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TECHNICAL REPORT

Developing a Framework for Establishing Clinical Decision Support Meaningful Use Objectives for Clinical Specialties

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HEALTH

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SUMMARY

Information technology has the potential to transform health care in the United States (President's Council of Advisors on Science and Technology, 2010). The automation of patient data—through electronic health records (EHRs)—is central to many health information technology applications (Institute of Medicine, 2001). One such EHR-enabled application is clinical decision support (CDS), which provides critical information and prompts at key points in clinical workflows to address clinical delivery failures that produce gaps in care. Various studies have demonstrated that CDS can influence clinical practice by helping clinicians improve diagnosis (Gorry and Barnett, 1968; Shortliffe et al., 1975; Berner et al., 1999; Friedman et al., 1999; Samore et al., 2005; Graber and Mathew, 2008; Elkin et al., 2010), improve quality and patient safety (Institute of Medicine, 2006; Hunt et al., 1998; Bates, Pappius, et al., 1999; Kuperman, Teich, et al., 2001; Garg et al., 2005; Kawamoto et al., 2005; Schedlbauer et al., 2009; Amarasingham et al., 2009; Jaspers, 2011), adhere to guidelines for prevention and treatment (McDonald and Overhage, 1994; Overhage et al., 1997; Maviglia et al., 2003; Sintchenko et al., 2004; Eslami, Abu-Hanna, and Keizer, 2007; Pearson et al., 2009; Shojania et al., 2009), and avoid medication errors (Bates, Teich, et al., 1999; Teich et al., 2000; Bates, Cohen, et al., 2001; Kaushal, Shojania, and Bates, 2003; Kuperman, Bobb, et al., 2007; Kaushal, Kern, et al., 2010). The Health Information Technology for Economic and Clinical Health (HITECH) Act (Pub. L. 111-5, 2009), authorized the Centers for Medicare and Medicaid Services (CMS) to provide incentive payments to eligible providers who successfully demonstrate meaningful use of EHRs (Blumenthal and Tavenner, 2010). In the notice of proposed rule making (NPRM) that proposed specific meaningful use (MU) requirements for stage 1 of the EHR Incentive Program, providers would have been required to implement five CDS rules relevant to their specialty or considered high clinical priority, along with the ability to track compliance with those rules. The proposed rule anticipated that implementing CDS interventions was likely to improve performance as reflected by results of quality measures included in stage 1 MU requirements. However, in response to comments from providers who raised concerns about the availability of CDS interventions relevant to their top priorities for improvement and to the MU quality measures most relevant to their hospital or practice, the final MU objectives required each hospital or eligible professional provider to implement only one CDS rule (CMS, 2009). Moving into future stages of MU requirements, the Office of National Coordinator for Health Information Technology (ONC) has signaled strong interest in identifying CDS objectives that are *clinically*

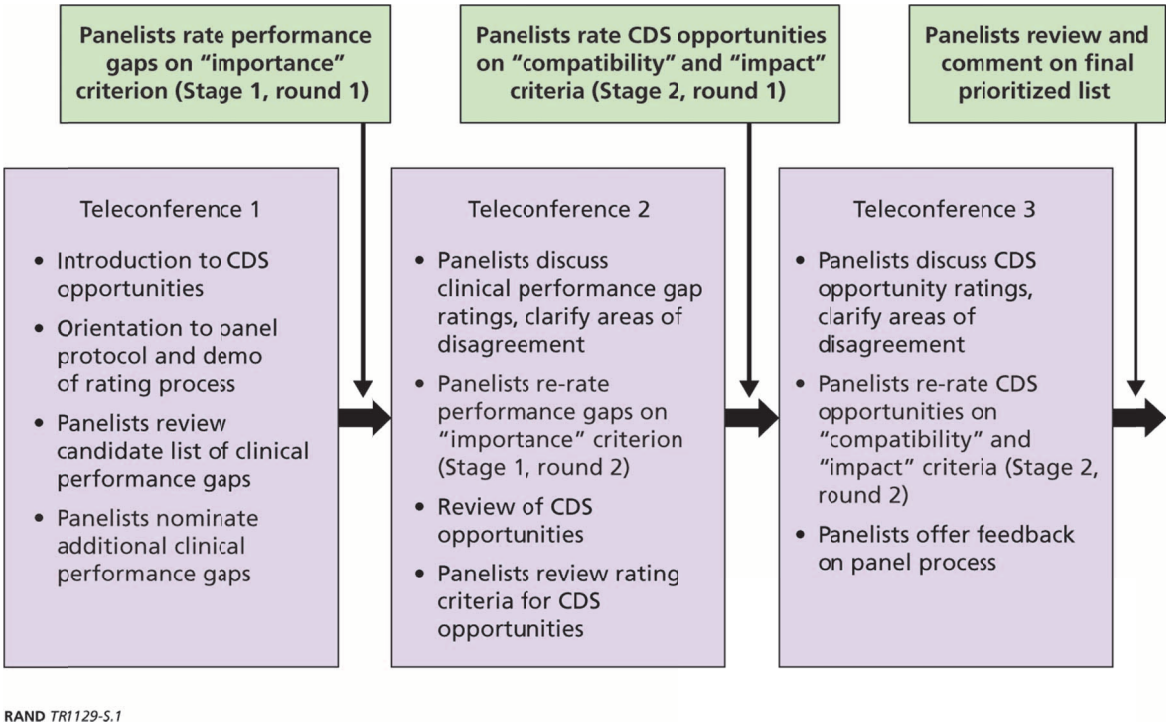
relevant and meaningful to a variety of clinical specialties and that are *implementable and measurable*.

A central question is how to identify high-priority targets for CDS for different clinical specialties to inform the selection and prioritization of national CDS MU objectives and to guide EHR vendors in developing tools. Although a variety of approaches could be devised, any process to define high-priority, specialty-specific CDS targets should include the following core elements:

- a systematic, evidence-based process to prioritize the clinical performance gaps within each specialty
- an evaluation of existing CDS tools or opportunities for CDS tool development that might address the prioritized gaps
- a rigorous process for eliciting expert feedback to prioritize performance gaps and associated CDS opportunities.

The approach we devised incorporates these three core elements in its design and provides a flexible protocol that can be used to elicit from any group of specialists the *high-priority clinical performance gaps* for the specialty and potential *CDS opportunities* for closing those gaps. Clinical performance gaps represent potential targets for CDS; however, these gaps affect population health to different degrees, and not all targets will be amenable to CDS if existing tools are either ineffective or incompatible with clinical workflows. Workflow and process must be considered when selecting and designing CDS interventions. Our protocol solicits ratings from experts on multiple dimensions to provide a consensus set of CDS targets. This report describes the development and testing of that protocol. The protocol involved a two-stage modified Delphi expert panel rating process, illustrated in Figure S.1. The first stage identified high-priority performance gaps based on expert ratings of each gap's importance to patient care within the specialty. Within stage 1, panelists engaged in two rounds of rating of candidate performance gaps. In the second stage, panelists rated (in two rounds of rating) the potential impact and compatibility of CDS opportunities for addressing each performance gap that was rated as *important* in the first stage. In assessing *compatibility*, panelists were instructed to consider the average clinical practice rather than their own practice and the extent to which the tool could be inserted in any workflow (i.e., either as currently designed or redesigned).

Figure S.1. Expert Panel Protocol



For each performance gap, panelists rated between two and four descriptions of specific example CDS opportunities (both existing CDS tools and hypothetical interventions) that might close the gap. They also provided an overall rating of the *collection* of CDS opportunities to address the gap, including both CDS opportunities embodied in the specific examples prepared in advance of the panel and any other opportunities envisioned by each panelist. *High-priority CDS targets* were defined as the clinical performance gaps that the panel rated as highly important and as having CDS opportunities that would have a high impact on closing the performance gap and that were compatible with clinical workflows (either as currently configured or as redesigned).

Four specialties were selected to pilot test the protocol: one medical specialty (oncology), one surgical specialty (orthopedic surgery), one nonsurgical procedural specialty (interventional cardiology), and one primary care specialty (pediatrics). Each panel successfully completed the two-stage rating process and compiled a prioritized list of CDS targets. Table S.1 shows the number of experts who began the panel process and the number of experts who completed all rating cycles.

Table S.1. Participation in Each Specialty Expert Panel

Panel	Number of Panelists Who Started the Panel Process	Number of Panelists Who Completed the Panel Process
Oncology	14	12
Orthopedics	20	17
PCI	15	13
Pediatrics	15	12

NOTE: *Completion* means that panelists completed both rounds of ratings in each of the two steps of our rating protocol. PCI = percutaneous coronary intervention.

Across the four panels, the first stage of ratings produced between six and 15 performance gaps for which panelists agreed that the gap was *highly important* for their specialty (median rating 7–9, on a scale of 1–9 with 1 being low importance and 9 being high importance). In the second stage of ratings, between three and 14 of the highly important gaps emerged as high-priority CDS targets, based on panel agreement that CDS would significantly impact the performance gap and would be compatible with workflows in their specialty. In generating overall CDS opportunity ratings, the expert panels considered from 16 to 44 specific example CDS opportunities. Among these, the panels rated between four and 31 as having both high potential impact and being highly compatible with workflow (see Table S.2). Although these individual CDS opportunities would, in most cases, be too specific for constructing CDS MU objectives, they are provided to help guide future CDS development by vendors.

Table S.2. Overall Summary of Panel Ratings

Panel	CDS Targets Considered	CDS Targets Rated High Priority	Individual CDS Opportunities Considered	Individual CDS Opportunities Rated High Priority
Oncology	15	14	44	31
Orthopedics	6	3	16	4
PCI	11	4	34	11
Pediatrics	11	3	35	10

NOTE: High-priority CDS targets were the performance gaps rated as highly *important* and as having CDS opportunities that could have a high *impact on closing the performance gap* and are *compatible with clinical workflow*. Each potential target was presented as the performance gap statement paired with example CDS opportunities.

Table S.3 summarizes for each of the four specialty panels, the high-priority CDS targets, and individual CDS opportunities that our panels rated highly and with agreement on the dimensions of impact and compatibility with workflow. The rating results at this more granular level could be useful for EHR vendors considering what types of CDS opportunities practitioners rated highest and viewed as potentially helpful in addressing high-priority performance gaps.

Table S.3(a). Summary of High-Priority Clinical Decision Support Targets by Specialty Panel: Oncology Panel

High-Priority CDS Targets	Highly Rated Example CDS Opportunities for This Target
Many patients receiving chemotherapy are at risk of experiencing adverse events due to errors in chemotherapy ordering.	Smart ordering forms that help reduce errors Alert at time of ordering or infusion if chemotherapy orders differ from accepted standards
Cancer patients often have poorly documented information on staging.	Cancer-specific documentation template that supports accurate staging for the type of cancer Info button to check latest staging criteria at the time that cancer diagnoses are being entered
Patients undergoing chemotherapy often fail to have a current care plan documented.	Pathway based on standard multicycle regimens with order sets and appropriate refinements for each step Smart form for chemotherapy that prompts documentation of current care plan and reasons for deviation from previous plan Timeline display of prior adverse reactions and therapy adjustments that should inform current care plan
Prescribed chemotherapy regimens are not always concordant with standard regimens (as defined by evidence or consensus groups).	Order tool for cancer-specific chemotherapy regimens (including combinations and specific doses) that are consistent with local standards and that allow overrides Documentation template for explaining deviation from standard regimen at the time of ordering Alert at time of ordering or infusion if chemotherapy plan differs from accepted standards
Many patients undergoing chemotherapy do not receive supportive care therapies, including potent antiemetic therapy and granulocyte-colony stimulating factor.	Order sets for chemotherapy regimens that include recommended antiemetic and other supportive care therapies.
Patients are often unaware of the risks and benefits of chemotherapy, and their understanding of the treatment's intent (palliative versus curative) is often inadequately documented.	Display inputs to and results from predictive models of treatment benefit at time of chemotherapy decisionmaking
Many patients who begin treatment with oral antineoplastic therapies (e.g., tamoxifen, aromatase inhibitors) do not receive treatment for the recommended duration.	Alert for low adherence based on medication utilization data
Among patients of reproductive age, infertility risks and fertility preservation options are inadequately discussed prior to chemotherapy.	Treatment plan suggestions in accordance with patient's documented fertility preferences
Many breast cancer patients who are candidates for trastuzumab do not receive the therapy, and patients who receive the therapy are not always followed for possible safety problems.	Breast cancer order set that searches for a patient's HER2+ status (or queries provider for it) Alert if left ventricular EF assessment has not been conducted on schedule or is trending unfavorably for patients receiving trastuzumab
Following curative resection, cancer patients do not always receive adequate surveillance or testing.	Automatically generated, diagnosis specific follow-up order sets Automated generation of cancer-specific survivorship care plan that includes all necessary tests (and responsible physician) that can be shared with patients
Chemotherapy and radiotherapy treatment summaries are not always fully documented or provided to patients or physicians providing continuing care.	Documentation template for treatment summary that includes content required by CCHIT that can be transmitted electronically (to physicians) or in hard copy (to patients) Patient-specific treatment summary automatically generated with order entry
Patients started on long-acting opioids do not always receive short-acting opioid formulations for breakthrough pain, and patients receiving chronic opioids do not always receive bowel regimens.	Order sets for long-acting or chronic opioid therapy that include appropriate medications required for breakthrough pain and bowels Distinct pain management display accessible by nurses and physicians that highlights missing orders and graphically charts patient's recent pain history

High-Priority CDS Targets	Highly Rated Example CDS Opportunities for This Target
The presence of pain and its intensity are inadequately assessed or quantified in cancer patients receiving chemotherapy or radiation therapy, and pain management plans are not routinely documented.	Display cancer pain history with intensity levels and current and prior treatments for pain Order set for cancer pain medication that results in a comprehensive management plan Pathway to guide initial selection of pain medication and to guide escalation of therapy when required Reminders to assess and to quantify pain at appropriate moments in workflow
Many cancer patients receive chemotherapy within the last two weeks of life, and many patients do not have discussions with their providers about hospice or palliative care within the last two months of life.	EHR smart form for patient's end-of-life preferences and performance status assessment Palliative care order sets, including recommended therapies Reminder to assess and document end-of-life care preferences triggered by data on performance status
Many patients do not undergo KRAS mutation testing before initiating anti-EGFR therapy.	Order set for anti-EGFR therapy that checks KRAS test result or requires input of test result Reminder to conduct KRAS test triggered by order for anti-EGFR therapy

NOTE: HER2 = human epidermal growth factor receptor 2; HER2+ indicates that the cancer tests positive for this protein. EF = ejection fraction. CCHIT = Certification Commission for Health Information Technology. KRAS = Kirsten rat sarcoma. EGFR = epidermal growth factor receptor.

Table S.3(b). Summary of High-Priority Clinical Decision Support Targets by Specialty Panel: Orthopedics Panel

High-Priority CDS Targets	Highly Rated Example CDS Opportunities for This Target
Patients are not always assessed preoperatively for their bleeding and VTE risks, resulting in prophylaxis that does not match the patient's risk.	Smart form that captures bleeding and VTE risk factors and recommends a prophylaxis strategy in accordance with guidelines
Patients undergoing total hip or total knee replacement surgery may not receive VTE prophylaxis when it is indicated.	Order set for VTE prophylaxis that recommends treatment customized to patient's bleeding risk and that conforms to guidelines
Patients who undergo total hip or total knee replacement surgery may not receive certain necessary preoperative tests, while others may undergo unnecessary testing.	Preoperative order set that includes recommended preoperative tests based on a patient's medical history and review of systems
Many patients who undergo surgery for hip fracture fail to receive follow-up risk assessment and therapy to prevent future osteoporotic fractures.	Smart form that captures risk factors for subsequent fractures and recommends orders for tests or treatments or both based on results
Antibiotic prophylaxis recommendations for the National Surgical Infection Prevention project and the American Academy of Orthopedic Surgeons may not be consistently followed for patients undergoing total hip or total knee replacement surgery.	Order set that recommends guideline-based antibiotic treatment customized to patient characteristics Reminder to stop antibiotic administration at the appropriate time prior to surgery

NOTE: VTE = venous thromboembolism.

Table S.3(c). Summary of High-Priority Clinical Decision Support Targets by Specialty Panel: Pediatrics Panel

High-Priority CDS Targets	Highly Rated Example CDS Opportunities for This Target
Children and adolescents fail to receive all recommended immunizations.	Display immunization history and highlight missing immunizations Tool to facilitate scheduling of immunizations according to recommended sequence and timing Alert for missing immunizations, with link to order set
Children with asthma are not routinely monitored for control of their condition.	Pathway to guide dose escalation or medication substitution
Children with ADHD who initiate medications may not receive optimal dose titration.	Smart form for ADHD encounter that captures changes in symptoms and medication side effects and recommends options for dose titration
Diagnosis of ADHD is often made without adequate documentation of DSM-IV or DSM-PC criteria.	Diagnostic assessment template for ADHD that includes all DSM-IV criteria Reminder to document DSM criteria triggered by new diagnosis of ADHD
Many sexually active adolescent women do not receive periodic chlamydia screening.	Order form that includes chlamydia test as part of routine screening tests based on patient's age and sexual history Reminder to conduct yearly chlamydia screening on patients who report being sexually active
Children with ADHD who are in the maintenance phase of medication therapy often receive inadequate follow-up care to reassess behavioral symptoms.	Tool that automatically develops a care plan (including dose titration) over multiple visits

NOTE: ADHD = attention deficit hyperactivity disorder. DSM-IV = Diagnostic and Statistical Manual of Mental Disorders, 4th Edition. DSM-PC = Diagnostic and Statistical Manual for Primary Care.

Table S.3(d). Summary of High-Priority Clinical Decision Support Targets by Specialty Panel: PCI Panel

High-Priority CDS Targets	Highly Rated Example CDS Opportunities for This Target
Nearly half of patients with STEMI receive no reperfusion therapy or receive delayed reperfusion (>12 hours after onset).	Alert to inform ED physician and staff of possible ACS diagnosis triggered by abnormal biomarkers Display ECG data, TIMI/GRACE scores, and likely time of symptom onset
Many patients undergoing PCI are not prescribed statins at discharge despite having no contraindications.	Order set that includes statins along with other medications commonly prescribed at discharge from the catheterization laboratory Reminder followed by alert to prescribe statin prior to discharge if not yet ordered
Many patients discontinue clopidogrel therapy within six months of DES implantation (12 months of continuous therapy are recommended).	Alert if prescriptions not refilled within expected window
Many high-risk patients with non-STEMI fail to receive early invasive care, while many low-risk patients receive early invasive care unnecessarily.	Display TIMI or GRACE risk scores and other clinical data that facilitate triage
Wide regional variation in rates of elective PCI suggests that some patients may not be appropriate candidates for elective PCI.	Order tool that requires input of data elements and returns appropriateness rating Display appropriateness rating or elements needed to determine appropriateness rating
The indications for PCI and stent selection (e.g., angina status, prior medical therapy, anatomical findings, flow) are often poorly documented.	Reminder to document indication for procedure or device prior to the procedure
Many STEMI patients who are candidates for thrombolysis receive the treatment outside of the recommended door-to-needle time (i.e., 30 minutes).	Thrombolysis order set for STEMI to guide physician through what is needed, how to administer, and what to monitor
Many patients undergoing PCI have limited understanding about the relative benefits and risks of the procedure.	Automated consent form that includes patient-specific benefit/risk data

NOTE: STEMI = ST segment elevation myocardial infarction. ED = emergency department. ACS = acute coronary syndrome. ECG = electrocardiogram. TIMI = thrombolysis in myocardial infarction. GRACE = Global Registry of Acute Coronary Events. DES = drug-eluting stent.

As panelists reviewed candidate CDS opportunities, there were some areas in which panelists noted an uncertain role for EHRs in resolving some performance gaps and the potential for EHR use to create more complexity. The panel process provides an opportunity for clinical experts to identify important workflow issues outside the scope of CDS that might be a function of structural problems that require addressing at an organizational level (e.g., training staff on how to perform a diagnostic test and interpret the results). This suggests that it would be important to discuss early in the process whether a clinical performance gap is amenable to CDS as a mechanism to close the gap. CDS is not always the answer to closing a performance gap; rather, workflow and clinical process may be the root of problem and require redesign to address the problem.

There were other important issues raised by the panelists as they considered the potential application of CDS to close high-priority clinical performance gaps. Some of the issues centered

on workflow and compatibility with currently configured workflows. A critical factor related to the success or failure of CDS implementation is an understanding of the unique aspects of workflow within specialty and for the clinical process identified. Workflow does vary by specialty, even for related processes. Additionally, the successful implementation of CDS, and health information technology (IT) more generally, likely requires the reevaluation and redesign of current workflows and processes. It might be challenging for panelists to see beyond their own workflows and consider alternatives to current workflow design as they consider potential CDS interventions. Therefore, background materials provided to panelists, including explanations of workflows and examples of workflow within the conditions, episodes, or procedures they were to consider, were designed to help panelists consider how and where CDS could be embedded into the workflow. Moreover, the panel composition should represent relevant care settings and consider differences across settings in incorporating CDS into the workflow.

Another key issue flagged by panelists was concern about CDS tools creating more work, rather than support. In various areas, physicians highlighted the tension between implementing tools that enhance care without increasing the workload and, in turn, the likelihood that the CDS tool would not be used. Successful implementation of CDS might require discussion and changes to existing workflow—for example, ensuring that the CDS intervention is targeted to the optimal person in the appropriate role. The Healthcare Information and Management Systems Society (HIMSS) "CDS Five Rights" highlights that effective CDS often involves changes to workflow to put the clinical information in the right hands at the right time (HIMSS, undated). Panelists also noted the potential for CDS to create too many false positives, which would lead to alert fatigue. Comments, such as these related to implementation and operational issues, can highlight shortcomings of EHR systems that could help vendors design CDS tools to be more useful to practicing clinicians.

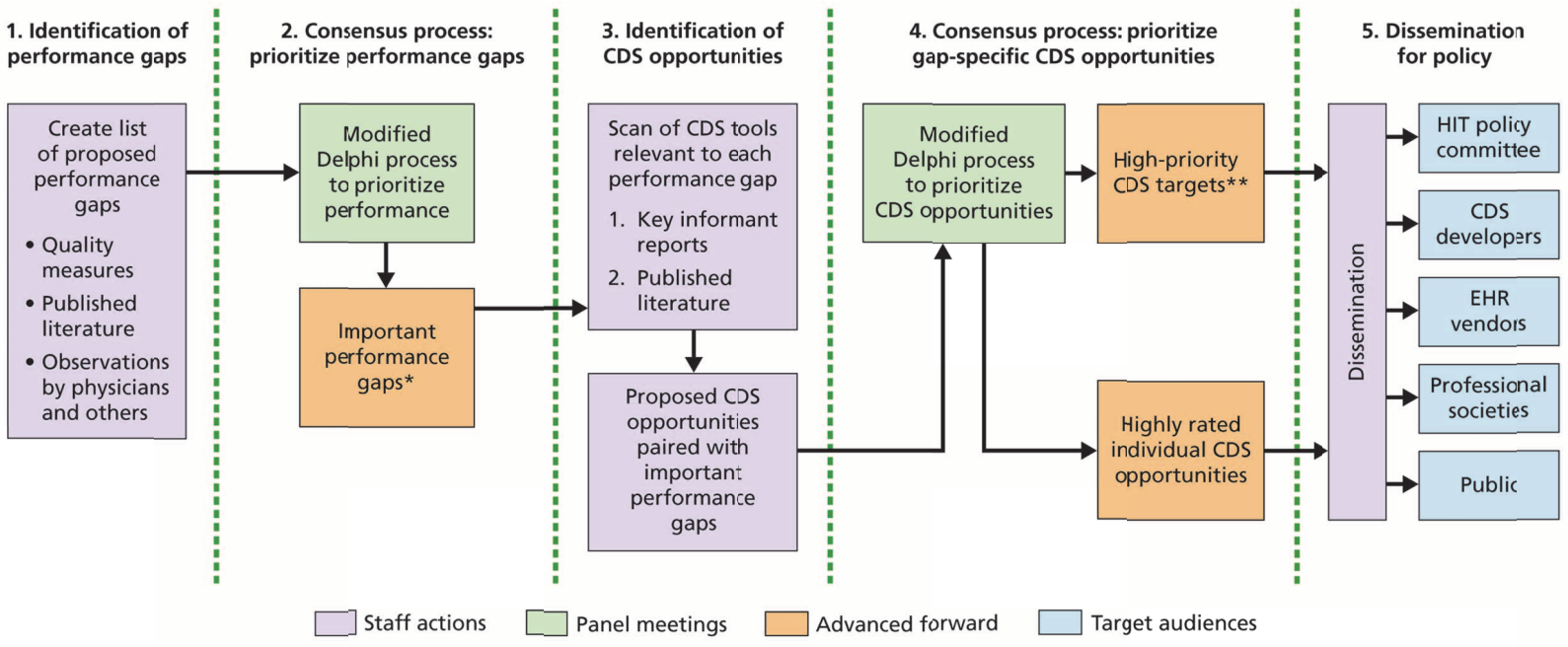
Panelists highlighted the lack of available standard order sets and the lack of support in some EHRs for order sets. During this discussion, panel members thought there would be potential for establishing a national clearinghouse for order sets from different sources to be shared to facilitate standardization.

Panelists felt that some performance gaps were inadequately specified as written (e.g., "comprehensive" radiologic evaluation, "metabolic derangement," and "postoperative hemorrhage") to allow the gap to be considered important. This issue could be better addressed at the front end of the panel process by ensuring adequate specificity when describing gaps and interventions.

Overall, the pilot testing demonstrated the successful use of a protocol that embodies a systematic, evidence-based expert consensus process to prioritize performance gaps that are

unique to individual specialties and that are likely to be amenable to CDS. The larger framework, of which the protocol is a key element, is illustrated in Figure S.2. The framework involves five phases: (1) identifying performance gaps, (2) implementing a consensus process to prioritize performance gaps, (3) identifying CDS opportunities, (4) implementing a consensus process to prioritize CDS opportunities associated with specific gaps, and (5) dissemination of high-priority CDS targets and individual CDS opportunities for policymaking and tool development. In each of these phases, the pilot testing identified areas that could result in a more robust process for eliciting high-priority CDS targets.

Figure S.2. Proposed Framework for Selecting High-Priority, Specialty-Specific Clinical Decision Support Targets



* Performance gaps rated with agreement as important targets for CDS; performance gaps not rated as important are dropped and do not move to CDS opportunity consideration.

** High-priority CDS targets are the performance gaps that were rated highly with agreement and that had high impact and compatible CDS opportunities; highly rated gaps without high impact and compatible CDS opportunities were dropped.

NOTE: HIT = health information technology.

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RECOMMENDATIONS FOR FUTURE SPECIALTY PANELS

Although the expert panel protocol that we constructed and tested is feasible and robust and produces quantitative and qualitative results that enhance the transparency of the expert panel process, we recommend the following additional actions for enhancing future specialty panels.

Composition of Expert Panels

- *Convene a multistakeholder "steering committee" with broad representation of potential end users to select the specialties, subspecialties, and clinical content topics to be addressed by future specialty panels.* In the pilot project, the selection of specialties and clinical topics was determined by the research team in consultation with ONC staff. However, this process should be guided by a broader set of perspectives for a variety of reasons. There are potentially hundreds of combinations of specialty and clinical topic combinations that could be used to form panels. Clearly, some of these combinations might yield greater benefit than others in terms of closing performance gaps. If population health improvement and costs of care are prominent considerations, the selection of panels should be informed by inclusion of government, public, and payer representatives and not just by specialty representatives. The most promising near-term opportunities for CDS development may be difficult to predict, so the steering committee should include experts with comprehensive knowledge of CDS development. It should also include experts in performance measurement who can assist in strategic planning for measurements that will be used to assess the impact of CDS on performance gaps in the future.
- *Create panels based on the intersection of four dimensions of interest: (1) specialties, (2) conditions, (3) treatments or procedures, (4) care delivery settings.* Any choice within one of these dimensions invariably constrains the others. For example, selecting knee pain as a condition could involve primary care, rheumatology, and orthopedic specialists. Choosing a knee pain panel comprised of orthopedic specialists could constrain the panel to consideration of arthroscopy, surgery, and rehabilitation. Each of these configurations will have implications for the types of performance gaps, CDS opportunities, and, ultimately, CDS objectives that can be generated.

Identification of Performance Gaps

- *In identifying the preliminary list of performance gaps, draw on population health and clinical delivery system gaps that may not yet be codified in performance measures.* Once the framework for identifying performance gaps has been defined, there are three important sources for identifying candidate performance gaps for the panel to consider: (1) quality measures (either nationally endorsed or locally implemented), (2) published literature (primarily epidemiology and health services research studies), and the (3) observations of practicing clinicians about gaps in care delivery. It seems desirable to ground the identification of performance gaps in the current set of nationally endorsed quality measures. However, this set typically comprises measures that can be implemented using administrative data and might not reflect gaps in care that can be assessed only through patient surveys, medical records, or other means. Important gaps in daily practice may be

ideal CDS targets but have not yet been specified as quality measures because of the lack of a data collection system.

- *Develop a method for querying practicing clinicians or their representative societies about performance gaps that have not yet been identified in peer-reviewed literature or reflected in nationally endorsed quality measures.* The experiences of practicing clinicians working on the front lines of care delivery are sometimes overlooked as a source of important clinical performance gaps. Astute clinicians can observe directly the processes of care that are prone to break down within a specialty practice, across teams of specialists, and across settings of care. They may also observe directly which processes of care are especially amenable to CDS interventions because of their knowledge of the workflow that produces high-quality services for patients with specific conditions. There is not as yet a straightforward process for obtaining this sort of feedback from clinicians. Not all physicians have the perspective or background to identify these gaps. Although members of the expert panels can also provide this feedback, they may not fully capture the diversity of perspectives within their specialty. A strategy for querying broadly to professional organizations might also be useful. Electronic surveys of practicing clinicians asking them to nominate clinical performance gaps that might be amenable to CDS may produce ideas for actionable CDS applications.

Identification of Clinical Decision Support Opportunities

- *Develop templates for describing CDS tools in a standardized format so that panelists are fully informed during discussion and rating tasks.* The portrayal of CDS tools may significantly influence panelists' ratings of those tools. CDS applications are complex, and many cannot be easily described in one or two sentences. A standard description of the key features of a CDS application and the evidence base that supports it may help to expedite the work of panelists and increase the validity and reliability of ratings of CDS opportunities.
- *Enhance panelist knowledge and consideration of clinical workflows before rating CDS opportunities.* The rating of CDS opportunities involves consideration of a variety of workflows and settings. Workflow engineering is not a typical expertise of most clinical specialists. It may be useful to insert a step that identifies the high-leverage workflow insertion points for CDS and presents those insertion points in a more highly structured manner or to include a workflow specialist on each panel. Additionally, the process could include some formal education of panelists in workflow analysis to help them assess CDS opportunities in a more informed manner. Alternatively, a small group of technical experts could evaluate the final list of CDS opportunities and targets and identify those that are most likely to be implemented in the short term.
- *Create opportunities for panelists and outside experts to nominate additional CDS opportunities for the candidate performance gap statements.* This could be done prior to the panel process by consulting with clinicians with expertise in the area of clinical practice and with knowledge of CDS, as well as during the panel process drawing on the panelists' expertise. Building in sufficient time prior to and during the panel process for broader input regarding candidate CDS opportunities for identified performance gaps would expand and strengthen the final set of CDS opportunities that panelists rate.

Use of Consensus Process to Prioritize Performance Gaps and Clinical Decision Support Opportunities

- *Consider convening separate panels to prioritize performance gaps and CDS opportunities.* Each of the panels we convened considered and rated clinical performance gaps and then considered and rated CDS opportunities associated with the list of high-priority gaps. It may be preferable to convene two separate panels—one that prioritizes performance gaps and can include broader specialty or stakeholder representation and a second panel that has technical expertise relevant to the prioritized subset of performance gaps that emerges from the first panel. This can ensure that relevant expertise is available to address specific conditions, cross-specialty, or setting-specific issues. Under this approach, the first panel could consider and rate performance gaps without being inhibited by the constraints of current systems, while the second panel could focus on what is feasible and achievable.
- *Allow adequate time within the modified Delphi process to enable thorough discussion of the performance gaps and CDS opportunities between rating tasks.* Methodological approaches developed for rating the appropriateness of care provides a transparent and rigorous basis for rating performance gaps and CDS opportunities. However, there are many nuances for panelists to consider in assessing performance gaps and significant complexity for panelists in assessing dozens of CDS opportunities. Thorough exchange between CDS experts and clinical practitioners appeared to identify CDS opportunities that might have little compatibility or impact in some specialty care settings. Allowing sufficient time for these discussions and opportunities to refine the specification of performance gaps and CDS tools will undoubtedly enhance the practical applicability (and hence the impact) of CDS. Panelists may also request additional evidence based on these discussions. Allowing more than one discussion period could enable panelists to consider additional evidence and strengthen the validity of subsequent ratings.