gaps_in_Care_Coordination.aspx. Last accessed February 2021**.

27 McDonald KM, Sundaram V, Bravata DM, et al. *Closing the Quality Gap: A Critical Analysis of Quality Improvement Strategies (Vol. 7: Care Coordination)*. Rockville (MD): Agency for Healthcare Research and Quality (US); 2007. **http://www.ncbi.nlm.nih.gov/books/NBK44015/. Last accessed January 2021**.

28 Catalyst N. What Is Care Coordination? *NEJM Catal*. January 2018. **https://catalyst.nejm.org/doi/full/10.1056/CAT.18.0291. Last accessed January 2021**.

29 The Promise of Care Coordination: Transforming Health Care Delivery. April 2013. **https://familiesusa.org/wp-content/uploads/2019/09/Care-Coordination.pdf**.

30 Care Coordination for Certified Community Behavioral Health Clinics (CCBHCs). **https://www.samhsa.gov/section-223/care-coordination. Last accessed January 2021**.

31 Committee COCWD and MHIPA. Patient- and Family-Centered Care Coordination: A Framework for Integrating Care for Children and Youth Across Multiple Systems. *Pediatrics*. 2014;133(5):e1451-e1460.

32 Börner B, Henninger M, Röthlin M, et al. Correlations Between Aspects Of Team Communication And Task Coordination During Medical Emergencies. :1.

33 Leppin AL, Gionfriddo MR, Kessler M, et al. Preventing 30-Day Hospital Readmissions: A Systematic Review and Meta-analysis of Randomized Trials. *JAMA Intern Med*. 2014;174(7):1095.

34 Freund T, Campbell SM, Geissler S, et al. Strategies for reducing potentially avoidable hospitalizations for ambulatory care-sensitive conditions. *Ann Fam Med*. 2013;11(4):363-370.

35 Bail K, Berry H, Grealish L, et al. Potentially preventable complications of urinary tract infections, pressure areas, pneumonia, and delirium in hospitalised dementia patients: retrospective cohort study. *BMJ Open*. 2013;3(6).

36 Bautista MAC, Nurjono M, Lim YW, et al. Instruments Measuring Integrated Care: A Systematic Review of Measurement Properties. *Milbank Q*. 2016;94(4):862-917.

37 Ziniel SI, Rosenberg HN, Bach AM, et al. Validation of a Parent-Reported Experience Measure of Integrated Care. *Pediatrics*. 2016;138(6):e20160676.

38 Singer S, Friedberg M, Kiang M, et al. Development and Preliminary Validation of the Patient Perceptions of Integrated Care Survey. *Med Care Res Rev MCRR*. 2012;70.

39 Tilling K, Sterne JA, Rudd AG, et al. A new method for predicting recovery after stroke. *Stroke*. 2001;32(12):2867-2873.

40 Shelkey M, Wallace M. Katz Index of Independence in Activities of Daily Living. *J Gerontol Nurs*. 1999;25(3):8-9.

41 ED-Based Care Coordination Reduces Costs for Frequent ED Users. AJMC. **https://www.ajmc.com/view/edbased-care-coordination-reduces-costs-for-frequent-ed-users. Last accessed January 2021**.

42 Mercer T, Bae J, Kipnes J, et al. The highest utilizers of care: individualized care plans to coordinate care, improve healthcare service utilization, and reduce costs at an academic tertiary care center. *J Hosp Med*. 2015;10(7):419-424.

43 Peralta J, Ham SW, Magee GA, et al. Impact of a care delivery redesign initiative for vascular surgery. *J Vasc Surg*. 2020;71(2):599-608.e1.

44 Al-Hashar A, Al-Zakwani I, Eriksson T, et al. Impact of medication reconciliation and review and counselling, on adverse drug events and healthcare resource use. *Int J Clin Pharm*. 2018;40(5):1154-1164.

45 Redmond P, Grimes TC, McDonnell R, et al. Impact of medication reconciliation for improving transitions of care. *Cochrane Database Syst Rev*. 2018;8:CD010791.

46 Harris DA, Archbald-Pannone L, Kaur J, et al. Rapid Telehealth-Centered Response to COVID-19 Outbreaks in Postacute and Long-Term Care Facilities. *Telemed J E-Health Off J Am Telemed Assoc*. 2021;27(1):102-106.

47 Hsiao C-J, King J, Hing E, et al. The role of health information technology in care coordination in the United States. *Med Care*. 2015;53(2):184-190.

48 Shields MC, Ritter G, Busch AB. Electronic Health Information Exchange At Discharge From Inpatient Psychiatric Care In Acute Care Hospitals. *Health Aff Proj Hope*. 2020;39(6):958-967.

49 A Path Toward Further Clinical and Administrative Data Integration. :111.

50 Stewart MT, Hogan TP, Nicklas J, et al. The Promise of Patient Portals for Individuals Living With Chronic Illness: Qualitative Study Identifying Pathways of Patient Engagement. *J Med Internet Res*. 2020;22(7):e17744.

51 Ramirez-Zohfeld V, Seltzer A, Xiong L, et al. Use of Electronic Health Records by Older Adults, 85 Years and Older, and Their Caregivers. *J Am Geriatr Soc*. 2020;68(5):1078-1082.

52 McDonough AL, Rabin J, Horick N, et al. Practice, Preferences, and Practical Tips From Primary Care Physicians to Improve the Care of Cancer Survivors. *J Oncol Pract*. 2019;15(7):e600-e606.

53 Donohue S, Haine JE, Li Z, et al. The Impact of a Primary Care Education Program Regarding Cancer Survivorship Care Plans: Results from an Engineering, Primary Care, and Oncology Collaborative for Survivorship Health. *J Cancer Educ Off J Am Assoc Cancer Educ*. 2019;34(1):154-160.

54 Expert Interview 2. January 2021.

55 Klein DM, Pham K, Samy L, et al. The Veteran-Initiated Electronic Care Coordination: A Multisite Initiative to Promote and Evaluate Consumer-Mediated Health Information Exchange. *Telemed J E-Health Off J Am Telemed Assoc*. 2017;23(4):264-272.

56 Turvey CL, Klein DM, Witry M, et al. Patient Education for Consumer-Mediated HIE. A Pilot Randomized Controlled Trial of the Department of Veterans Affairs Blue Button. *Appl Clin Inform*. 2016;7(3):765-776.

57 Paving the Road to Health Equity - OMHHE - CDC. **https://www.cdc.gov/minorityhealth/publications/health_equity/index.html. Published November 30, 2020. Last accessed August 2021**.

58 Social Determinants of Health - Healthy People 2030 | health.gov. **https://health.gov/healthypeople/objectives-and-data/social-determinants-health. Last accessed January 2021**.

59 Social determinants of health. **https://www.who.int/westernpacific/health-topics/social-determinants-of-health. Last accessed January 2021**.

60 About Social Determinants of Health (SDOH). **https://www.cdc.gov/socialdeterminants/about.html. Published December 14, 2020. Last accessed January 2021**.

61 When Talking About Social Determinants, Precision Matters | Health Affairs Blog. **https://www.healthaffairs.org/do/10.1377/hblog20191025.776011/full/. Last accessed August 2021**.

62 Sevak P, Stepanczuk CN, Bradley KWV, et al. Effects of a community-based care management model for super-utilizers. *Am J Manag Care*. 2018;24(11):e365-e370.

63 Klinger EV, Carlini SV, Gonzalez I, et al. Accuracy of race, ethnicity, and language preference in an electronic health record. *J Gen Intern Med*. 2015;30(6):719-723.

64 About Rural Health | CSELS | OPHSS | CDC. **https://www.cdc.gov/ruralhealth/about.html. Published March 25, 2020. Last accessed January 2021**.

65 Kruse CS, Kristof C, Jones B, et al. Barriers to Electronic Health Record Adoption: a Systematic Literature Review. *J Med Syst*. 2016;40(12):252.

66 Centers for Medicare & Medicaid Services, Center for Medicare & Medicaid Innovation, RTI International. *Accountable Health Communities (AHC) Model Evaluation First Evaluation Report*. **https://innovation.cms.gov/data-and-reports/2020/ahc-first-eval-rpt. Last accessed August 2021**.

67 Glossary | eCQI Resource Center. **https://ecqi.healthit.gov/glossary. Last accessed May 2021**.

68 United States Core Data for Interoperability (USCDI) | Interoperability Standards Advisory (ISA). **https://www.healthit.gov/isa/united-states-core-data-interoperability-uscdi. Last accessed January 2021**.

69 Rationale for Including Work Information in EHRs | NIOSH | CDC. **https://www.cdc.gov/niosh/topics/ehr/rationale.html. Published April 24, 2020. Last accessed January 2021**.

70 Gravity Project | HL7 International. **https://www.hl7.org/gravity/. Last accessed January 2021**.

71 Kharrazi H, Anzaldi LJ, Hernandez L, et al. The Value of Unstructured Electronic Health Record Data in Geriatric Syndrome Case Identification. *J Am Geriatr Soc*. 2018;66(8):1499-1507.

72 O'Malley AS, Draper K, Gourevitch R, et al. Electronic health records and support for primary care teamwork. *J Am Med Inform Assoc*. 2015;22(2):426-434.

73 Medicare Promoting Interoperability Program Stage 3 Eligible Hospitals, Critical Access Hospitals, and Dual-Eligible Hospitals Attesting to CMS Objectives and Measures for 2018 Objective 4 of 6. July 2018. **https://www.cms.gov/Regulations-and-Guidance/Legislation/EHRIncentivePrograms/Downloads/MedicareEHStage3_Obj4.pdf**.

74 Interoperability | HealthIT.gov. **https://www.healthit.gov/topic/interoperability. Last accessed May 2021**.

75 Information Blocking | HealthIT.gov. **https://www.healthit.gov/topic/information-blocking. Last accessed May 2021**.

76 Certification Criteria | HealthIT.gov. **https://www.healthit.gov/topic/certification-ehrs/certification-criteria. Last accessed June 2021**.

77 Expert Interview 7. June 2021.

78 CarePlan - FHIR v4.0.1. **https://www.hl7.org/fhir/careplan.html. Last accessed June 2021**.

79 Summary - FHIR v4.0.1. **https://www.hl7.org/fhir/summary.html. Last accessed June 2021**.

80 Expert Interview 8. June 2021.

81 CMS. *CPC+ Electronic Clinical Quality Measure Reporting RequirementsPage 1 of 2Overview for the 2020 Measurement Period CPC+ Electronic Clinical Quality Measure Reporting Requirements Overview for the 2020 Measurement Period*. Woodlawn, Maryland; 2020. **https://innovation.cms.gov/files/x/cpcplus-qualrptpy2020.pdf**.

82 Expert Interview 1. January 2021.

83 Patient & Family Experience Outcome Measurement: the Pediatric Integrated Care Survey | Boston Children's Hospital. **https://www.childrenshospital.org/integrated-care-program/patient-and-family-experience-outcome. Last accessed May 2021**.

84 NQF. *Care Coordination Measures: 2016-2017.*; 2017. **https://www.qualityforum.org/Publications/2017/08/Care_Coordination_Measures_Technical_Report.aspx. Last accessed January 2021**.

85 Pany MJ, Chen L, Sheridan B, et al. Provider Teams Outperform Solo Providers In Managing Chronic Diseases And Could Improve The Value Of Care. *Health Aff Proj Hope*.

Appendices

Appendix A: Literature Review Search Terms

The team used specific terms or "strings" to search for information sources. NQF developed several strings of three terms, including important keywords related to care communication, care coordination, and healthcare activities. The team then searched in PubMed for each string, downloaded each results list, removed duplicates, and evaluated the literature per the inclusion/exclusion criteria. Less structured searches to find grey literature, including government documents, nonprofit and commercial reports, and other relevant web-based information, were conducted using Google. Additionally, ad hoc-focused searches were performed based on the Committee's feedback for topics such as care communication and care coordination related to patient engagement/patient-centered care, PAC and other specialties, cost, and utilization. Information from all search strategies were incorporated into the Environmental Scan Report.

1. (Care Coordination) and (Electronic Health Record) and (Medication Reconciliation)
2. (Care Coordination) and (Electronic Health Record) and (Medical Errors)
3. (Care Coordination) and (Electronic Health Record) and (Handoff)
4. (Care Coordination) and (Electronic Health Record) and (Information Transfer)
5. (Care Coordination) and (Electronic Health Record) and (Patient Communication)
6. (Care Coordination) and (Electronic Health Record) and (Hospital Admission)
7. (Care Coordination) and (Electronic Health Record) and (Emergency Visit)
8. (Care Coordination) and (Electronic Health Record) and (Duplication of Services)

Appendix B: Existing Care Communication and Care Coordination Measures

The full list of 222 measure can be found in the companion **Measure Scan spreadsheet**. The following information is included for each measure: CMS Measure Inventory Tool (CMIT) identification number, NQF identification number, NQF endorsement status, title, description, direct/indirect care communication and care coordination activity, care communication and care coordination activity classification, type, data source, usage in federal programs, and steward.

Appendix C: Expert Interview Guide

In this CMS-supported project, a multistakeholder Committee will be convened to identify best practices to leverage EHR-sourced measures to improve care communication and care coordination quality measurement in an all-payer, cross-setting, and fully electronic manner. Expert interviews will also be performed as part of the process to develop the environmental scan.

The goal of the expert interview is to have experts provide feedback on the project, identify relevant literature that has not yet been uncovered, help NQF understand current activities in care communication and care coordination and where these may evolve, provide insight on how EHRs and EHR-sourced measures are currently used and what the future might hold, and provide feedback on themes raised while conducting the environmental scan or raised by the Committee.

All expert interviews were conducted from January to June 2021.

TOPIC	QUESTIONS/DISCUSSION GUIDANCE
CARE COMMUNICATION AND CARE COORDINATION	• How would you define care communication and care coordination? • What are some of the ways that care coordination and communication are most effectively used in your setting? • Are there any best principles or best practices when it comes to care communication and care coordination? • How are you currently measuring the success of care coordination activities? • How does your measurement approach address attribution? • What incentives currently exist that encourage healthcare professionals to improve care coordination and communication? • What are some of the barriers/challenges you see in measuring care coordination? In payment programs or in public reporting programs? • What published literature or other reports on measuring care coordination do you consider to be essential to the field?
EHR-SOURCED MEASURES	• What EHR-sourced measures exist currently to measure care coordination? • How can EHRs be used to measure whether specific actions related to care coordination or communication are implemented effectively? • How can different measures be used across settings? How about in post-acute care or long-term care settings? How is this affected if those settings do not use an EHR? • What existing care coordination activities are performed or measured in your setting that could be potentially modified into EHR-sourced measures? • What technologies exist within EHRs to facilitate care coordination? How could such existing technologies be used as EHR-sourced measures? • What are some of the data challenges of EHR-sourced measures, and how do these specifically apply to measuring care coordination? What are approaches to mitigate these challenges? • What data are needed to support the development and testing of EHR-sourced measures for care coordination and communication? • What guidance has already been published by standard-setting bodies that relate to EHR-sourced measures and care coordination and communication? • What are the biggest challenges related to measuring care coordination activities with EHR data? • What is the role of SDOH in care coordination, and does this apply to EHR-sourced measures for coordination and communication?

Appendix C Continued

TOPIC	QUESTIONS/DISCUSSION GUIDANCE
GAPS IN MEASUREMENT	• What are the limitations that have prevented robust development of EHR-sourced measures for care coordination and communication to date? • Based on the existing EHR measures identified in the environmental scan, what gaps in measurement can be identified?
WRAP-UP QUESTIONS	• What else about care coordination and communication is important that we have not discussed? • What other types of experts should we speak with on this subject?

Appendix D: Public Comments

BACKGROUND

On July 12, 2021, National Quality Forum (NQF) posted the Environmental Scan Report on the project webpage for a 21-day review and commenting period. NQF sought feedback on the tone of the Environmental Scan Report, whether the Literature Review accurately captures the current state of the use of electronic health records (EHRs) in the measurement of care communication and coordination, any additional advantages or challenges in using EHRs for measuring care communication and coordination, and any additional EHR-based tools to assist in performing or measuring care communication and coordination.

Public Comment Prompts:

1. What general comments do you have on the report?

2. The Environmental Scan Report is intended to educate and convey the importance of leveraging EHRs to measure and improve care communication and coordination to a broad, nontechnical audience with an educational tone. How could the language or tone of the Environmental Scan Report be improved to be more educational or more accessible to a broad, nontechnical audience?

3. The Literature Review is intended to be a technical overview of the current state of leveraging EHRs to measure and improve care communication and coordination. How could the Literature Review more accurately reflect the current state?

4. What additional advantages or challenges of measuring care communication and coordination in EHRs should be included in the Literature Review?

5. What additional EHR-based tools should be included in the Literature Review that are most useful for performing or measuring care communication and coordination activities?

COMMENTS RECEIVED

What general comments do you have on the report?

ORGANIZATION: RELI GROUP, INC.

RELI Group, Inc., thanks NQF for the opportunity to review this important work and to provide comments. The document emphasizes important communication and coordination issues, including the importance of communication with the patients and providing them access to information. The report emphasizes the use of patient portals and various items that should be available to the patient through such portals (e.g., patient plan of care).

However, the authors may consider whether there is sufficient recognition of the fact that for portals to be helpful, they must be used and usable. Additionally, there needs [sic] to be alternatives for patients who do not find use of IT portals feasible and practical. Although having important information “available” to patients is helpful, it has no effect if patients do not sign up for and/or use the portal to access the information.

Potential EHR measurement concepts that could address these issues include: (1) data as to the use of patient portals, including whether patients sign up for the portal; (2) whether patients who are signed up for the portal access important items (e.g., the patient plan of care); (3) whether messages entered by the patient are responded to within a particular period of time; (4) experience of patients in using portals to improve usability and use; (5) pushing information to patients who so opt via email or text rather than require patients to pull the information; and (6) whether there are alternative, easily used, and accessible methods of communication, particularly telephone, available to patients who do not sign up for the portal or who cannot effectively use IT systems. This applies particularly to the very elderly for whom telephone communication options would often be much more suitable.

Although these concepts are process rather than outcome based, they would appear practical and foundational. By contrast, tying outcomes to the EHR communication for measurement purposes may be impractical. For example, measures such as readmission rates or ED visits are insensitive indicators once they are risk-adjusted. Use of the EHR itself could provide comprehensive data for the measure concepts suggested above, ultimately allowing for patient-focused communication improvement efforts. This contrasts also with approaches such as patient surveys, which are labor intensive, sample based, and ultimately provide only summary information.

COMMITTEE RESPONSE:

Thank you for your comments. We have added language to the Environmental Scan Report and Literature Review to reflect both the strengths and weaknesses of patient portals. In particular, we have highlighted usability as a central issue and one that would need to be considered in the development of quality measures for portals. We have also made note of the measure concepts provided to be considered during the development of recommendations in future efforts to advance this work.

ORGANIZATION: UNIVERSITY OF COLORADO SCHOOL OF MEDICINE

Generally, I feel this is a good start at outlining the state of care coordination and many challenges to its measurement. One area [that] is not mentioned that is very important in the care of children, especially those with special healthcare needs and disabilities, is coordination beyond “the four walls” of the core healthcare system. Community resources and especially schools must be included in care coordination if it is to be fully relevant for children. This means addressing the communication barriers between EHRs and school systems, ensuring access for appropriate school personnel (nurses, special education directors for example) and enabling bidirectional communication to make coordination possible. Other community resources, such as therapy and other service providers, are similarly important. Parents and children see these community partners as an essential part of their child’s healthcare.

COMMITTEE RESPONSE:
Thank you for your comments. We have added additional language in the Environmental Scan Report and Literature Review about the importance of including community-based services and entities (e.g., schools, food services, and housing services) for holistic care communication and care coordination for patients and families.

ORGANIZATION: AMERICAN COLLEGE OF MEDICAL QUALITY
Because care coordination has always been thorny, complex, and dynamic, there is a new opportunity to make progress right now. It is hence disappointing that NQF continues to spend time on “Literature Reviews”, such as the unscientific and anecdotal one provided in this Report. While the final conclusions of the Report are promising, much of what was presented was not at all data driven, such as this rather nebulous and disappointing summary from the Environmental Scan of the information presented in the [*sic*] on pages 7-9 of the Report:

This literature review identified several outcomes of care communication and coordination that can be measured in the EHR, including readmissions, ED visits, hospitalizations, preventable hospitalizations, and others. Yet while many of these outcomes are related to care communication and coordination, other factors (e.g., clinical, patient, community, and SDOH) may be greater contributors, thus making it a challenge to isolate the effects of care communication and coordination efforts.

2. In the Environmental Scan, NQF staff glossed over the one critically important systematic evidence review of Care Coordination from 2013 (excluded by the search criterion of only studies 2014 and later) authored by Ellen Schultz, et al (attached).[1] The tables in this review are excellent and effectively summarize the available evidence at the time that was evaluated through a structured, scientific methodology. This comprehensive evaluation is important for the Committee to review in detail because it successfully bundles several main domains of Care Coordination together (see especially Table 2) and highlights the need to move from “point solution” and “transactional” measurements that exist widely throughout the current NQF set of 162 measures labelled as “Care Coordination” (as identified within the NQF Quality Positioning System[2] listed in Appendix B of the Report).

[1] Schultz, E.M., Pineda, N., Lonhart, J. et al. A systematic review of the care coordination measurement landscape. BMC Health Serv Res 13, 119 (2013). **https://doi.org/10.1186/1472-6963-13-119 Accessed August 2, 2021**.

COMMITTEE RESPONSE:
Thank you for your comments. The intent of this Environmental Scan Report and Literature review was to provide an overview of the current state of care communication and care coordination and how EHRs could be leveraged to measure and improve it. This information will be built upon to develop recommendations in future iterations of this project. Although the Schultz et al publication is outside the range of our initial search criteria, we agree it is foundationally important and certainly relevant to our current efforts. We have therefore added language to the Literature Review to highlight the findings from the Schultz systematic literature review from 2013.

ORGANIZATION: AMERICAN COLLEGE OF MEDICAL QUALITY
3. Some major biased assumptions appear in the report, such as this excerpt on page 13:

Reduction of unplanned hospital readmissions is a classic outcome of an effective care communication and coordination activity. When a patient’s care is not well coordinated during and after a hospital discharge, there may be gaps in follow-up care, poor communication among clinicians, or poorly executed plans of care. This can lead to a patient returning and requiring additional inpatient care, termed a readmission.

However, there is extensive “mixed” evidence that the 30-day readmission rates are actual, valid, “meaningful” accountability quality measures of true care coordination. For example, in the recently published Health and Human Services Fiscal Year 2021 Annual Performance Plan and Report:

Based on national trends, which reflect a slowing in readmissions reductions for all Medicare beneficiaries after a number of years of larger declines, CMS has selected a more modest target reduction rate for CY 2021 of 0.25 percent.[i]

In addition, there have been numerous studies calling into question the importance of sustaining hospital readmissions as valid measures of actionable quality improvement interventions.[ii] [iii] [iv] [v] These and many other similar studies call into question the generalized statement that readmissions measures are useful in evaluating whether/if care has been truly well coordinated.

[i] FY 2021 Annual Performance Plan and Report - Goal 1 Objective 2 | HHS.gov Accessed August 2, 2021.

[ii] Trends in 30- and 90-Day Readmission Rates for Heart Failure - PubMed (nih.gov) Accessed August 2, 2021.

[iii] **https://www.hcup-us.ahrq.gov/reports/statbriefs/sb248-Hospital-Readmissions-2010-2016.pdf Accessed August 2, 2021**.

[iv] Link between readmission rates, mortality rates back under scrutiny | Fierce Healthcare Accessed August 2, 2021.

[v] DeVore AD, Granger BB, Fonarow GC, et al. Effect of a Hospital and Post discharge Quality Improvement Intervention on Clinical Outcomes and Quality of Care for Patients With Heart Failure With Reduced Ejection Fraction: The CONNECT-HF Randomized Clinical Trial. JAMA. 2021;326(4):314–323. doi:10.1001/jama.2021.8844

COMMITTEE RESPONSE:
Thank you for your comments. We agree that claims-based readmission measures are imperfect for measuring the outcomes of care communication and care coordination. In the future, EHR-sourced data may be leveraged to improve measures such as readmission, as well as other types of utilization (e.g., ED visits), and provide more granularity and specificity. Information in EHRs may be valuable to determine the ways in which readmissions and other types of utilization metrics are related to problems with care communication and care coordination.

ORGANIZATION: AMERICAN COLLEGE OF MEDICAL QUALITY

Team-based care is a strategy that can be implemented at the health system level to enhance patient care by having two or more healthcare providers working collaboratively with each patient. [i] [ii] [iii] These teams may include doctors, nurses, pharmacists, community paramedics, primary care providers, community health workers, and others (e.g., dietitians). Yet this report fails to acknowledge and document a major and essential strong body of evidence with (perhaps) the greatest potential to truly improve Patient-Centered Care Coordination across the full continuum of the U.S. healthcare delivery system.

[i] Promoting Team-Based Care to Improve High Blood Pressure Control | CDC | DHDSP Accessed August 2, 2021.

[ii] Outcomes in Multidisciplinary Team-based Approach in Geriatric Hip Fracture Care: A Systematic Review - PubMed (nih.gov) Accessed August 2, 2021.

[iii] Team-Based Care and Patient Satisfaction in the Hospital Setting: A Systematic Review - PubMed (nih.gov) Accessed August 2, 2021.

COMMITTEE RESPONSE:
Thank you for your comments. We have added language to the Environmental Scan Report and Literature Review about the importance of considering the entire team, including those within healthcare facilities and within the community (across multiple disciplines, including but not limited to nurses, pharmacists, community paramedics, primary care providers, community health workers, social workers, behavioral health providers, and educators), for effective care communication and care coordination. In particular, multidisciplinary, team-based care is now explicitly highlighted as a care communication and care coordination activity in the documents.

ORGANIZATION: AMERICAN COLLEGE OF MEDICAL QUALITY

5. This report did not explicitly evaluate the role and/or impact of care coordination on total cost of care, including identifying any formal evaluation of the countless payment and infrastructural programs that have or have not had a significant and sustained impact on quality of care. What is really needed is a significant "unified" capital investment by all current stakeholders (especially health systems, large medical groups, commercial and government payers, Health IT and digital health firms and employers), rather than waiting for federal and state governmental agencies to run more "pilots". Furthermore, stakeholders should no longer be concerned about "ownership" of Intellectual Property, but rather, effective execution of impactful care coordination in accordance with the best and evolving evidence.

COMMITTEE RESPONSE:
Thank you for your comments. We have added language to the Environmental Scan Report and Literature Review to include consideration of costs of care while also focusing on value and patient/family experience. We have incorporated examples of health system changes to address the value-cost balance and expanded the discussion of the role of interoperability in leveraging the EHR to measure and improve care coordination and care communication. Concerning ownership of intellectual property, we have incorporated references to interoperability and the investment healthcare systems need to make for effective care communication and care coordination.

ORGANIZATION: AMERICAN COLLEGE OF MEDICAL QUALITY

6. The report does an excellent job of summarizing the importance of documenting and assessing Social Determinants of Health (SDOH) in the context of Care Coordination:

SDOH factors can have a major impact on an individual's overall health and well-being and can also serve as barriers to care communication and coordination as people move within and across clinicians and healthcare settings.....Better EHR capture of SDOH has three potential benefits: (1) improving medical care through better recognition of SDOH by clinicians, (2) serving as standard variables for use in performance measurement and risk adjustment, and (3) serving as data for EHR-based tools to help risk stratify patients and direct the delivery of social service resources. Notably, all of these goals would serve to improve care communication and coordination across settings. (From Expert Interview 2. January 2021)

NQF should also acknowledge the growing body of evidence documenting important cautions and challenges of inaccuracy and bias of analyzing SDOH data obtained from EHRs[i]:

Machine learning algorithms have the potential to improve medical care by predicting a variety of different outcomes measured in the electronic health record and providing clinical decision support based on these predictions. However, attention should be paid to the data that are being used to produce these algorithms, including what and who may be missing from the data. Existing healthcare disparities should not be amplified by thoughtless or excessive reliance on machines.

Additionally, recently published evidence (this past week) is showing marked reductions in racial and ethnic disparities in insurance coverage, access to care, and self-reported health,[ii] suggesting that care coordination may be playing an important role in closing these gaps. Perhaps there are new "lessons learned" from this important progress relative to more effective care coordination (perhaps) as a result of increasing widespread access to and use of EHRs.

[i] Gianfrancesco MA, Tamang S, Yazdany J, Schmajuk G. Potential Biases in Machine Learning Algorithms Using Electronic Health Record Data. JAMA Intern Med. 2018;178(11):1544–1547. doi:10.1001/jamainternmed.2018.3763

[ii] Wallace J, Jiang K, Goldsmith-Pinkham P, Song Z. Changes in Racial and Ethnic Disparities in Access to Care and Health Among US Adults at Age 65 Years. JAMA Intern Med. Published online July 26, 2021. doi:10.1001/jamainternmed.2021.3922

COMMITTEE RESPONSE:
Thank you for your comments. We added language to the Environmental Scan Report and Literature Review about the challenges of inaccurate and biased SDOH data analysis that comes from machine-learning algorithms. We also expanded the narrative about the implications about care coordination and care communication for addressing health equity and have added that emphasis. We acknowledge the important contribution to the literature of the Wallace article cited above that showed reductions in racial and ethnic disparities in coverage and access to care. It does suggest that care coordination may play a role in these gaps, but we were unable to determine that directly from the data presented in the article.

ORGANIZATION: AMERICAN COLLEGE OF MEDICAL QUALITY
7. CMS, AHRQ, FDA, CDC, HHS, ONC, NIH and NQF should together strongly consider jointly funding and supporting an updated, formal, comprehensive systematic evidence review of Care Coordination (such as the 2013 Schultz study) and include a more specific focus on digital health (not just EHRs), as well as social determinants of health, team-based care, shared decision making and clinical decision support algorithms (all as examples) that help to guide complex care. How the latest advances in technology with widespread digital health uptake, FHIR standards, [and] APIs are most effectively impacting care coordination and cost of care could also be addressed in this process. It would certainly be of greater value to follow a more rigorous, standardized, explicit, and scientific approach to evaluating and quantifying evidence (such as that deployed by NICE[i] rather than what was described in this report). Using a framework such as PICOTS to strengthen evidence assessments (e.g., from the AHRQ's Evidence-Based Practice Centers Program[ii]) would provide a far more formal discipline to this process as well.

[i] Reviewing research evidence | Developing NICE guidelines: the manual | Guidance | NICE; Accessed online August 2, 2021.

[ii]Using the PICOTS Framework to Strengthen Evidence Gathered in Clinical Trials—Guidance from the AHRQ's Evidence-based Practice Centers Program **https://www.fda.gov/media/109448/download Accessed online August 2, 2021**.

COMMITTEE RESPONSE:
Thank you for your comments. This project was designed as an environmental scan of the care communication and care coordination landscape similar to a scoping review rather than a systematic review. We appreciate the recommendation of supporting and funding additional research in care coordination using digital health.

ORGANIZATION: AMERICAN COLLEGE OF MEDICAL QUALITY
8. Some members of the current Patient Experience and Function Committee participated intensively in the 2014 HHS-sponsored work as participants on the then NQF Care Coordination Steering Committee.[i] A major "Ah-Ha Moment" for many of the attendees at this multi-day session was that traditional measure developers did not appear (then) up to the task of coming up with a more dynamic, technologically-enabled, comprehensive, and parsimonious set of Care Coordination quality "measures for accountability" that could address the complete lack of important synergies between and among the various domains referenced in Comment 2 above. Hence, trying to "force fit" any more accountability measures, such as those currently in the NQF QPS, any further into future value-based payment arrangements and public quality reporting systems (still largely invisible to consumers) is, in the opinion of many healthcare providers, a major distraction of valuable time and resources.

Comments submitted by Donald E. Casey Jr MD, MPH, MBA, FACP, FAHA, CPE, DFAAPL, DFACMQ

Past Chair/Co-Chair, NQF Care Coordination Steering Committee 2005-2017

Member, NQF Patient Experience and Function Standing Committee 2017-Present

Associate Professor of Medicine, Rush Medical College

Affiliate Faculty, Jefferson College of Population Health

Adjunct Faculty, University of Minnesota Institute for Healthcare Informatics

Past President, American College of Medical Quality

Senior Associate Editor, American Journal of Medical Quality

[i] NQF: NQF-Endorsed Measures for Care Coordination: Phase 3 (qualityforum.org); Accessed August 2, 2021.

COMMITTEE RESPONSE:
Thank you for your comments. The findings in this Environmental Scan Report may inform the future creation of consensus-based recommendations for facilitating and improving EHR-based care communication and care coordination measurement. We have made note of the need for these recommendations to consider the development of more dynamic, technologically-enabled, comprehensive care communication and care coordination measures that may be more appropriate for value-based payment models.

What additional advantages or challenges of measuring care communication and coordination in EHRs should be included in the Literature Review?

ORGANIZATION: UNIVERSITY OF COLORADO SCHOOL OF MEDICINE

As I mentioned before, one area [that] is not mentioned that is very important in the care of children, especially those with special healthcare needs and disabilities, is coordination beyond "the four walls" of the core healthcare system. Community resources and especially schools must be included in care coordination if it is to be fully relevant for children. This means addressing the communication barriers between EHRs and school systems, ensuring access for appropriate school personnel (nurses, special education directors for example) and enabling bidirectional communication to make coordination possible. Other community resources, such as therapy and other service providers, are similarly important. Parents and children see these community partners as an essential part of their child's health care.

COMMITTEE RESPONSE:

Thank you for your comments. We added language to the Environmental Scan Report and Literature Review about the importance of holistic care communication and care coordination that includes engaging with community resources, including schools.

Appendix E: NQF Staff

Kathleen Giblin
Senior Vice President, Quality Innovation

Maha Taylor, MHA
Managing Director, Quality Measurement

Chelsea Lynch, MPH, MSN, RN, CIC
Director, Quality Innovation

Erin Buchanan, MPH
Manager, Quality Measurement

Elizabeth Flashner, MHA
Manager, Quality Measurement

Monika Harvey, MBA, PMP
Project Manager, Quality Measurement

Victoria Freire, MPH, CHES®
Analyst, Quality Measurement

Jesse Pines, MD, MBA, MSCE
Consultant