THE DEVELOPMENT AND TESTING OF EHR-BASED CARE COORDINATION PERFORMANCE MEASURES IN AMBULATORY CARE

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EXECUTIVE SUMMARY

Background

In *Priority Areas for National Action: Transforming Health Care Quality*, the Institute of Medicine (IOM) called for national action to address the failures of coordination in the medical care system, pointing to the potential for significant benefits to accrue across the life span (IOM 2003). Good coordination of care in the ambulatory setting has the potential to reduce unnecessary or duplicative use of health services, prevent hospitalizations for ambulatory-sensitive conditions, improve patient safety, and potentially reduce costs (Bodenheimer 2008). Recent innovations to better compensate primary care providers for their critical coordination activities, as evidenced by financial incentives offered by public and private payers for the patient-centered medical home, highlight the importance of care coordination in the ambulatory setting. Measurement can drive practice change, particularly if reimbursement aligns with measurement. Unfortunately, well-developed, standardized measures of care coordination are still not available for wide-scale application (NQF 2006). Furthermore, care coordination, in terms of how coordination is done and what can be measured, will change significantly with the diffusion of the electronic health record (EHR). Development of new measures of care coordination, therefore, must take into consideration the implication of these changes to the practice environment and the capabilities of the EHR for reporting on the quality of care coordination of organizations or providers.

Project Objective and Specific Aims

The primary objective of this project is to address the lack of ambulatory care coordination measures identified by the National Quality Forum (NQF 2006). Specifically, this project aims to create a set of reliable and valid measures that: 1) are meaningful to practicing primary care physicians, and 2) can be used to document the achievement of care coordination for the referral process by:

- identifying existing care coordination measures, developing candidate measure concepts, and reviewing and prioritizing measures for further specification;

- developing preliminary technical specifications for care coordination measures prioritized by a stakeholder panel and practicing physicians; and

- assessing specified measures' usability, acceptability, and technical feasibility in a variety of practice settings, including different levels of access to EHRs.

Methods

The overall objective of this project was to develop measures of the referral coordination process that are meaningful and credible to practicing generalists and can potentially be reportable through EHR systems. To accomplish this objective, the project proceeded in three phases: 1) development of measurement framework and drafting measure concepts; 2) measure concept refinement and prioritization; and 3) evaluation of face validity, acceptability, and implementation feasibility of specified measures. Details on the methods used in this project are provided in Appendix I.

Summary of Key Findings

- **Clinically relevant and face valid measures of the referral coordination process can be developed and implemented using electronic health records.** Our project developed and tested measures of referral coordination for clinical relevance and acceptability with practicing primary care providers. The final set of measures includes three specific to the primary care setting and two measures evaluating specialist care (Exhibit ES-1).

Exhibit ES-1. Final Measure Set

	From the Primary Care Perspective	From the Specialty Care Perspective
Eligible Population (denominator)	Number of patients age 18 and older who were sent to another clinician for referral or consultation. Exclusions: Patients who self-refer to a specialist.	Number of patients age 18 and older who were referred to a specialist and seen by that clinician. Exclusions: Patients who self-refer to a specialist.
Referral Loop Opened	**1A. Critical Information Communicated with Request for Referral/Consult to Specialist (Sent by Primary Care Physician)** Number of patients in the denominator with relevant clinical information communicated using the Continuity of Care Document (HL7 CCD) with request for referral to specialist. Relevant clinical information is defined as: • activity requested (referral, consultation, co-management); • clinical reason for requesting the referral/consultation; • preferred timing for completion of the referral/consultation; • problem list; • medication list; • medical history, including relevant test results.	**1B. Critical Information Communicated with Request for Referral/Consult to Specialist (Received by Specialist)** Number of patients in the denominator with relevant clinical information communicated using the Continuity of Care Document (HL7 CCD) with request for referral to specialist. Relevant clinical information is defined as: • activity requested (referral, consultation, co-management); • clinical reason for requesting the referral/consultation; • preferred timing for completion of the referral/consultation; • problem list; • medication list; and • medical history, including relevant test results.

Patient Informed	2. Primary Care Communication About Referral to Patient/Family	4. Specialist Communication of Results to Patient/Family
	Number of referred patients where primary care physician gave patient written information on reason for referral/consultation. Information must include: • reason for need for specialist involvement; and • name and contact information for specialist.	Number of patients in the denominator seen by a specialist where the specialist provided written results to the patient.
Referral Loop Closed	5. Primary Care Physician Review of Specialist Report	3. Specialist Report to Primary Care Physician
	Number of referred patients seen by the specialist where the primary care physician reviewed the results of the specialist report.	Number of patients in the denominator where the specialist communicated results in a report to the primary care clinician using the Continuity of Care Document (HL7 CCD). Elements of the report must include: • findings; and • treatment recommendations including degree of shared management of patient and roles for specialist and primary care clinician. Exclusions: Patients in the eligible population who refuse to allow sharing of results with primary care physician.

- **The emerging consensus on a model of the referral coordination process highlights opportunities for future measure development.** Our project developed a model to guide the measure development process that appeared to have face validity with practicing physicians, national experts, and key stakeholders involved in care coordination. Aside from the measures developed in this project, the model suggests future measures that would reflect actions taken by all parties involved in coordination, including shared decision-making and shared care plan, which cannot be feasibly implemented in the current health system environment.

- **Two measures can potentially be implemented immediately in practices using EHRs.** Of the final set of five measures, two (Measure 1: Primary care physician (PCP) communication of critical information; and Measure 5: PCP receipt and review of specialist report) could be implemented with modest changes to current practice work flow or information systems. Data elements required to calculate these measures can be found in the electronic chart for most, if not all, sites we visited. Furthermore, approximately half already record the data needed for the numerator of Measure 1 on a routine basis and five of the seven sites regularly record data needed for the numerator of Measure 5. Although at least four of six sites have the required data for

Measure 2 (PCP communication with patient/family) available in the chart, none regularly record this information, limiting the feasibility of measure implementation without significant changes to documentation procedures at the sites we visited. The implementation feasibility of specialist measures was not consistently examined in the site visits.

- **Lack of structured data is a key impediment to reporting measures directly from the EHR.** Even for the two measures considered feasible for implementation, none of the sites we visited have structured data available for all of the required data elements for the numerator of the referral loop opening and closing measures.

- **Irregular documentation and lack of interoperability pose threats to the accuracy of measures.** There are important barriers to accuracy of reporting these measures that may affect these measures. Required data elements are often inconsistently documented even if there is a field with drop-down lists because the fields often allow uncoded data as well. For example, data on self -referrals, an important exclusion for the denominator of all the measures, are not regularly documented at many sites, which poses reliability problems for all measures. In addition, structured data are often not available, even when appropriate data fields or drop-down lists are used, as free-text fields often are available to allow uncoded data to be entered. The lack of EHR interoperability contributes to significant missing data for some elements. For example, many providers from sophisticated integrated delivery systems (IDSs) still use paper-based processes to exchange information with providers outside their information system, whether these outside providers use paper or electronic health records. These paper-based information exchanges are often only archived as PDFs without any searching or coding that makes this information readily available for measure reporting.

- **EHRs significantly change the information exchange process for internal and external referrals.** The process of information exchange is quite different for internal (within the practice or delivery system) and external referrals (with outside providers). For internal referrals in practices with an EHR, information exchange generally does not involve active "sending" actions by the primary care provider or specialist. Instead, exchange occurs when providers access the repository of information available in the system. This is especially true for data elements such as problem list, medical history, and medication list. Consequently, the salience of measures, such as the measure on sending critical information about the referral,

differed for providers linked by the same EHR system and for providers using paper-based or noninteroperable EHR systems.

- **Implications for policy and practice.** Our project focused on developing new quality measures of care coordination for the ambulatory setting. However, through our interviews, site visits, and discussions with national experts and key stakeholders in care coordination, several key observations emerged that have relevance for policy and practice.

  - *A communication infrastructure is needed to facilitate information exchange among patients/family, primary care, and other providers or health facilities. Barriers to information exchange across settings, even for providers from integrated delivery systems with sophisticated health information technology (HIT), are widespread. Unless user-friendly strategies are developed to allow for real-time updates, access, and communication among all parties engaged in coordination, system-wide improvements in care coordination will be limited.*

  - *A new reimbursement structure for care coordination activities should be developed to support system-wide improvements. Most providers participating in our study were already recognized through one of the National Committee for Quality Assurance's programs, including the one on patient centered medical homes, or were leading IDSs. Among these providers, many contribute unreimbursed time and resources to enhancing care coordination processes for their patients. Unless an adequate reimbursement structure for care coordination is provided, coordination will continue to happen on a physician-by-physician basis.*

  - *A system to track referrals should be widely implemented by practices. Having a tracking system for referrals allow practices to ensure follow-up of high-priority referrals. For example, as part of NCQA's Physician Practice Connections–Patient-Centered Medical Home (PPC-PCMH), practices are required to keep a log for tracking critical referrals (including reason for the consultation, pertinent clinical findings, etc.) and noting when the referral visit occurs and results are returned (NCQA 2008b). While some practices have created some version of this, deploying standardized definition of important referrals to track and embedding this registry within all practices can have system-wide effects on care coordination.*

– *Clearer delineation of patient and provider responsibilities in care coordination is needed. Although our project focused on generalist-to-specialist exchange, patients are clearly critical agents and valuable informants about cross-setting service use. In particular, one of the challenges to care coordination involves patient self-referrals that are often not known nor consistently documented. Since important clinical information such as new medications can be generated in these self-referrals, patients should provide their primary care provider details of these encounters. Clear explanation of the benefits of care coordination and patients' responsibilities in this process, perhaps through a formalized agreement, can greatly increase the effectiveness of care coordination actions by providers.*

Conclusions

This project demonstrates that a set of measures on ambulatory care coordination can be developed that are clinically meaningful to practicing primary care providers. The measure concepts and preliminary specifications were generally supported by the physicians we interviewed and by national experts and key stakeholders in our advisory panel. While further development of these measures, especially to enhance their reportability through EHRs, is needed, preliminary results indicate promise. In fact, from the feasibility assessment, two of the developed measures can potentially be implemented with only modest changes to practice work flows or information systems. However, our study also found significant data availability, format, and interoperability problems that impede near-term implementation and, particularly, the reportability of these measures from existing EHR systems.

This project represents the first stage of measure development. Significant additional research and development work will be needed before these measures can be widely implemented. For example, while we examined the availability of key data elements required for our target measures, we know little about the reliability of these data elements when they are present. Therefore, it is unclear whether these measures can be reliably reported from EHRs. Finally, although this project purposively selected a range of practice settings for our empirical evaluation, our sample was relatively small and drawn from NCQA-recognized practices and integrated delivery systems, which may not be representative of all practices in the country. Empirical evaluation, including validation studies, of these measures in a larger and more diverse sample of practices will be needed.

These new measures, representing processes enabled by health information technology (IT), are likely candidates for future iterations of the Centers for Medicare and Medicaid Services (CMS) EHR Incentive Program, which enables increased payment to clinicians who are "meaningful users" of EHRs. Without valid measures, we cannot evaluate how different care coordination processes affect health care costs and patient outcomes nor identify breakdowns in process that could be the target of quality improvement efforts. To be practical, routine measures of care coordination need to be by-products of the care process. The growing use of EHRs in medical practices offers a tremendous opportunity for addressing this challenging measurement problem. Demonstrating feasibility of measures in time for National Quality Forum endorsement and inclusion in meaningful use criteria for 2013 will address the dearth of care coordination measures, but more importantly, provide measures to guide quality improvement and accountability efforts in the future.

Finally, observations emerged during the conduct of this project that highlight the challenges to care coordination persisting within our health care system. Policies such as better reimbursement for care coordination activities and support for the development of improved information and data exchange infrastructures, including improving the interoperability of EHR systems, will prove critical to system-wide improvements in care coordination. At the practice level, the development of a system for tracking referrals and clear specification of patient and provider responsibilities in the care coordination process can also substantially improve the care coordination process and outcomes.

THE DEVELOPMENT AND TESTING OF EHR-BASED
CARE COORDINATION PERFORMANCE MEASURES
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PROJECT GOALS AND SPECIFIC AIMS

Care coordination is a function that supports information sharing across providers, patients, types and levels of service, sites, and time frames. The goal of coordination is to ensure that patients' needs and preferences are achieved and that care is efficient and of high quality (AHRQ 2007; NQF 2006; NQF-NPP 2008). There is enormous interest in improving care coordination through innovations, such as by linking financial incentives with the patient-centered medical home (Abrams, Davis, and Haran 2009). One of the early but critical steps in fostering this improvement is to implement reliable and valid measures of care coordination so that these innovations can be rigorously evaluated and provider performance accurately determined. Unfortunately, there are few well-developed, standardized measures of care coordination, particularly for ambulatory care, currently available for widespread application (NQF 2006).

The electronic health record (EHR) is expected to change both the practice and measurement of care coordination. EHRs can support care coordination by offering new functions to allow multiple providers timely access to view and update critical information. The EHR also offers a rich new set of data from which more reliable and valid measures of care coordination can be developed. There is a need for measures derived from traditional data sources that can be deployed in the near term to accommodate clinical practices that remain reliant on paper records or are not fully interoperable. However, over the longer term, we expect that EHRs and other health information technology (HIT) will play an essential role in the performance and measurement of coordination of care. Conceptual frameworks, valid measures, and practical data collection strategies for measures of care coordination that reflect these major changes in coordination processes and data environment must be developed and tested.

The project team, composed of Johns Hopkins University, the National Committee for Quality Assurance (NCQA), and Park Nicollet Institute scientific staff, proposed to create and pilot test a set of measures that can be used to document the achievement of care coordination. The project emphasized measures that: 1) are meaningful to practicing physicians; and 2) can eventually be reportable by EHRs. However, the feasibility of reporting these measures in settings with no or little access to

interoperable EHRs was also examined. We focused on the ambulatory setting, specifically the referral coordination process between primary and specialty care providers. Developed measures are intended for internal quality improvement, real-time care management, external regulation and monitoring, and pay-for-performance applications. The specific aims of this project were to:

1. Identify existing care coordination measures, develop candidate measure concepts, and review and prioritize measures for further specification.

2. Develop preliminary technical specifications for care coordination measures prioritized by a stakeholder panel and practicing physicians.

3. Assess specified measures' usability, acceptability, and technical feasibility in a variety of practice settings, including different levels of access to EHRs.

BACKGROUND

Problems in Care Coordination Contribute to Poor Outcomes

In *Priority Areas for National Action: Transforming Health Care Quality*, the Institute of Medicine (IOM) called for national action to address the failures of coordination in the medical care system, pointing to the potential for significant benefits to accrue across the life span (IOM 2003). Each transition between providers is an opportunity for critical patient information to become lost or corrupted, often leaving the patient to act as the sole link between providers. The numerous parties with which a patient and a primary care physician would need to coordinate and the lack of a clear system of coordination have contributed to increased waste, decreased quality of care, and compromised patient safety (Pham et al. 2007; Bodenhemier 2008; AHRQ 2007).

Efforts to improve care coordination can be effective (MedPAC 2006). In particular, improved mechanisms for information exchange appear to facilitate communication between providers and improve patient outcomes. Branger et al. (1999) found that an electronic communication network that linked the computer-based patient records of physicians who had shared care of patients with diabetes significantly increased frequency of communications between physicians and availability of important clinical data. In contrast, poor coordination was associated with greater joint pain reported by surgical patients six and 12 weeks after discharge from the hospital (Weinberg et al. 2007).

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Referrals and Consultations Are Common

Referrals and consultations are the most common care transition situations within the ambulatory setting. Of all patients seen by specialists during the sampling period of the National Ambulatory Medical Care Survey, about 23 percent were originally referred by another provider (NAMCS 2006). Between 5 percent and 8 percent of generalist visits result in formal (or informal) referral or consultation request by another physician (Starfield 1998; Forrest et al. 2006). Furthermore, approximately 3 percent of visits to specialists result in referral to yet another physician (Starfield 1998).

However, major problems in the outpatient referral and consultation process have been documented, including delayed and incomplete information exchange between the specialist and the referring physician (Gandhi et al. 2000; Forrest et al. 2000; Stille et al. 2005). In fact, Gandhi et al. (2000) found that 68 percent of specialists reported receiving no information from the primary care provider prior to referral visits, and 25 percent of primary care providers had not received any information from specialists four weeks after referral visits. In another study of 963 referrals (Forrest et al. 2000), pediatricians scheduled appointments with specialists for only 39 percent and sent patient information only 51 percent of the time. These findings highlight the need for measures that can track the quality of coordination in the referral process.

Measurement of Care Coordination Is Challenging

While there is widespread agreement that care coordination is a key aspect of health care quality, it has been challenging to identify feasible, reliable, valid measures for evaluating care coordination (AHRQ 2007). One important barrier is the lack of a common conceptual model of care coordination from which measures can be developed. Although useful definitions have been developed (AHRQ 2007; NQF 2006), a consensus around a measurement framework of care coordination in the ambulatory setting has not been reached, hampering measure development for this domain. Consequently, there are few measures endorsed by the National Quality Forum (NQF) for care coordination in the ambulatory care setting, particularly of the generalist-to-specialist referral.

Despite these challenges, valid and clinically meaningful measures are clearly needed. Empirical evaluations of promising care coordination processes are not possible without valid and reliable measures. Efforts to better align payment to performance of care coordination require measures that can accurately identify good performers from poor performers. Having good measures of care coordination can also help researchers and practitioners identify breakdowns in process that could be the target of quality improvement efforts.

Opportunities and Challenges to EHR Measurement

The EHR is expected to change both the practices and the measurement of care coordination. In terms of measurement, the EHR potentially offers rich new data about the level of coordination attained by organizations or providers. Particularly for process-based performance, the EHR makes feasible the routine tracking of cross-system flows of information by providing data that are automatic by-products of the information exchange process. Current efforts to assess care coordination generally require special surveys or manual chart abstraction to document information flow or use of shared care planning (AHRQ 2007). The burden of manual data collection accounts for why research measures have not been proposed or adopted for ongoing monitoring of care coordination or pay-for-performance.

The literature on the reliability and validity of EHR data suggests that these systems have advantages over other data sources. EHRs can provide more complete information for identifying diabetic patients than administrative data (Tang et al. 2007). Other studies have shown coded EHR data to be comparable in data accuracy to manual record review (Goulet et al. 2007). Still, the use of EHR data for quality measurement poses problems, including: 1) differences in data capture and coding across different EHRs (or across users of the same EHR system); 2) the lack of structured data, with many systems relying primarily on free-text fields to allow users flexibility and freedom in data entry; and 3) the challenge of mixing scanned or faxed documents with the structured record. Recent studies documented several implications of these problems for quality reporting. Two studies found that "apparent quality failures" identified in structured EHR data were classified incorrectly, either because of invalid exclusion criteria or missing evidence of quality care (Persell et al. 2006; Kmetik et al. under review).

In devising measures of care coordination, it is important to recognize this changing data environment. To unlock EHRs' potential for routine reporting on care coordination, measures must be developed that rely on data elements that are reliably documented in structured format and can be electronically abstracted to a data warehouse to allow for analysis. To begin to accomplish this, understanding of the current care coordination and data capture processes in relation to desired care coordination practices and outcomes is essential. Identification of key data elements needed for clinically meaningful measures are also needed so that these elements can be captured by all EHR systems being used in the United States.

METHODS OVERVIEW

The overall objective of this project was to develop measures of the referral coordination process that: 1) are meaningful and credible to practicing generalists; and 2) can potentially be reportable through EHR systems. To accomplish this goal, our project team performed the following tasks, organized in three major phases:

Development of Measurement Framework and Draft Measure Concepts

We performed a measure scan of care coordination measures that have been developed to determine areas of ambulatory coordination of care where measure development would be most important. We also conducted qualitative interviews with 12 generalists from a range of practices and EHR settings to inform the project team's development of a process flow model for referral coordination between generalists and specialists (Appendix II, Figure 1). The project team then used these findings to develop draft measures based on this process flow model.

Measure Refinement and Prioritization

To obtain feedback on the process flow model and draft measure concepts, we convened a national expert panel meeting in May 2009 at NCQA in Washington, D.C. Based on feedback from the panel, the project team refined the proposed measure concepts and the process flow model. Prioritized measures were then specified.

Preliminary Evaluation of Measure Face Validity, Acceptability, and Feasibility

Measures were assessed for clinical importance, usefulness, acceptability, and feasibility of implementation by 15 primary care physicians practicing in a variety of practice settings. Based on feedback from these primary care physicians, measure specifications were refined and measures re-prioritized. Finally, the project team conducted site visits to six practices from non-integrated delivery system environments and three with integrated delivery systems (IDSs) to assess feasibility of implementation of the final set of specified measures across different practice settings.

A detailed description of the methods is in Appendix I.

RESULTS

Literature Review

We identified a total of 40 measures dealing with coordination of care across all care settings from our review of the peer-reviewed and gray literature. All measures rely on traditional data sources, including medical chart abstraction, surveys, or administrative

data, sometimes in combination (Appendix I). Of these measures, only four focused on primary care physician (PCP) to specialist transitions. Furthermore, all of these PCP to specialist measures were in the pediatric chronic care domain. Measures specific to primary care transitions of care to specialists, and vice versa, relied solely on administrative or patient survey data. In general, measures of transitions of care from hospitals and rehabilitation facilities to primary care clinicians tended to be more readily available. Overall, this review found few developed measures of transitions between PCPs and specialists. Furthermore, the fact that the developed measures are relevant for a narrowly construed population highlights the need for new measures that can be applied to the care coordination needs of a much broader population. A preliminary model of the parties involved in care coordination is shown in Exhibit 1. The arrows indicate the direction of information exchange, with adjacent numbers reflecting the number of measures identified in our review for the specified exchange. Data sources for these measures are presented in the lower right-hand box. Nineteen measures could not be easily categorized.

Exhibit 1. Preliminary Model of Parties Involved in Care Coordination, Matched to Available Measures

Key Parties Involved in Ambulatory Care Coordination Process
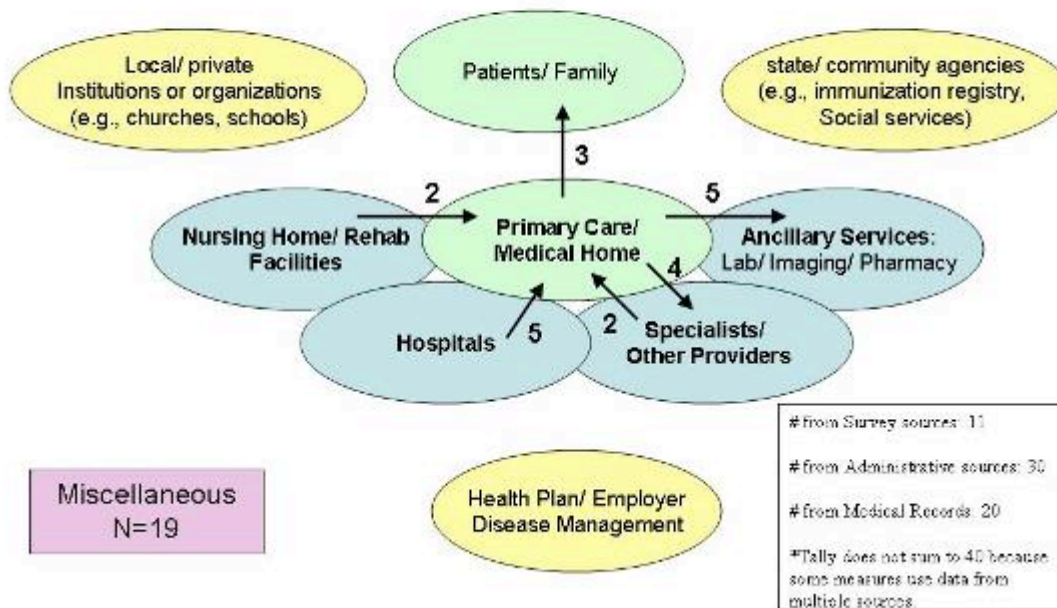
Gaps in Existing Measures and Refining Our Project Scope

Our review of existing definitions and measures of care coordination (AHRQ 2007; NQF 2006) clearly highlights the multifaceted nature of the care coordination process. As shown in Exhibit 1, information exchange and coordination of services may involve any two of the following: patient/family, primary care physician, specialists, ancillary services, hospitals, and nursing homes. However, a narrower focus for measure development would allow for greater refinement in measure specification and more thorough preliminary testing. To guide our measure development effort, we used the following criteria: 1) *provider accountability*, measures should clearly specify providers' responsibilities for care coordination; 2) *general applicability*, measures should reflect common coordination practices that affect the care that all or most patients receive; and 3) *feasibility of routine reporting*, measures can potentially be derived from electronic data sources.

A number of general hospital-to-ambulatory care coordination measures have been or will be the focus of measure development efforts (see Appendix II). In contrast, few measures were applicable to care coordination processes for the general patient population in the ambulatory setting. Existing ambulatory measures often involve special populations (children with special needs, cancer patients). Furthermore, they tend to require survey administration for data collection. Given the prevalence and problems observed in the referral coordination process (Gandhi et al. 2000; Forrest et al. 2000; Stille et al. 2005), our project determined that an emphasis on the primary care-to-specialist referral coordination process was warranted. Our emphasis on information exchange is supported by a recent systematic review that found interventions to improve the quality of this process have been associated with statistically and clinically significant benefits in outcomes (Foy et al. 2010).

Patients and their families are critical to the care coordination process and can serve as a valuable source of information on the quality of care coordination. However, our measure development emphasized provider actions to focus on provider accountability and also to identify measures that can be feasibly implemented in the near future from electronic data sources. Measure concepts that involve the input of patients were not further developed in the current project because reliable data collection of patient input through EHRs has not been demonstrated. We anticipate that measures based on patient input can be developed in future measurement efforts as the capacity and reliability of data collection through EHRs grow.

Wave 1: Qualitative Interviews with PCPs on Referral Process

The research team developed a draft process flow model for referral coordination in the ambulatory setting. The hypothesized referral coordination process begins with the identification of a need for a referral to a specialist by the PCP. Subsequent steps included the PCP sending relevant medical information on the patient to the referred provider. The specialist is expected to receive and review the information on the patient, provide the service, and send the results back to the referring physician. The PCP then receives and reviews the specialist report and, finally, acts on the report of the specialist in consult with the patient and family.

The research team matched interview responses to the proposed process flow to identify areas of concordance and discordance between experiences described by physicians and the proposed model (Exhibit 2). Interview findings confirmed the steps in the hypothesized process flow model. There were only minor deviations observed. First, respondents did not specifically mention the first step in the process flow—identifying the need for a referral to a specialist or imaging services. However, it was implied throughout their discussions. These interviews also expanded on the second step in the process—the identification of relevant patient information to share with specialist. Respondents identified specific types of information that should be shared, including medical and medication history, patient notes, and action requested in referral. Interviewees also made a clear distinction between internal referrals, for multispecialty and IDS settings with EHR access, from external referrals in the steps involving information transfer between generalist and specialist (PCP sends patient information, specialist receives patient information, PCP receives and views specialist report). Although not included in the hypothesized process model, a number of respondents identified scheduling the appointment for the patient and checking that the visit takes place as part of their care coordination process. However, other respondents did not feel that these steps were necessarily the responsibility of the PCP. Finally, interviewees emphasized that the actions the specialist or the PCP takes after the specialist visit will vary depending on patient status, urgency, and patient need. No single set of actions or procedures would be appropriate for all patient situations.

Exhibit 2. Key Findings from the Wave 1 Interviews

Process Flow	Key Points from Interviews
PCP identifies need and discusses options (for referral, specialist involvement)	• This rarely came up in the interviews, although the discussion with patient regarding need was implied.
PCP identifies relevant existing information (registry or medical record)	• *Key clinical data to send:* summary of medications, diagnoses, allergies, past medical history, and social history. Sometimes different specialists have special requests for information to be included in referral letter. • Other suggested information to include (no consensus among interviewees): last notes, last year of labs, any studies in past two years. • *Referral request to include:* reason for consult/referral, urgency of referral (urgent, necessary, or optional self-limiting), what the request is for (diagnosis, recommendation, consult/management/meds/complete care). • *Care/treatment plan to include:* all specialists patient sees, all contact information, issues around special equipment needs or issues around schooling (if CSHCN), key problems patient may present with and how to deal with them. Best course of therapy based on past history. • Could involve contact with and synthesizing recommendations across multiple EHR/record systems, disparate providers (prior PCPs, ER/hospital docs), settings (hospital, medical home), or tracking down old records. • PCP may contact specialist to see what tests are needed and order tests before the visit and send this along to the specialist.
PCP sends information with (referral request, request for visit, request for service)	• Greatly simplified for internal referrals for multispecialty practices/IDS settings with real-time EHR access by specialists. • May also be sent via fax or secured e-mail.
Scheduling the appointment	• Responsibilities for scheduling vary (sometimes patient, PCP, or specialist practice/department does scheduling). • If urgent, PCP usually personally arranges by phone. • Difficulty accessing specialists at night/ weekends, nonlocal tertiary specialists with whom PCP does not have relationship, for urgent cases. This poor access may lead PCP to refer patient to ER.

Checking that visit takes place	• Not all practices track this. Of those that do, some:
	  – developed system to track referrals;
	  – have the specialists (especially if internal) notify PCP of missed appointment (usually electronically); or
	  – ask patient if referred visit happened and what took place.

Specialist receives and reviews information and performs service	• Having specialists get information is simplified if it's an internal referral and/or information is EHR accessible.

Specialist sends results to PCP, patient/family	• In many cases, PCP doesn't see need for specialist to send back information. Sometimes specialist takes over the care or the issue is resolved at the specialist.
	• Important information to get back from specialist/lab:
	  – changes in medication (med reconciliation) and reason for change;
	  – lab results, especially critical or abnormal labs;
	  – consultation notes, recommendations; and
	  – whether visit took place.
	• For urgent cases, specialists will call or PCP will maintain phone/e-mail contact with specialists and other providers who care for patient to communicate results.
	• Getting information back is simplified if it's an internal referral and/or the information is EHR accessible.

PCP reviews results/report	• Access to specialist visit information is simplified if it's an internal referral and/or the information is EHR accessible.
PCP acts on results/report and shares with patient/family or PCP and specialist, with patient and family agreeing on comanagement plan	• Follow-up with patient usually happens at next visit, possibly by phone or e-mail. • For chronic conditions, PCP reviews goals with patients and checks for problems with meds. • Protocol (timing of follow-up, next clinical steps) depends on severity, urgency, and type of situation. • PCP may make arrangement for other services. • Reviews patient meds and reconciles between patient and record, either periodically (every six months) or at next follow-up visit. • Develops or revises care/treatment plans as needed.

Respondents offered additional insights on the referral coordination process including the need for special steps for complex cases and closing the loop on urgent referrals. In particular, some noted taking special steps to ensure treatment plans are updated for patients with multiple health problems. External factors affect the responsiveness of specialist to PCP and the closing of the referral loop; examples include resource availability (specialist scarcity, insurance coverage), patient behavior, market environment for specialists, and the strength of the PCP-specialist relationship. Many patients and families play an active role in the coordination process.

Advisory Panel

The advisory panel generally endorsed the overall project objectives and the process flow model developed by the team. To further guide the project in the measure development process, they offered the following recommendations:

- **Focus on the primary care to specialist/imaging/consult process.** There are already measure development efforts initiated for other care coordination areas, such as inpatient ambulatory care and PCP coordination with laboratories.

- **Map measures to a care coordination process that is feasible in routine practice's work flow.** Measures that create the need for an added step or additional effort on the part of the practices will introduce burden and be less successful.

- **Emphasize measures that can be implemented in current health care settings.** The panel considered measures of shared decision-making and a shared care plan to be important. However, these measures were also recognized to be aspirational and difficult to define and measure in current health care settings.

- **Consider how the urgency of referrals varies.** All consults are not created equal (urgent, necessary, not urgent, not necessary). It may be desirable to develop measures tied to timeliness.

- **Incorporate patient perspective in measures.** Conceptual framework and process flow models should give greater emphasis to patient/caregiver role.

- **Use common standard for community-based practices and integrated delivery systems.** Despite differences in resource availability for community-based and integrated delivery systems, a common standard for evaluating care coordination should be used.

- **Address patient self-referrals.** The specialist is still responsible for the consult if not referred by a PCP. It is fair to exclude the PCP from measurement if the patient self-refers.

- **Focus on EMR-based measures but make sure that measures are meaningful in paper-based settings.** There was some discussion of differential measurement of practices with integrated EMRs versus those without. General consensus is that measures should be developed according to what needs to happen—the ideal care processes—and deal with EMR functionality as a function of the measures, not the other way around.

The panel's recommendations for specific measure concepts or process flow step are presented in Exhibit 3.

Exhibit 3. Panel Recommendations for Proposed Measures by Process Flow Step

Process Flow Step	Panel Suggestion for Measures
PCP identifies the need for a referral and discusses options with patient	• This may not be a shared decision. Patient may want a referral but does not need one. Could measure if there was a shared decision-making process about whether a specialist was needed or not. • There is evidence that patients can be educated and decisions made together that will lead to patients selecting less intensive solutions, such as not to go to a specialist, etc.
PCP identifies relevant existing information to send with referral	• Minimum data set in standard format.
PCP sends information with referral request in a timely manner	• This is a separate measure than the previous. • It is the referring physician's responsibility—refer, track, issue reminder, take action if necessary.
Specialist receives and reviews information and performs requested service	• Track referrals scheduled, not appointments actually made, because when specialist visit takes place may be due to availability of specialist, not coordination efforts by PCP. • This could just be a measure for the specialist.
PCP reviews results/report; PCP acts on results/report and shares with patient and family	• First measure: Results/consults reviewed and acknowledged. – Could give PCP credit if they try to get the results (give them numerator hit). • Second measure: Recommendations/results shared with and explained to patient and family. Could be done by specialist already (e.g., ophthalmologist visit for diabetic eye exam). Imaging and other diagnostic tests may require action by PCP because results are sent back to PCP and not to patient. • Comanagement comes in here as well—communication between providers. Don't try to measure this at this point.

Wave 2: Telephone Interviews of Face Validity and Acceptability Assessment
Based on these panel comments and suggestions, the project team decided to develop specifications for six measure concepts. The six measures focused on coordination by the primary care provider. The research team presented these measures, with preliminary specifications, to 15 practicing physicians to assess the measures' clinical importance, usefulness, feasibility, and acceptability. These measures are:

- *Measure 1: Critical Information Communicated with Request for Referral/Consult to Specialist*
- *Measure 2: Use of Standardized Format to Communicate Critical Information*
- *Measure 3: PCP Communicates to Patient the Reason for Referral*
- *Measure 4: Visit Scheduled Within Requested Time Frame*
- *Measure 5: PCP Receipt and Review of Specialist Report*
- *Measure 6: PCP Communicates Results of Specialist Visit to Patient/Family*

Responses to each specified measure in the Wave 2 interviews are described below and presented in Exhibit 4.

Exhibit 4. Wave 2 Interview Synthesis; Responses (N=15) Organized by Measure

Specified Measures	Clinically Important	Useful	Feasible	Acceptable	Decision
Measure 1 **Critical Information Communicated with Request for Referral/Consult to Specialist**	100%	80%	80%	87%	Retain
Measure 2 **Use of Standardized Format to Communicate Critical Information**	47%	40%	40%	40%	Delete
Measure 3 **PCP Communicates to Patient the Reason for Referral**	87%	73%	73%	67%	Retain
Measure 4 **Visit Scheduled Within Requested Time Frame**	47%	33%	60%	40%	Delete
Measure 5 **PCP Receipt and Review of Specialist Report**	93%	73%	73%	80%	Retain
Measure 6 **PCP Communicates Results of Specialist Visit to Patient/Family**	47%	33%	60%	40%	Delete

Of the six evaluated measures, respondents found three measures to be clinically important, useful, feasible to measure, and acceptable as a way to evaluate coordination performance. These include Measure 1 (Critical Information Communicated with Request for Referral/Consult to Specialist), Measure 3 (PCP Communicates to Patient the Reason for Referral), and Measure 5 (PCP Receipt and Review of Specialist Report). At least 13 of the 15 respondents ($\geq 87\%$) considered these measures to be clinically important. In addition, 11 or 12 of the 15 respondents (73% to 80%) considered these three measures to be useful and feasible to measure. Physician respondents also found these measures generally acceptable to for evaluating performance on coordination. Specifically, 12 respondents considered PCP review of specialist report after the visit (Measure 5) to be an acceptable measure, and 13 respondents considered PCP communication of critical information to specialist before the visit (Measure 1) to be acceptable.

Fewer than half of the physician respondents considered the remaining three measures (Measure 2: Use of Standardized Format to Communicate Critical Information; Measure 4: Visit Scheduled Within Requested Time Frame; and Measure 6: PCP Communicates Results of Specialist Visit to Patient/Family) to be clinically important, useful, and acceptable. Sixty percent, or nine respondents, did consider visit timing and PCP communication of specialist visit results to be feasible to measure. However, given the poor performance on face validity to physicians, these measures were given lower priority for further development. Reasons given for the lower assessment of these measures include the redundancy of Measure 2 (Use of Standardized Format to Communicate Critical Information) to Measure 1 and the influence of external factors, such as specialist availability, for Measure 4 (Visit Scheduled Within Requested Time Frame), which are outside the control of the PCP. As for Measure 6, some respondents cited the fact that PCPs were expected to do this with patients and families, although others believe that responsibility for communicating with the patient and family falls to the physician making the assessment or requesting tests.

Physicians from IDS versus non-IDS settings expressed some diversity of opinions for several measures. For Measure 1, there was no consensus around the information that would be critical to send. Furthermore, physicians from IDS settings found the measure to be less useful since information exchange in these settings occurs by having different providers access the same EHR system. Similarly, for Measure 3, IDS physicians did not find communicating the reason for referral to the patient to be useful to measure either, in contrast to the non-IDS physicians, who supported the measure's usefulness.

Wave 3 Site Visits: Implementation Feasibility of Measures

Based on Wave 2 findings, Measure 2 was removed. In addition, our PCP respondents highlighted the integral role specialists have in the referral process. Therefore, two new measures were developed to assess the specialist's role in the referral coordination process: 1) percent of patients seen by specialists where specialist gave report to PCP; and 2) percent of patients seen by specialist where specialist gave report to patient. The data elements for the retained PCP and new specialist measures (Exhibit 5) were identified and evaluated for data availability, format, and reliability during the Wave 3 site visits. Of the 18 data elements, data for eight elements could be obtained from all seven sites and another five elements could be collected by five to six sites we visited (Exhibit 6). Two or fewer sites have data in the chart for: 1) time frame of referral given to patient and 2) whether the specialist visit occurred (separate from having the specialist report sent back to PCP), both of which are part of Measure 2. The remaining elements are captured in fewer than half the sites participating in Wave 3, all of which were IDSs.

Exhibit 5. Data Elements Required for Measures

Measure	Denominator or Numerator	Required Data Element
All Measures	Denominator	• age • patient referred (y/n) • referral source (self vs. PCP)
Measure 1 **Critical Information Communicated with Request for Referral/Consult to Specialist**	Numerator	• activity requested (referral, consultation, comanagement) • reason for referral • preferred timing • problem list • medication list • medical history
Measure 2 **PCP Communicates to Patient the Reason for Referral**	Numerator	• reason for referral given to patient • name of specialist given to patient • time frame given to patient
Measure 3 **Specialist Report Sent to PCP**	Numerator	• specialist report sent to PCP
Measure 4 **Specialist Communicates with Patient/Family**	Numerator	• specialist report received by patient
Measure 5 **PCP Receipt and Review of Specialist Report**	Numerator	• specialist report viewed by PCP

Few data elements are currently electronically abstracted to a data warehouse. Three sites abstract data on whether the specialist report has been received by the PCP. Two sites are abstracting data for whether the patient was referred. Only one site abstracts data on: 1) the activity requested in the referral and 2) the reason for the referral.

No site abstracts data on: 1) preferred timing for referral and 2) whether the reason for referral was given to patients.

Exhibit 6. Number of Sites (N=7) with Data Element Available in Chart, in Structured Format, and Regularly Recorded

Data Element	Available in Chart	Structured	Regularly Recorded
Age	7	6	7
Patient referred (y/n)	7	5	5
Referral source (PCP vs. other)	6	3	3
Activity requested in referral	5	1	3
Reason for referral in referral	7	1	3
Preferred timing in referral	7	4	3
Problem list in referral	7	3	2
Medication list in referral	7	3	3
Medical history in referral	7	0	3
Reason for referral given to patient	4	1	0
Name of specialist given to patient	6	1	0
Time frame given to patient	0	NA	NA
Date of visit where patient referred	5	4	4
Scheduled date of appointment with specialist	5	3	0
Actual date of appointment with specialist	3	3	0
Visit with specialist occurred (y/n)	2	0	0
Specialist report received/viewed by PCP	7	3	5
PCP communicates specialist report with patient	3	0	1

At the measure level, our findings suggest that Measures 1 and 5 can feasibly be implemented in both paper-based and electronic practices, with only modest changes to data collection or documentation procedures. However, neither can be reliably reported through the EHR in the systems we evaluated. The implication of data availability and accessibility for the implementation of each measure we retained are summarized in Exhibit 7. Further details on the implementation feasibility of each measure from our site visits are provided in Appendix V.

Exhibit 7. Implications of Data Availability and Access on Measure Implementation

Measure	Required Data Elements	Key Implementation Findings
All Measures (denominator)	• age • patient referred (y/n) • referral source (self vs. PCP)	• Age and referral event captured electronically at all EHR-based sites. • Referral source (self/PCP) not consistently captured in either paper or electronic practices.
Measure 1 **Critical Information Communicated with Request for Referral/Consult to Specialist** (numerator)	• activity requested • reason for referral • preferred timing • problem list • medication list • medical history	• Most elements available in chart of all or nearly all seven sites. • Data elements are often not sufficiently structured for electronic capture and reporting. • Elements may not be consistently recorded.
Measure 2 **PCP Communicates to Patient the Reason for Referral** (numerator)	• reason for referral given to patient • name of specialist given to patient • time frame given to patient	• Many sites document data on reason for referral and name of specialist (or practice) given to patient. • None provided time frame for referral to patient. • Elements not consistently recorded or explicitly tracked.
Measure 3 **Specialist Report Sent to PCP** (numerator)	• specialist report received by PCP	• Not evaluated in site visits.
Measure 4 **Specialist Communicates with Patient/Family** (numerator)	• specialist report received by patient	• Not evaluated in site visits.
Measure 5 **PCP Receipt and Review of Specialist Report** (numerator)	• specialist report viewed by PCP	• Variety of paper and electronic strategies are used for this coordination step. • Manual abstraction will allow this action to be tracked in practices with paper-based or electronic records systems. • Element of PCP receipt and review of specialist report not operationally different from element for Measure 3 in EHR practices.

SUMMARY OF KEY FINDINGS

- **Clinically relevant and face valid measures of the referral coordination process can be developed and implemented using electronic health records.** Our project developed and tested measures of referral coordination for clinical relevance and acceptability with practicing primary care providers. The final set of measures includes three specific to the primary care setting (see Exhibit 8 below) and two measures evaluating specialist care.

Exhibit 8. Final Measure Set

	From the Primary Care Perspective	From the Specialty Care Perspective
Eligible Population (denominator)	Number of patients aged 18 and over who were sent to another clinician for referral or consultation. Exclusions: Patients who self-refer to a specialist.	Number of patients aged 18 and over who were referred to a specialist and seen by that clinician. Exclusions: Patients who self-refer to a specialist.
Referral Loop Opened	**1A. Critical Information Communicated with Request for Referral to Specialist (Sent by PCP)** Number of patients in the denominator with relevant clinical information communicated using the Continuity of Care Document (HL7 CCD) with request for referral to specialist. Relevant clinical information is defined as: • activity requested (referral, consultation, comanagement); • clinical reason for requesting the referral/consultation; • preferred timing for completion of the referral/consultation; • problem list; • medication list; and • medical history, including relevant test results.	**1B. Critical Information Communicated with Request for Referral to Specialist (Received by Specialist)** Number of patients in the denominator with relevant clinical information communicated using the Continuity of Care Document (HL7 CCD) with request for referral to specialist. Relevant clinical information is defined as: • activity requested (referral, consultation, comanagement) • clinical reason for requesting the referral/consultation; • preferred timing for completion of the referral/consultation; • problem list; • medication list; and medical history, including relevant test results.
Patient Informed	**2. PCP Communicates to Patient the Reason for Referral** Number of referred patients where primary care clinician gave patient written information on reason for referral/consultation. Information must include: • reason for need for specialist involvement; and • name and contact information for specialist.	**4. Specialist Communicates with Patient/Family** Number of patients in the denominator seen by a specialist where the specialist provided written results to the patient.
Referral Loop Closed	**5. PCP Receipt and Review of Specialist Report** Number of referred patients seen by the specialist where the PCP reviewed the results of the specialist report.	**3. Specialist Report Sent to PCP Physician** Number of patients in the denominator where the specialist communicated results in a report to the PCP using the Continuity of Care Document (HL7 CCD). Elements of the report must include: • findings; and • treatment recommendations including degree of shared management of patient and roles for specialist and PCP. Exclusions: Patients in the eligible population who refuse to allow sharing of results with PCP.

- **The emerging consensus on a model of the referral coordination process highlights opportunities for future measure development.** Our project developed a model to guide the measure development process that appeared to have face validity with practicing physicians, national experts, and key stakeholders involved in care coordination. Aside from the measures developed in this project, the model suggests future measures that would reflect actions, including shared decision-making and shared care plan, taken by all parties involved in coordination that cannot be feasibly implemented in the current health system environment.

- **Two measures can potentially be implemented immediately in practices using EHRs.** Of the final set of five measures, two (Measure 1: Critical Information Communicated with Request for Referral/Consult to Specialist and Measure 5: PCP Receipt and Review of Specialist Report) could be implemented with modest changes to current practice work flow or information systems. Data elements required to calculate these measures can be found in the electronic chart for most, if not all, sites we visited. Furthermore, approximately half already record the data needed for numerator of Measure 1 on a routine basis, and five of the seven sites regularly record data needed for numerator of Measure 5. Although at least four of six sites have the required data for Measure 2 (PCP Communicates to Patient the Reason for Referral) available in the chart, none regularly record this information, limiting the feasibility of measure implementation without significant changes to documentation procedures at the sites we visited. The implementation feasibility of specialist measures was not consistently examined in the site visits.

- **Lack of structured data is a key impediment to reporting measures directly from the EHR.** Even for the two measures considered feasible for implementation, none of the sites we visited have structured data available for all of the required data elements for the numerator of the referral loop opening and closing measures.

- **Irregular documentation and lack of interoperability pose threats to the accuracy of measures.** There are important barriers to accuracy of reporting these measures that may affect these measures. Required data elements are often inconsistently documented. For example, data on self-referrals, an important exclusion for the denominator of all the measures, are not regularly documented at many sites. In addition, structured data are often not available, even when appropriate data fields or drop-down lists are used, because free-text fields often are available to allow uncoded data to be entered. The lack of EHR interoperability contributes to significant missing data for some elements. For example, many providers from

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sophisticated IDSs still use paper-based processes to exchange information with providers outside their information system, whether these outside providers use paper or electronic health records. These paper-based information exchanges are often archived as scanned documents without any searching or coding that makes this information readily available for measure reporting.

- **EHRs significantly change the information exchange process for internal and external referrals.** The process of information exchange is quite different for internal referrals (within the practice or delivery system) and external referrals (with outside providers). For internal referrals in practices with an EHR, information exchange generally doesn't involve active "sending" actions by the primary care provider or specialist. Instead, exchange occurs when providers access the repository of information available in the system. This is especially true for data elements such as problem list, medical history, and medication list. Consequently, the salience of measures, such as the measure on sending critical information about the referral, differed for providers linked by the same EHR system and for providers using paper-based or using non-interoperable EHR systems.

- **Implications for policy and practice.** Our project focused on developing new quality measures of care coordination for the ambulatory setting. However, through our interviews, site visits, and discussions with national experts and key stakeholders in care coordination, several key observations emerged that have relevance for policy and practice.

  - *A better communication infrastructure is needed to facilitate information exchange among patients/family, primary care and other providers, and health facilities.* Barriers to information exchange across settings, even for providers from integrated delivery systems with sophisticated health information technology, are widespread. Unless user-friendly strategies are developed to allow for real-time updates, access, and communication among all parties engaged in coordination, system-wide improvements in care coordination will be limited.

  - *New reimbursement structure for care coordination activities should be developed to support system-wide improvements.* Most providers participating in our study were recognized through one of NCQA's programs, including the one on patient-centered medical homes. Among these providers, many contribute unreimbursed time and resources to enhancing care coordination

processes for their patients, unless an adequate reimbursement structure for care coordination is provided.

- *A system to track referrals should be widely implemented by practices.* Having a tracking system for referrals allows practices to ensure follow-up for high-priority referrals. For example, as part of NCQA's Physician Practice Connections–Patient-Centered Medical Home (PPC-PCMH), practices are required to keep a log for tracking critical referrals (including reason for the consultation, pertinent clinical findings, etc.) and noting when the referral visit occurs and results are returned (NCQA 2008b). While some practices have created some version of this, deploying standardized definition of important referrals to track and embedding this registry within all practices can have system-wide effects on care coordination.

- *Clearer delineation of patient and provider responsibilities in care coordination is needed.* Although our project focused on generalist-to-specialist exchange, patients are clearly critical agents and valuable informants about cross-setting service use. In particular, one of the challenges to care coordination involves patient self-referrals that are often not known nor consistently documented. Since important clinical information such as new medications can be generated in these self-referrals, patients should provide their primary care provider details of these encounters. Clear explanation of the benefits of care coordination and patients' responsibilities in this process, perhaps through a formalized agreement, can greatly increase the effectiveness of care coordination actions by providers.

CONCLUSIONS

This project demonstrates that a set of measures on ambulatory care coordination can be developed that are clinically meaningful to practicing primary care providers. The measure concepts and preliminary specifications were generally supported by the physicians we interviewed and by national experts and key stakeholders in our advisory panel. While further development of these measures, especially to enhance their reportability through EHRs, is needed, preliminary results indicate promise. In fact, from the feasibility assessment, two of the developed measures can potentially be implemented with only modest changes to practice work flows or information systems. However, our study also found significant data availability, format, and interoperability problems that impede near-term implementation and, particularly, the reportability of these measures from existing EHR systems.

This project represents the first stage of measure development. Significant additional research and development work will be needed before these measures can be widely implemented. For example, while we examined the availability of key data elements required for our target measures, we know little about the reliability of these data elements when they are present. Therefore, it is unclear whether these measures can be reliably reported from EHRs. Finally, although this project purposefully selected a range of practice settings for our empirical evaluation, our sample was relatively small and drawn from NCQA-recognized practices or advanced IDSs, which may not be representative of all practices in the country. Empirical evaluation, including validation studies, of these measures in a larger and more diverse sample of practices will be needed.

These new measures, representing processes enabled by health information technology, are likely candidates for future iterations of the CMS EHR Incentive Program, which enables increased payment to clinicians who are "meaningful users" of EHRs. Without valid measures, we cannot evaluate how different care coordination processes affect health care costs and patient outcomes or identify breakdowns in process that could be the target of quality improvement efforts. To be practical, routine measures of care coordination process need to be by-products of the care process. The growing use of EHRs in medical practices offers a tremendous opportunity for addressing this challenging measurement problem. Demonstrating feasibility of measures in time for National Quality Forum endorsement and inclusion in meaningful use criteria for 2013 will address the dearth of care coordination measures, but more importantly, will provide measures to guide quality improvement and accountability efforts in the future.

Finally, observations emerged during the conduct of this project that highlight the challenges to care coordination that persist within our health care system. Policies such as better reimbursement for care coordination activities and support for the development of improved information and data exchange infrastructures, including improving the interoperability of EHR systems, will prove critical to system-wide improvements in care coordination. At the practice level, the development of a system for tracking referrals and clear specification of patient and provider responsibilities in the care coordination process can also substantially improve the care coordination process and outcomes.

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APPENDIX I. DETAILED PROJECT METHODOLOGY

Development of Measurement Framework and Draft Measure Concepts

Literature Review
We had two main goals for the literature review. First we wanted to develop a conceptual framework for our project to provide guidance for measure development. To accomplish this, we reviewed the published and gray literature to identify existing frameworks for care coordination, including those by the National Quality Forum (NQF) and Barbara Starfield, and existing measures of care coordination.

Our literature review consisted of two parts. The first was a search in PubMed following the search string employed by the Agency for Healthcare Research and Quality (AHRQ) in its 2007 technical review, *Closing the Quality Gap: A Critical Analysis of Quality Improvement Strategies*. Refining the original AHRQ search string, we limited the search to conceptual pieces, systematic reviews, and meta-analyses published after October 1, 2006. This generated 141 articles. Three of the project staff reviewed the article abstracts for relevance, which identified 17 articles addressing care transitions. Project staff read the articles for measures of care coordination, methods for developing measures of care coordination, and steps in the coordination process, which were used to inform the development of a model of care coordination.

The second part of the literature review employed a search of the gray literature to identify existing measures of care coordination that are within the scope of this project. We used the National Committee for Quality Assurance's standard procedures for identifying existing measures. These included publications from the NQF, measures from the National Quality Measures Clearinghouse (NQMC), measures from the American Medical Association's Physician Consortium for Practice Improvement (PCPI), and Care Transition Measure-3 from Eric Coleman and colleagues (2005). These measures were categorized according to the origin of the data for the measure (ambulatory, hospital, other), the direction of transfer (hospital to ambulatory versus ambulatory to hospital), and the source of the data (survey, claims data, or administrative data). We complemented these with measures identified during our review of published literature.

Wave 1 Telephone Interviews: Understanding the Referral Coordination Process
The aim of the first wave of interviews was to better understand the current referral coordination processes being used by high-performing practices in the United States. These interviews consisted of 12 in-depth, semi-structured interviews with primary care

practice–based physicians, eight in single/small-group and multispecialty practice, and four in IDS settings. Physicians were identified by their affiliation with the NCQA Physician Practice Connections–Patient Centered Medical Home program (PPC-PCMH). Generalist specialties including family medicine and internal medicine were eligible for the study. An initial e-mail was sent to over 1,000 physicians inviting them to contact the project team if they were interested in participating. Forty-six physicians expressed interest in participating in the study and responded to the questionnaire in the e-mail which solicited their specialty, the name and location of their practice, and whether the practice had an electronic health record system, purely paper records, or a combination system.

From the 46 responses, the team identified 12 practices and integrated delivery systems from across the country with a variety of health record-keeping systems (EHR N=4; combination N=3; paper N=1), and who identified as either a general internist (N=3) or a family practitioner (N=5). In some cases, physicians identified staff as experts in care coordination in their offices and designated them as the primary respondent for the practice. Each respondent participated in a one-hour telephone interview conducted using a standardized interview guide. The interview guide was provided to them one week in advance of the interview. The guide included two scenarios of care coordination and solicited two other scenarios from the physician's own experience. The questions and scenarios were developed with the help of primary care physicians at Johns Hopkins and Park Nicollet Institute. Two project team members participated in each interview. Each interview was audio recorded. In addition, notes were taken and interview findings were summarized individually.

Summaries of the Wave 1 interviews were compiled by the team and reviewed and coded by three team members. These codes were entered into a matrix based on the steps of the referral process in the first draft process flow model developed by the project team. These Wave 1 findings and the information generated by the literature review informed the process flow model for referrals between primary and specialty care, a conceptual framework of participants in ambulatory care coordination, and a draft set of proposed measures developed by the team.

Measure Refinement and Prioritization

Advisory Panel
A national expert panel was convened in the offices of NCQA on May 1, 2009. The panel comprised experts and stakeholders in quality of health care and care coordination from

the AMA, AARP, Bridges to Excellence, AHRQ, vendor organizations (EPIC, Eclinicalworks, GE), and provider and insurer organizations (Billings Clinic, Geisinger Health System, Taconic, WellPoint). Representatives attending the meeting are listed in Appendix IV.

At the meeting, project staff presented preliminary findings from the literature review and Wave 1 qualitative interviews. Panel members were also presented with working drafts of the process flow model and an example of measure specification for their review and comment. Panel members were asked to provide general guidance on the appropriate scope for this project, given other efforts to develop quality measures of care coordination. They were also asked to identify salient issues with the proposed process flow and measurement concepts and provide recommendations for further measure development. These comments and suggestions were used to refine the proposed process flow and measure concepts and guide the prioritization of measures for specification by the project team. Ultimately, six measures were selected for specification (see Appendix III, Process Flow Model).

Preliminary Evaluation of Measure Face Validity, Acceptability, and Feasibility

Wave 2: Telephone Interviews of Face Validity and Acceptability Assessment
The second wave of semi-structured interviews was conducted with 15 respondents. Of the 15 respondents, 10 were new small-group or single-practice physicians drawn from the original solicitation of physicians interested in the study. The remaining five were physicians from the IDSs that participated in Wave 1 interviews. However, the physicians from these IDSs were different from those responding to Wave 1. Respondents were sent the process flow model, preliminary specifications of the measures, and an interview guide in advance of the interview. They were asked to reflect on the clinical importance and usefulness of a measure to their practice, feasibility of capturing the data, and comfort being assessed on such a measure. Interviews were conducted over the phone, audio recorded, and summarized individually.

Responses from the Wave 2 interviews were organized into a matrix according to the validity, acceptability, feasibility, and usability of each measure. The results were used to further refine the measures and their specifications. The refined specifications and measures were evaluated for implementation feasibility through Wave 3 site visits.

Wave 3 Site Visits: Implementation Feasibility of Measures
To assess the feasibility of implementing the refined set of measures, the project team traveled to conduct face-to-face interviews and site visits at three integrated health systems, two EHR networked practices, one regional health information organization (RHIO), and one paper-based primary care practice located across the United States. The providers participating in Wave 3 site visits are listed in Exhibit A1. Non-IDS sites were selected from among practices that expressed interest in participation during the original recruitment effort for the project. The IDS participants were longtime collaborating organizations that had already agreed to participate in the project. One week before the site visit, the specified measures, process flow model, and a semi-structured interview guide were shared with the respondents. This wave focused on determining the availability, form, and the potential for electronic extraction of each data element necessary for electronic reporting of the specified measures.

At each site, the project team (comprising three to six project team members from Johns Hopkins University, NCQA, and Park Nicollet Institute) met with clinicians (primary care physicians, physician assistants, nurse practitioners) and other clinical staff (referral coordinators, medical assistants, other front-office staff) familiar with the referral process at the site and, as available, staff with expertise or experience in quality improvement and information systems.

Exhibit A1. Wave 3 Participant Sites

Organization/Practice	Type	Location	EMR Type
Billings Clinic	IDS	Montana	Cerner
Park Nicollet Health Services	IDS	Minnesota	Centricity
Geisinger Health System	IDS	Pennsylvania	EPIC
Taconic Health Information Network and Community (THINC)	RHIO	New York State	eClinicalWorks, NextGen
New York City Department of Health's Primary Care Information Project (PCIP)	Networked practices	New York City	eClinicalWorks
Johns Hopkins Community Physicians (JHCP)	Networked practices	Baltimore, Md.	Centricity
Cameron Medical Group	Small group/ solo practice	Silver Spring, Md.	No EMR

At each site, relevant staff provided information on or demonstration of their referral coordination process using their health record system, whether electronic or paper-based. Site staff also provided documentation of referral process as available (e.g., referral letter forms, screenshots of referral templates). We also asked about referral processes and documentation of coordination activities with outside providers (other practices, hospitals, other organizations) that may not share the same EHR system.

We reviewed the process flow chart, measure specifications, and each data element needed to implement the measures with the appropriate staff. For each data element, we asked about the presence and the format of the element, including whether each data element was:

- currently available in the chart;
- available in free-text or structured format and, if structured, the codes/categories or coding system used with the data element;
- regularly recorded by the practice; and
- currently being electronically abstracted to a data warehouse.

Participants were not asked questions that previous responses precluded; for instance, a respondent who identified that a data element was not available in their chart would not be asked further questions about that data element.

APPENDIX II. MEASURES IDENTIFIED FROM LITERATURE SEARCH

Measures are grouped by the following transitions across parties (N=number gathered):

A. Primary care to specialist (N=4)
B. Specialist to primary care (N=2)
C. Primary care to ancillary (N=5)
D. Ancillary to primary care (N=0)
E. Primary care to rehabilitation center (N=0)
F. Rehabilitation center to primary care (N=2)
G. Primary care to hospital (N=0)
H. Hospital to primary care (N=5)
I. Primary care to patient and family (N=3)
J. Patient and family to primary care (N=0)
K. Miscellaneous (N=19)

Total: 40 measures

Number from survey sources: 11

Number from administrative sources: 30

Number from medical records: 20

* Tally does not sum to 40 because some measures use data from multiple sources.

Abbreviations:
NQMC: National Quality Measures Clearinghouse
PCPI: Physician Consortium for Performance Improvement
AMA: American Medical Association
CTM-3: The Care Transitions Measure

	Measure (short description)	Measure Specification (numerator/denominator)	Data Source	Type of Measure	Source of Measure
A. Primary Care to Specialist					
1	Parents or guardians of children with chronic conditions indicate whether they received assistance with coordination of care and services for their child. The "Coordination of Care" composite measure is based on two questions in the CAHPS 3.0H Child Questionnaire.	Numerator: The number of "Yes" or "No" responses on the "Coordination of Care" questions; Denominator: Health plan members with chronic conditions 17 years and younger whose parent or guardian answered the "Coordination of Care" questions on the CAHPS 3.0H Child Questionnaire	Patient survey	Patient experience	NQMC
2	Proportion of children needing more than one health care service who received coordinated care.	Numerator: Children whose parent responded, "Yes" to the item in the "Care Coordination (CC)" scale; Denominator: Children age 3 months to 48 months who needed care from multiple health care providers or used more than one service, who received a well-child visit in the last 12 months, and whose parent answered the item in the "Care Coordination (CC)" scale on the Promoting Healthy Development Survey (PHDS)	Patient Survey	Process, patient experience	NQMC
3	Access to Specialized Services Composite Measure: parents or guardians of children with chronic conditions report how much of a problem they had in obtaining specialized care for their child. The measure is based on six questions in the CAHPS 3.0H Child Questionnaire.	Numerator: The number of "A big problem," "A small problem," and "Not a problem" responses on the six "Access to Specialized Services" questions regarding whether parents had a problem obtaining specialized care for their child and if a problem, the number of "Yes" and "No" responses to the questions regarding whether anyone from their child's health plan, doctor's office, or clinic helped them with this problem; Denominator: Health plan members with chronic conditions 17 years and younger whose parent or guardian answered the "Access to Specialized Services" questions on the CAHPS 3.0H Child Questionnaire	Patient survey	patient experience, access	NQMC

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#	Description	Numerator / Denominator	Data Source	Measure Type	Source
4	This measure is used to assess the percentage of respondents who reported they received assistance with **coordination** of care for their children with chronic conditions*.	Numerator: The number of health plan members from the denominator whose parents indicated "Yes" or "No" on the "Parents' Experiences with Coordination of Their Child's Care" questions; Denominator: Health plan members age 17 years and younger with chronic conditions (as determined by specific screening criteria included in the questionnaire) whose parents or guardians answered the "Parents' Experiences with Coordination of Their Child's Care" questions on the CAHPS 4.0 Health Plan Survey (Child Questionnaire)	Patient survey	Patient experience	NQMC
B. Specialist to Primary Care					
5	Percentage of patients seen with a new occurrence of melanoma who have a treatment plan documented in the chart that was communicated to the physician(s) providing continuing care within one month of diagnosis.	Numerator: Patients who have a treatment plan documented in the chart that was communicated to the physician(s) providing continuing care within a month of diagnosis; Denominator: All patients diagnosed with a new occurrence of melanoma	Administrative data, medical record	Process,	NQMC
6	Percentage of patients, regardless of age, with a diagnosis of cancer who have undergone brachytherapy or external beam radiation therapy who have a treatment summary report in the chart that was communicated to physician(s) providing continuing care and to the patient within one month completing treatment.	Numerator: Patients who have a treatment summary report in the chart that was communicated to the physician(s) providing continuing care and to the patient within one month of completing treatment; Denominator: All patients, regardless of age, with a diagnosis of cancer who have undergone brachytherapy or external beam radiation therapy	Administrative data, medical record	process	NQMC
C. Primary Care to Ancillary					

#	Description	Numerator/Denominator	Data Source	Type	Source
7	Percentage of members 18+ years who received at least a 180-days supply of ambulatory medication therapy for angiotensin converting enzyme (ACE) inhibitors or angiotensin receptor blockers (ARBs) during the measurement year and at least one serum potassium and either a serum creatinine or a blood urea nitrogen therapeutic monitoring test in the measurement year. This measure is a component of a composite measure. For each product line, four separate rates and a combined rate are reported.	Numerator: Members from the denominator with at least one serum potassium and either a serum creatinine or a blood urea nitrogen therapeutic monitoring test* in the measurement year; Denominator: Members 18 years of age and older as of December 31 of the measurement year on angiotensin converting enzyme (ACE) inhibitors or angiotensin receptor blockers (ARBs) -- defined as members who received at least a 180-days supply of ambulatory medication in the measurement year	Administrative data, laboratory data, pharmacy data	process	NQMC
8	Percentage of members 18+ years who received at least a 180-days supply of ambulatory medication therapy for digoxin during the measurement year and at least one serum potassium and either a serum creatinine or a blood urea nitrogen therapeutic monitoring test in the measurement year. This measure is a component of a composite measure. For each product line, four separate rates and a combined rate are reported.	Numerator: Members from the denominator with at least one serum potassium and either a serum creatinine or a blood urea nitrogen therapeutic monitoring test* in the measurement year; Denominator: Members 18 years of age and older as of December 31 of the measurement year on digoxin -- defined as members who received at least a 180-days supply of ambulatory medication in the measurement year	Administrative data, laboratory data, pharmacy data	process	NQMC

9	This measure is used to assess the percentage of members 18 years of age and older who received at least a 180-days supply of ambulatory medication therapy for diuretics during the measurement year and at least one serum potassium and either a serum creatinine or a blood urea nitrogen therapeutic monitoring test in the measurement year. This measure is a component of a composite measure. For each product line, four separate rates and a combined rate are reported.	Numerator: Members from the denominator with at least one serum potassium and either a serum creatinine or a blood urea nitrogen therapeutic monitoring test* in the measurement year; Denominator: Members 18 years of age and older as of December 31 of the measurement year on diuretics -- defined as members who received at least a 180-days supply of ambulatory medication in the measurement year	Administrative data, laboratory data, pharmacy data	process	NQMC

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| 10 | Percentage of members 18+ years who received at least a 180-days supply of ambulatory medication therapy for anticonvulsants (phenobarbital, carbamazepine, phenytoin, divalproex sodium, valproic acid) during the measurement year and at least one serum potassium and either a serum creatinine or a blood urea nitrogen therapeutic monitoring test in the measurement year. This measure is a component of a composite measure. For each product line, four separate rates and a combined rate are reported. | Numerator: Members from the denominator with at least one drug serum concentration level monitoring test for the prescribed drug in the measurement year. If a member received only one type of anticonvulsant, the drug serum concentration level test must be for the specific drug taken as a persistent medication (i.e., a member on phenytoin received a drug serum test for phenytoin). If a member persistently received multiple types of anticonvulsants, each anticonvulsant medication and drug monitoring test combination is counted as a unique event (i.e., a member on both phenytoin and valproic acid with at least a 180-days supply for each drug in the measurement year must separately show evidence of receiving drug serum concentration tests for each drug [Table MPM-E] to be considered numerator-compliant for each drug). Denominator: Members 18 years of age and older as of December 31 of the measurement year on anticonvulsants (phenobarbital, carbamazepine, phenytoin, divalproex sodium, valproic acid) -- defined as members who received at least a 180-days supply of ambulatory medication in the measurement year. | Administrative data, laboratory data, pharmacy data | process | NQMC |

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11	Access to Prescription Medicines composite measure: Parents of children with chronic conditions report how much of a problem they had in obtaining prescription medicine for their child and if a problem, whether anyone from their child's health plan, doctor's office, or clinic helped them with this problem. (CAHPS 3.0H Child Questionnaire)	Numerator: The number of "A big problem," "A small problem," and "Not a problem" responses on the "Access to Prescription Medicines" question regarding whether parents had a problem obtaining prescription medicine for their child and if a problem, the number of "Yes" and "No" responses to the question regarding whether anyone from their child's health plan, doctor's office, or clinic helped them with this problem (see the related "Numerator Inclusions/Exclusions" field in the Complete Summary); Denominator: Health plan members with chronic conditions 17 years and younger whose parent or guardian answered the "Access to Prescription Medicines" questions on the CAHPS 3.0H Child Questionnaire (see the "Description of Case Finding" and "Denominator Inclusions/Exclusions" fields in the Complete Summary)	Patient survey	patient experience, access	NQMC
F. Rehab to Primary Care					
12	Percentage of patients aged 65 years and older discharged from any inpatient facility (e.g., hospital, skilled nursing facility, or rehabilitation facility) and seen within 60 days following discharge in the office by the physician providing on-going care who had a reconciliation of the discharge medications with the current medication list in the outpatient medical record documented.	Numerator: Patients who had a reconciliation of the discharge medications with the current medication list in the outpatient medical record documented; Denominator: All patients aged 65 years and older discharged from any inpatient facility (e.g., hospital, skilled nursing facility, or rehabilitation facility) and seen within 60 days following discharge in the office by the physician providing on-going care	Administrative data, medical record	process	NQMC

#	Measure	Numerator/Denominator	Data Source	Type	Source
13	Percentage of separations for which there is an appropriate discharge plan for a patient (excluding deaths and those cases where a suspension of rehabilitation treatment leads to a care type change to acute care), during the 6 month time period.	Numerator: Total number of separations for which there is an appropriate discharge plan for a patient, during the 6 month time period; Denominator: Total number of separations, during the 6 month time period	Administrative data, medical record	process	NQMC
H. Hospital to Primary Care					
14	Percentage of patients, regardless of age, discharged from an inpatient facility to home or any other site of care for whom a written transition record was transmitted to the facility or primary physician or other health care professional designated for follow-up care on the day of discharge.	Numerator: Patients for whom a written transition record* was transmitted* to the facility or primary physician or other health care professional designated for follow-up care* on the day of discharge. Denominator: All patients, regardless of age, discharged from an inpatient facility (eg, hospital inpatient or observation, skilled nursing facility, or rehabilitation facility) to home/self care or any other site of care, excluding patients who expired or left AMA.	Administrative data	Tertiary Inpatient	PCPI Care Transition Measures, AMA
15	Percentage of patients, regardless of age, discharged from an inpatient facility to ambulatory care with a principal discharge diagnosis of heart failure, who were scheduled by the discharging facility for a follow-up visit with a physician OR advanced practice nurse OR physician assistant to take place within 7 days of discharge.	Numerator: Patients who were scheduled by the discharging facility for a follow-up visit with a physician OR advanced practice nurse OR physician assistant to take place within 7 days of discharge. Denominator: All patients, regardless of age, discharged from an inpatient facility (eg, hospital inpatient or observation, skilled nursing facility, or rehabilitation facility) to ambulatory care (home/self care) with a principal discharge diagnosis of heart failure, excluding patients who expired or left AMA.		Tertiary Inpatient	PCPI Care Transition Measures, AMA
16	Percentage of inpatients who have a discharge summary or letter, at the time of hospital discharge, during the 6 month time period.	Numerator: Total number of inpatients who have a discharge summary or letter, at the time of hospital discharge, during the 6 month time period; Denominator: Total number of inpatient separations, during the 6 month time period	Administrative data, medical record	process	NQMC

#	Measure	Numerator/Denominator	Data Source	Type	
17	Percentage of inpatients who have a final discharge summary recorded in the medical record within 2 weeks of hospital discharge, during the 6 month time period.	Numerator: Total number of inpatients who have a final discharge summary recorded in the medical record within 2 weeks of hospital discharge, during the 6 month time period; Denominator: Total number of inpatient separations, during the 6 month time period	Administrative data, medical record	process	NQMC
18	Documentation in the medical record that a Home Management Plan of Care (HMPC) document was given to the pediatric asthma patient/care giver. *This is a Joint Commission only measure.	Numerator: Pediatric asthma inpatients with documentation that they or their caregivers were given a written Home Management Plan of Care (HMPC) document that addresses all of the following: Arrangements for follow-up care Environmental control and control of other triggers Method and timing of rescue actions Use of controllers Use of relievers Include pediatric asthma inpatients discharged with a distinct or stand alone HMPC document that addresses the five specific topic areas above. Denominator: Pediatric asthma inpatients (age 2 years through 17 years) discharged home.	Administrative data, medical record	process	NQMC
I. Primary Care to Patient and Family					
19	Percentage of patients diagnosed and treated for bipolar disorder who are provided with education and information about their illness and treatment within 12 weeks of initiating treatment.	Numerator: Patients who receive education/information about bipolar disorder within 12 weeks of initiating treatment; Denominator: Patients diagnosed and treated for bipolar disorder.	Administrative data, medical record	process	NQMC

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#	Description	Numerator/Denominator	Source	Category	Reference
20	Family Centered Care ("Getting Needed Information") measure: parents or guardians of children with chronic conditions indicate how often their children's doctor or other health provider made it easy for them to get needed information regarding their child. Based on three questions in the CAHPS 3.0H Child Questionnaire.	Numerator: The number of "Never," "Sometimes," "Usually," or "Always" responses on the "Family Centered Care: Getting Needed Information" questions; Denominator: Health plan members with chronic conditions 17 years and younger whose parent or guardian answered the "Family Centered Care: Getting Needed Information" questions on the CAHPS 3.0H Child Questionnaire	Patient survey	patient experience, access	NQMC
21	Percentage of respondents who reported their experiences with shared decision-making for their children with chronic conditions".	Numerator: The number of health plan members from the denominator whose parents indicated "Yes" or "No" to the "Parents' Experiences with Shared Decision-making" questions; Denominator: Health plan members age 17 years and younger with chronic conditions (as determined by specific screening criteria included in the questionnaire) whose parents or guardians answered the "Parents' Experiences with Shared Decision-making" questions on the CAHPS 4.0 Health Plan Survey (Child Questionnaire)	Patient survey	patient experience, access	NQMC
K. Miscellaneous					
Hospital to Patient, 22	Care Transition: patient/family preferences	"The hospital staff took my preferences and those of my family or caregiver into account in deciding what my health care needs would be when I left the hospital."	Survey	Tertiary	CTM-3
Hospital to Patient, 23	Patient understanding of self-management plans upon discharge.	"When I left the hospital, I had a good understanding of the things I was responsible for in managing my health"	Survey	Tertiary	CTM-3
Hospital to Patient, 24	Patient understanding of need for medications.	"When I left the hospital, I clearly understood the purpose for taking each of my medications"	Survey	Tertiary	CTM-3

Hospital to Patient, 25	Care Transition at Hospital Discharge (Medication Reconciliation)	Numerator: Patients or their caregiver(s) who received a reconciled medication list at the time of discharge including, at a minimum, medications in the following categories:discontinued, continued, new. Denominator: All patients, regardless of age, discharged from an inpatient facility (eg, hospital inpatient or observation, skilled nursing, excluding patients who expired or left AMA.	Administrative data	Tertiary Inpatient	PCPI Care Transition Measures, AMA
Hospital to Patient,26	Percentage of patients, regardless of age, discharged from an inpatient facility to home or any other site of care, or their caregiver(s), who received a written transition record at the time of discharge including, at a minimum, all of the specified elements.	Numerator: reason for admission, major tests and procedures performed during stay, principal Dx at discharge, advance care plan, meds list, studies pending, contact info for phys, designee for follow-up care. Denominator: All patients, regardless of age, discharged from an inpatient facility (eg, hospital inpatient or observation, skilled nursing facility, or rehabilitation facility) to home/self care or any other site of care excluding patients who expired or left AMA.	Administrative data	Tertiary Inpatient	PCPI Care Transition Measures, AMA
Hospital to Patient, 27	Percentage of patients, regardless of age, discharged from an emergency department (ED) to ambulatory care, or their caregiver(s), who received a written transition record at the time of ED discharge including, at a minimum, all of the specified elements.	Numerator: Patients or their caregiver(s) who received a written transition record at the time of emergency department (ED) discharge including, at a minimum, all of the following elements: reason for ED visit, major procedures and tests performed in ED, principal Dx at discharge, ot instructions including plan and follow-up care, phys designee for follow-up care, list of meds. Denominator: All patients, regardless of age, discharged from an emergency department (ED) to ambulatory care (home/self care) excluding patients who expire or left AMA	Administrative data	Tertiary ED	PCPI Care Transition Measures, AMA

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Within hospital, 28	This measure is used to assess the percentage of patients (regardless of age) with an emergency department diagnosis of ST-elevation myocardial infarction (STEMI) or new left bundle branch block (LBBB) on 12-lead electrocardiogram (ECG) who received primary percutaneous coronary intervention (PCI) who had documentation that the emergency physician initiated communication with the cardiology intervention service within 10 minutes of the diagnostic 12-lead ECG.	Numerator: Patients with documentation that the emergency physician initiated communication with the cardiology intervention service within 10 minutes of the diagnostic 12-lead electrocardiogram (ECG); Denominator: All patients (regardless of age) with an emergency department (ED) diagnosis of ST-elevation myocardial infarction (STEMI) or new left bundle branch block (LBBB) on 12-lead electrocardiogram (ECG) who receive primary percutaneous coronary intervention (PCI)	Administrative data, patient survey	Inpatient care, emergency	NQMC
Within Rehab, 29	Percentage of patients admitted to a rehabilitation unit/facility with a documented established multidisciplinary rehabilitation plan within 7 days of patient admission.	Numerator: Total number of patients admitted to a rehabilitation unit/facility for whom there is a documented established multidisciplinary rehabilitation plan within 7 days of patient admission, during the 6 month time period; Denominator: Total number of patients admitted to a rehabilitation unit/facility with a minimum length of stay of 7 days, during the 6 month time period	Administrative data, medical record	process	NQMC
Oncology to Radiology, 30	Percentage of patients with squamous cell carcinoma (SCC) of the oral cavity, oropharynx, hypopharynx and larynx who wait longer than 6 weeks from their definitive surgery to commencing their radiotherapy, during the 6 month time period.	Numerator: Total number of patients with squamous cell carcinoma (SCC) of the oral cavity, oropharynx, hypopharynx and larynx who wait longer than 6 weeks from their definitive surgery to commencing their radiotherapy, during the 6 month time period Denominator: Total number of patients receiving post-operative radiotherapy for squamous cell carcinoma (SCC) of the oral cavity, oropharynx, hypopharynx and larynx, during the 6 month time period	Administrative data, medical record	Process, access	NQMC

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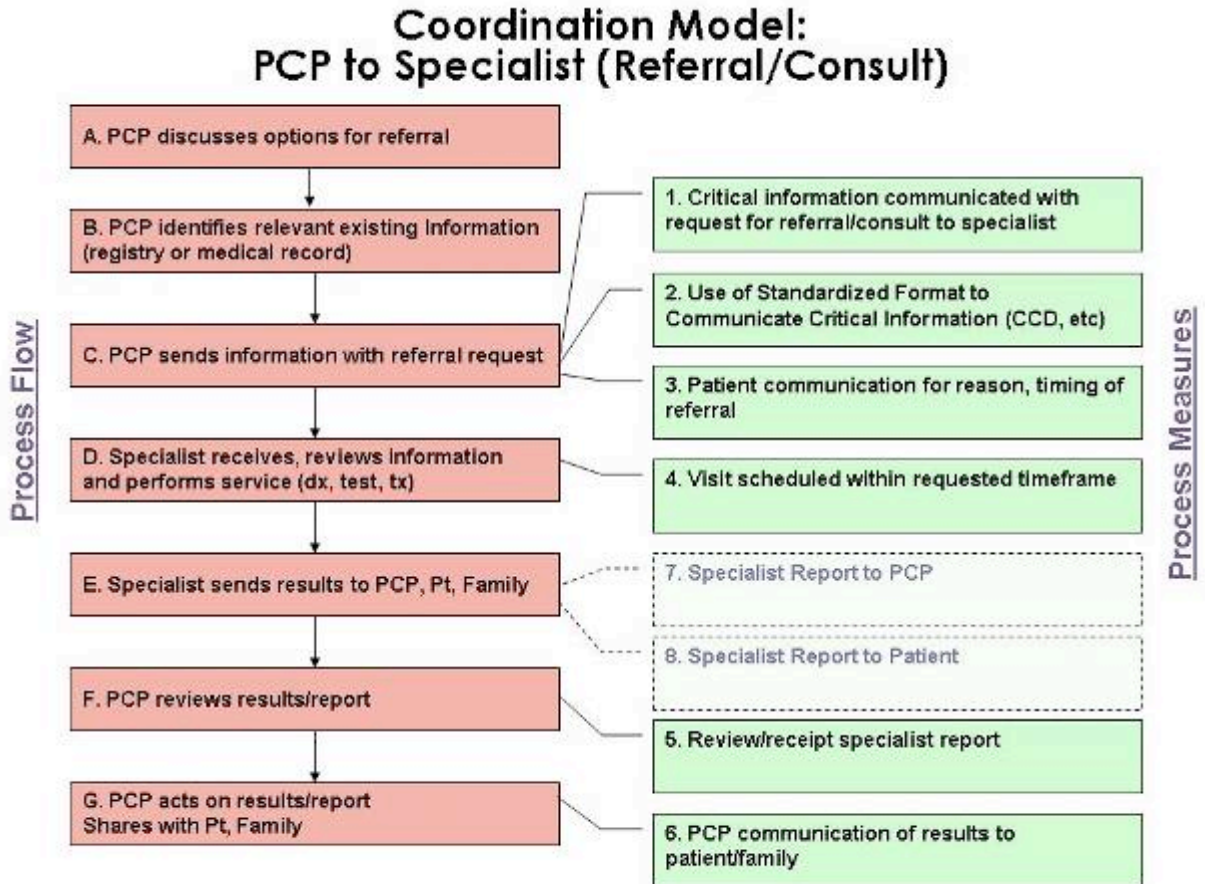|	Description	Numerator/Denominator	Data source	Type	
Hospital to MH follow-up, 31	Percentage of discharges for members 6 years of age and older who were hospitalized for treatment of selected mental health disorders and who had an outpatient visit, an intensive outpatient encounter, or partial hospitalization with a mental health practitioner within 30 days of discharge.	Numerator: An outpatient visit, intensive outpatient encounter, or partial hospitalization with a mental health practitioner within 30 days after discharge; Denominator: Members 6 years of age and older discharged alive from an acute inpatient setting (including acute care psychiatric facilities) with a principal mental health diagnosis on or between January 1 and December 1 of the measurement year.	Administrative data	process	NQMC
Hospital to MH follow-up, 32	Percentage of discharges for members 6 years of age and older who were hospitalized for treatment of selected mental health disorders and who had an outpatient visit, an intensive outpatient encounter, or partial hospitalization with a mental health practitioner within 7 days of discharge.	Numerator: An outpatient visit, intensive outpatient encounter, or partial hospitalization with a mental health practitioner within 7 days after discharge. Include outpatient visits, intensive outpatient encounters or partial hospitalizations that occur on the date of discharge. Denominator: Members 6 years of age and older discharged alive from an acute inpatient setting (including acute care psychiatric facilities) with a principal mental health diagnosis on or between January 1 and December 1 of the measurement year.	administrative data	process	NQMC
Continuity, 33	Percentage of enrolled members who turned 15 months old during the measurement year who had the following number of well-child visit with a primary care practitioner (PCP) during their first 15 months of life.	Numerator: Seven separate numerators are calculated, corresponding to the number of members who received zero, one, two, three, four, five, six or more well-child visits with a primary care practitioner (PCP) during their first 15 months of life; Denominator: Enrolled members who turned 15 months old during the measurement year	Administrative data	Process, access	NQMC
Continuity, 34	Percentage of patients diagnosed and treated for bipolar disorder who are monitored for change in their symptom complex within 12 weeks of initiating treatment.	Numerator: Patients who were assessed for change in their symptom complex, using a validated tool or a monitoring form, within 12 weeks of initiating treatment for bipolar disorder; Denominator: Patients diagnosed and treated for bipolar disorder	Administrative data, medical record	process	NQMC

Continuity, 35	Presence of complete register of patients in need of palliative care/support for practice.	Numerator: The practice has a complete register available of patients in need of palliative care/support. Denominator: Practices whose patient population includes individuals who are in need of palliative care/support (one practice at a time).	Registry data	structure	NQMC
Continuity, 36	Percent of patients beginning a new episode of treatment for substance use disorder (SUD) who maintain continuous treatment involvement for at least 90 days after the qualifying date.	Numerator: Veterans beginning treatment for substance use disorder (SUD) who maintain continuous treatment involvement for at least 90 days as demonstrated by at least 2 days with visits every 30 days for a total of 90 days in any of the outpatient specialty SUD clinics (see the related "Numerator Inclusions/Exclusions" field in the Complete Summary) Denominator: Veterans beginning specialty treatment for substance use disorder (SUD)* Note: Universe includes all veterans with an SUD outpatient encounter or inpatient discharge from a SUD specialty bed section in Veterans Health Administration (VHA).	Administrative data, medical record	process	NQMC
Continuity, 37	Percentage of patients with an established diagnosis of rheumatoid arthritis (RA) whose RA is evaluated by a physician at least annually.	Numerator: Patients whose rheumatoid arthritis is evaluated by a physician at least annually; Denominator: Patients with an established diagnosis of rheumatoid arthritis	Administrative data, medical record	process	NQMC
Continuity, 38	Mental health inpatient: Percentage of inpatients who have a multidisciplinary review recorded every 3 months, during the 6 month time period.	Numerator: Total number of inpatients who have a multidisciplinary review recorded every 3 months, during the 6 month time period; Denominator: Total number of inpatients with a stay greater than 3 months, during the 6 month time period	Administrative data, medical record	process	NQMC
Continuity, 39	Percentage of patients with a current diagnosis of melanoma or a history of melanoma who were entered into a recall system with the date for the next complete physical skin exam specified, at least once within the 12 month reporting period.	Numerator: Patients entered into a recall system with the target date for the next complete physical skin exam specified, at least once within the 12 month reporting period; Denominator: All patients with a current diagnosis of melanoma or a history of melanoma.	Administrative data, medical record	process	NQMC

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Continuity, 40	Percentage of members who were three to six years old during the measurement year who received one or more well-child visits with a primary care practitioner during the measurement year.	Numerator: At least one well-child visit with a primary care practitioner (PCP) during the measurement year; Denominator: Members age three to six years old as of December 31 of the measurement year	Administrative data	process, access	NQMC

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APPENDIX III. CONCEPTUAL FRAMEWORKS
AND DRAFT MEASURE CONCEPTS

Exhibit A2. Care Coordination Process Flow Model (Final Version)

Coordination Model:
PCP to Specialist (Referral/Consult)

Process Flow

A. PCP discusses options for referral

B. PCP identifies relevant existing Information (registry or medical record)

C. PCP sends information with referral request

D. Specialist receives, reviews information and performs service (dx, test, tx)

E. Specialist sends results to PCP, Pt, Family

F. PCP reviews results/report

G. PCP acts on results/report Shares with Pt, Family

Process Measures

1. Critical information communicated with request for referral/consult to specialist

2. Use of Standardized Format to Communicate Critical Information (CCD, etc)

3. Patient communication for reason, timing of referral

4. Visit scheduled within requested timeframe

7. Specialist Report to PCP

8. Specialist Report to Patient

5. Review/receipt specialist report

6. PCP communication of results to patient/family

APPENDIX IV. CARE COORDINATION ADVISORY PANEL

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APPENDIX V. WAVE 3 SITE VISIT FINDINGS: IMPLICATION OF DATA AVAILABILITY AND ACCESS ON MEASURE IMPLEMENTATION

Denominator. The denominator for all developed measures requires data on age, whether the patient was referred (yes or no), and whether the referral came from the PCP or the patient. Of these, age and whether patient was referred can be captured electronically at all EHR sites, although not necessarily in structured format. In terms of data needed to determine exclusions from the denominator (referral source), not all EHR sites collect data electronically on whether the referral was from the patient or the PCP. Furthermore, data are not consistently documented and may be in unstructured form, making the identification of exclusions based on self-referrals challenging. The lack of this data in some systems, even those with EHRs, poses immediate implementation challenges for all measures. To better support the implementation of all measures, especially if they are to be reported by EHRs, a structured field or code for referral source must be added to all EHR systems.

 Measure 1. Critical Information Shared with Specialist. To calculate the numerator for this measure, six data elements (Exhibit A3) are required. These data elements are available in the charts at all or nearly all of the sites we visited (Exhibit A3). However, electronic capture of these data is difficult within existing systems. Data elements on activity requested and reason for referral are often not differentiated. Furthermore, while some EHR systems have fields for this information, often they are in free-text format. Sometimes links to ICD-9 codes or pick lists are available, but this isn't universally done. As for preferred timing, the data are not always structured. Even when coded data is available, there is no consistent definition or interpretation of these terms by organization or clinical staff. For the data elements on the problem list, medication list, and medical history, information exchange for internal referrals (or when outside providers have access privileges to the system) occurs through EHR system access by either physician. This information is often included as part of a chart summary and/or can be attached to a referral in both paper-based and EHR systems. Finally, the frequency of regular recording of these was quite low and primarily done within the IDS sites. Very few of these elements were currently being electronically abstracted. Given the availability of required data in nearly all sites, this measure appears ready for implementation in both paper-based and EHR-based practices. However, the measure will require manual abstraction from the record. This measure is not capable of being reported through EHRs. To do so, strategies to produce structured data are needed, documentation practices must be improved, and a data abstraction process put into place.

Measure 2. PCP Communication with Patient About Referral. The elements required to calculate the numerator of this measure are: 1) reason for referral given to patient; 2) name of specialist given to patient; and 3) time frame given to patient. Fewer of the sites have these data elements currently documented in the charts. Few systems track whether the patient has received information on the reason for referral and the name of specialists, although this information may be included in the referral form that is sent or given to the patient. The specialist the patient is being sent to may be identified as an individual physician or a practice. The time frame for referral is rarely provided to patients, although appointments can be made for the patient if the referral is urgent. In general, these data elements are not found in structured data format, often appearing only on the referral form to the patient. Finally, these elements were not regularly recorded nor abstracted electronically. Based on these findings, better data capture is needed before this measure can be implemented in either paper-based or EHR-based practices.

Measures 3. Specialist Sent Report to PCP; and Measure 4. Specialist Communication Results to Patient/Family. These specialist measures were developed to complete the measure set for referral coordination. However, they were not developed in time to be included for evaluation during the site visits.

Measure 5. Primary Care Clinician Receipt and Review of Specialist Report. The numerator of this measure requires only one data element: whether specialist report was received/viewed by the PCP. Reports may be faxed in, sent in temporary messages, or delivered into the PCP's electronic inbox. Referral reports may also be scanned into the system and attached to the patient's EHR. All sites have data on when a physician had reviewed the specialist report, either through time stamps and signatures in electronic systems or by a check-box or physician signatures in the paper-based practice. Many sites regularly recorded this data element. However, few of the data are in structured format and even fewer sites abstracted the data to a database. These findings indicate that this measure can be implemented through manual chart abstraction in both paper and EHR-based practice settings. However, this measure is not currently reportable through the EHR.

Exhibit A3. Data Elements Required for Each Measure

Data Element	Measure 1 Critical Information	Measure 2 PCP Communicates with Patient	Measure 3 Specialist Sends Report to PCP	Measure 4 Specialist Communicates with Patient/Family	Measure 5 PCP Receipt/ Review
Age	D	D	D	D	D
Patient referred (y/n)	D	D	D	D	D
Referral source (PCP vs self-referral)	D	D	D	D	D
Activity requested in referral	N				
Reason for referral in referral	N				
Preferred timing in referral	N				
Problem list in referral	N				
Medication list in referral	N				
Medical history in referral	N				
Reason for referral given to patient		N			
Name of specialist given to patient		N			
Time frame given to patient		N			
Date of visit where patient referred					
Scheduled date of appointment with specialist					
Actual date of appointment with specialist					
Visit with specialist occurred (y/n)					
Specialist report received by PCP			N		N
Specialist report received by patient				N	

D = element required for denominator; N = element required for numerator.