The State of Outcomes Measurement Among Epic EHR Users: A Descriptive Study

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Introduction

As technology has advanced over the years, the possibilities for improving health care through the effective use of information technology continue to expand. Although the U.S. health care system costs approximately $3 trillion per year (California Healthcare Foundation, 2014), offers unsatisfactory quality, and provides limited access to care (Porter & Teisberg, 2006), the health care system has not fully utilized the capabilities of information technology to address these problems.

Ultimately, the goal of health care is to provide maximum value for patients, which depends upon achieving better health outcomes while minimizing the cost of care. The value-based agenda is a framework for focusing on improving value for patients that include outcomes measurement and information technology as two key components (Porter & Teisberg, 2006). Outcomes measurement allows providers to measure and improve upon their performance, and information technology can enable the accurate measurement of both health outcomes and costs and facilitate provider collaboration by consolidating and recording patient data (Porter, 2010).

Electronic health record (EHR) systems represent a key component of health care information technology. An EHR is a “repository of electronically maintained information about an individual’s health status and health care” (Shortliff & Cimino, 2014, p. 391). When used correctly, EHRs can solve the problems of legibility, organization, and inaccessibility inherent to paper records. Barriers to EHR adoption include the lack of standards in clinical terminology, concerns about data privacy, and challenges associated with the integration of EHRs and other information sources (Shortliff & Cimino, 2014). In addition, designing a usable interface and determining users’ information needs also present challenges to EHR design (Shortliff & Cimino, 2014).

In recent years, as the EHR market has grown, a few vendors have come to dominate the market. Trends suggest that Epic, the largest EHR vendor, may replace other vendors and take over the marketplace, since over 50% of large hospitals purchasing new EHR systems are choosing Epic’s EpicCare Inpatient Clinical Systems (Koppel & Lehmann, 2014). Currently, 69% of HIMMS Stage 7 hospitals are Epic clients (Epic Systems, 2014). HIMMS Stage 7 represents the highest stage an organization can achieve, based on an EHR adoption model developed by the Healthcare Information and Management Systems Society (HIMMS).

In recent years, the government has encouraged hospitals and health care systems to move from paper systems to electronic medical records. The American Recovery and Reinvestment Act (ARRA) of 2009 incentivized health systems, hospitals, and providers to implement EHRs to meet a set of Meaningful Use criteria, setting aside $27 billion in incentives (Blumenthal & Tavenner, 2010). In order to achieve Meaningful Use and qualify for CMS incentive programs, providers much meet specific objectives set by the administration. Meaningful Use includes three stages, each of which build upon each other and focus on different uses for EHRs: (i) data capture and sharing; (ii) advancing clinical processes; and (iii) improved outcomes (HealtIT.gov, 2013).

However, Meaningful Use compliance does not necessarily mean that hospitals measure outcomes (Walters et al., 2014). Although the percentage of non-federal acute care hospitals adopting basic EHR systems has increased to 59.4% in 2013 (Charles, King, Patel, & Furukawa 2013), few providers collect patient outcomes. Only a few complex areas of care, such as transplant surgery, require...
Factors Influencing Outcomes Measurement

We evaluated both the status of outcomes measurement as well as factors influencing the implementation of EHRs for outcomes measurement for the health care organizations we researched. While some organizations (TCH, Stanford, and UCSF) have implemented outcomes measurement, they have only done so in certain departments. Other organizations are not measuring outcomes, and fall along a varied spectrum in terms of planning for outcomes measurement for the future. One organization (BSW) has begun discussions about outcomes measurement, but has not yet moved forward to implementation. Another organization (OHSU) has decided to focus on process measures and quality improvement, rather than outcomes measurement.

Tools for PRO Collection

The organizations measuring outcomes (TCH, Stanford, and UCSF) use a variety of mechanisms to collect PROs; while UCSF administers surveys to patients through MyChart, TCH and Stanford do not. At TCH, patients at the Voiding Dysfunction Clinic fill out a paper questionnaire, which nurses then enter into a Smart Form. In contrast, Stanford administers patient surveys online with computer adaptive testing (CAT), which MyChart currently does not support. CAT customizes surveys to survey participants based upon previous questions they have answered, thus minimizing survey fatigue (Forrest, 2012).

Data Extraction

All of the organizations measuring outcomes (TCH, Stanford, and UCSF) use additional software to extract data from Epic. UCSF also cited the difficulty in customizing reports from Epic as their reason for using another vendor to extract data. OHSU, which only uses Clarity for extracting data, uses data analysts to manually extract a lot of their data.

Factors Influencing Outcomes Measurement

Factors that influenced outcomes measurement at health care organizations implementing Epic included culture at both the management and provider level, Meaningful Use requirements, costs, the degree of standardization, the design process, communication, and Epic’s technical capabilities.
Culture

Each of the health care organizations emphasized outcomes measurement to a different degree through their culture, both at the management and provider level. At TCH, management demonstrated their commitment to outcomes measurement by forming a team of thirteen FTEs, including clinically licensed outcomes nurses, clinical data specialists, and technical team members. In contrast, OHSU’s team is composed of only five people, including a quality manager, patient safety officer, and process improvement consultants. Management can also influence the specific department in which outcomes measurement starts; for example, at TCH, emphasis was placed on obtaining outcomes for spine surgery, since it is especially dangerous. UCSF has constructed a five year strategic plan to build a culture of quality, and required doctors to attend mandatory training sessions to learn how to use Epic.

Aside from management, individual providers can also cause organizations to work towards obtaining outcomes. At TCH, the outcomes measurement team worked with a physician in the orthopedics group to build a document flow sheet, since he was extremely interested in using them. Because this particular physician was so committed to using the document flow sheet, he pushed forward its development.

Meaningful Use

Meaningful Use requirements did not encourage health care organizations to track outcomes; in fact, one organization (BSW) mentioned that Meaningful Use and other regulatory requirements created such a great burden that it prevented them from moving forward with plans to implement outcomes measurement. OHSU, which does not measure outcomes, stated that it prioritized Meaningful Use requirements. None of the organizations obtaining outcomes data mentioned Meaningful Use as a driver behind their implementation of outcomes measurement. In addition, meetings with Epic revealed that organizations that decide to pursue an expedited implementation with more barebones capabilities do so in order to meet Meaningful Use requirements, and that these organizations must then modify their EHR more than organizations that spend more time in the planning stage if they would like to obtain outcomes data.

Costs

Every organization mentioned costs, both monetary costs as well as time costs, as barriers to EHR implementation and outcomes measurement. One organization (BSW) described the process of creating PRO assessments through MyChart as overwhelming, because of the time it takes to build the survey into a legible format, build the survey in the system, and then sign up patients. Stanford mentioned that even after “go-live,” when clinical staff started using the EHR, an enormous amount of work was needed to adjust to the system and optimize clinical workflow.

Degree of Standardization

Most of the organizations moved towards more standardization over time. OHSU originally held flexible policies that allowed everyone to use their own documentation, and was very provider-centric in allowing everyone to create their own Smart Phrases; however, in the past few years, OHSU has tried to reduce the variability in the system and standardize. UCSF also allowed some variability in documentation at the beginning, but is working towards more standardization. BSW noted that the standard, “out-of-the-box” Epic implementation allows each group to set its own banners, which is confusing for physicians who work at both the clinic and hospital. Thus, BSW standardized the patient headers so that the same type of information is in the same location.
Design Process & Communication

For the organizations collecting outcomes measurements, communicating throughout the design process helped move the process forward more quickly and smoothly. At TCH, the design process for building the Voiding Dysfunction Clinic’s Smart Form involved several months of testing different versions of prototypes and communicating with the software developer to ensure that the final Smart Form was intuitive for providers and measured the variables they wanted to measure. At Stanford, putting all the stakeholders into one room allowed them to bounce ideas off of each other and move towards action.

Epic Technical Capabilities

Several organizations commented that Epic did not provide the functionality necessary for measuring and analyzing outcomes. TCH found that many of the standard Epic fields were mineable, but weren’t the fields that clinicians wanted to measure; most of those fields were not discrete data fields. In addition, UCSF mentioned that Epic did not provide clinicians with an easy way to access data, since custom reports are difficult to build. Thus, in order to access the data that they want, clinicians must often request that Epic or someone with software experience with Epic build the report. Furthermore, discussions with the Epic team revealed that no option exists for incorporating a survey on another platform into MyChart. In the process of determining the best way to collect PROs, MD Anderson found itself restricted because MyChart does not provide the best survey functionality but also does not provide an easy way to integrate a better survey tool with MyChart.

In terms of visualization, while Epic offers a charting capability for reviewing symptom changes in one patient over time, it does not display aggregated patient responses over time. In addition, Slicer Dicer, an Epic-based tool for patient cohort exploration, only works with data within Epic.

### Discussion

The discussion will explain the value agenda framework in more detail, implications of our findings for health care organizations, EHR vendors, and U.S. policymakers, and describe a few limitations of this study.

### The Value Agenda

The value-based health care agenda, introduced in 2006 by Michael Porter and Elizabeth Teisberg, provides a strategy for transforming healthcare to reduce costs and improve quality of care. First and foremost, the value agenda focuses on improving value for patients, by improving value means improving health outcomes and reducing costs, without sacrificing one for the other. The value agenda involves six components: (i) integrated practice units (IPUs), (ii) outcome and cost measurement for each patient; (iii) bundled payments for care cycles; (iv) integrated care delivery across separate facilities; (v) expansion of excellent services geographically; and (vi) an enabling information technology platform (Porter & Lee, 2013).

This paper specifically focuses on the second and sixth part of the value agenda. In order for health care organizations to work towards improving value for patients, they must possess some way to measure value for each patient, in terms of outcomes and costs, over the entire cycle of care. An enabling information technology platform should support all aspects of the value agenda, including outcomes measurement. In the past, healthcare IT systems have often complicated care due to fragmentation; different departments, services, and data types often involve different systems, without a way to communicate between systems (Shortliff & Cimino, 2014). In contrast, an IT platform that could increase value would focus on patients, use standard data definitions, store all data in one place, provide extractable data, and allow patients, clinicians, and non-clinical staff involved in care to access the data.

### Recommendations for Health Care Organizations

**Management**

In order to track outcomes, management must prioritize outcomes measurement in their strategic plan. Management should

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**Table 2. Summary of the various factors influencing outcomes measurement at the hospitals interviewed.**

<table>
<thead>
<tr>
<th>Hospital</th>
<th>Major Barriers to Outcomes Measurement</th>
<th>Major Factors Supporting Outcomes Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>TCH</td>
<td>• cost, • de-prioritization, • internal divisions within the hospital (surgery vs. non-surgery)</td>
<td>• physician champions, • management support (large team), • iterative design process</td>
</tr>
<tr>
<td>Stanford</td>
<td>• cost, • time, • exaggerated focus on metrics, rather than action</td>
<td>• design process – iterative, based on teamwork, • physician champion</td>
</tr>
<tr>
<td>UCSF</td>
<td>• cost, • time</td>
<td>• physician champions, • 5 year strategic plan for culture of quality</td>
</tr>
<tr>
<td>MD Anderson</td>
<td>• cost, • time</td>
<td>• management support, • in process</td>
</tr>
<tr>
<td>BSW</td>
<td>• regulatory requirements, • time, • priorities</td>
<td>• did not implement outcomes measurement</td>
</tr>
<tr>
<td>OSHU</td>
<td>• early implementation of Epic, • flexibility</td>
<td>• did not implement outcomes measurement</td>
</tr>
</tbody>
</table>
allocate budget to a team specifically focused on outcomes measurement to ensure that someone focuses on driving this forward, as TCH did. Rather than one stream of optimization for clinical workflow and for outcomes measurement, these should be considered as two separate priorities, so that work towards obtaining outcomes does not get delayed. Otherwise, given the extraordinary number of competing concerns that physicians must face, outcomes measurement may get pushed to the side in favor of more urgent matters, such as treating patients. In addition, management should require that all physicians and potential Epic users within the organization undergo training, both to educate people about the use of Epic and to show their firm commitment to utilizing EHRs for obtaining outcomes. Management could also tie financial incentives to EHR usage (Silow-Carroll, Edwards, & Rodin, 2012).

Physician Champions

Health care organizations should identify physician champions, since they will push the process forward and increase engagement among other physicians. As the example from TCH’s orthopedics group shows, physician champions who are motivated to measure outcomes can ensure that it remain a priority, a finding also supported by other studies (Locklear et al.).

Design Process & Data Management

Throughout the entire design process, communication between management, clinical staff, and Epic is key for ensuring that the final product suit the needs of the health care organization. Organizations that are planning to switch to Epic should engage in dialogue beforehand with Epic about the specific data fields they would like to measure, since customization after implementation increases costs dramatically. Organizations already utilizing Epic should convene clinicians and clinical data experts to discuss the data fields they would like to measure, and then discuss with the Epic team the best way to customize their system to discretely measure this data. According to the Epic team, if another organization has already asked for the same customization, the organization may not have to request another custom build, and can instead use the same modification. Organizations should also ensure that Epic’s EHR allows them to collect data in a manner that is not only discrete, but also minable, so that they will be able to report the variables. Throughout this process, organizations must be explicit in stating exactly what they would like for the EHR.

According to the experiences of both TCH and Stanford, organizations should start small as they begin the process of measuring outcomes, with data points that people most want to know. In addition, given the current functionality of Epic, health care organizations may need to construct their own enterprise data warehouse or use a third party vendor to access the data that they need for outcomes measurement. Thus, outcomes measurement may prove difficult and costly for smaller health systems.

Integrating Outcomes Measurement into Clinical Workflow

When collecting PROs, organizations should ideally utilize electronic mechanisms to administer surveys to patients, such as web pages, tablets, or kiosks. TCH’s Voiding Dysfunction Clinic requires clinicians to manually enter PROs, which provides a barrier to recording outcomes. In general, reducing the amount of work for physicians increases the success of outcomes measurement (Landes et al., 2014). PROs should also be collected before clinicians see their patients, so that the information provided can be incorporated into treatment decisions (Ayers 2013).

Both advantages and disadvantages exist for integrating PRO measurement tools into the EHR system; while this allows the data to be more easily accessible to the EHR, it also reduces the functionality of the PRO assessment tool, since MyChart does not support computer adaptive testing. Organizations with fewer resources for outcomes measurement should probably use MyChart, while organizations with more resources should use third party vendors and customize their EHR to integrate PRO data into the EHR system.

Organizations must also consider their resources when deciding the specific Epic tools they would like to use. Structured templates, which are used within the NoteWriter and allow the use of Smart-Phrases, SmartLists, and SmartLinks (Shillingstad, 2013), generate notes. They are the cheapest and quickest to make, but are not user friendly. Document flow sheets, which record discrete data, are also simple to make, although they require a bit more planning (Epic Systems, 2014). Finally, Smart Forms record both text and discrete data, as well as images. Smart Forms also disrupt workflow the least, but take significantly more time and effort to build. Organization should also take into account the preferences of clinicians who will be using the tool.

Customization & Standardization

Health care organizations should try to standardize procedures and clinical workflow as much as possible when implementing an EHR system, as this balances flexibility between different specialties, and incorporates the feedback and suggestions of clinical staff, standardizing reduces confusion and allows for easier integration of data. More customization requires the addition of metadata, or data describing other data, to the system, which adds complexity (Manion, Harris, Buyuktur, Clark, An, & Hanauer, 2012). For organizations using structured templates, a standard progress note increases the amount of outcomes data extracted, compared to a free form progress note (Steidl & Zimmern, 2013). Standardization also facilitates the sharing of data across health delivery systems (Wu, 2013). Furthermore, standardization helps reduce disturbances of workflow during implementation, so that providers are able to reduce the amount of time they lose while learning the system (Locklear et al., n.d.)

At the same time, some customization may increase provider buy-in (Landes et al., 2014). Wu suggests balancing the two by using a standardized underlying record, but then customizing on top of that (Wu, 2013).

Recommendations for Vendors

Specifically, this paper will focus on recommendations for Epic, but these may be applicable more broadly to other EHR vendors as well. Because of its large market share, Epic can highly impact healthcare through aspects such as decision support rules, visualization, and workflows (Koppel & Lehmann, 2014).

Technical Capabilities

Epic should incorporate more mineable fields for capturing outcomes data, increase the reporting capabilities of its data warehouse, and improve its PRO collection tools or PROM integration functionality. Because the standard build does not include many discrete data fields for outcomes measures, TCH was forced to highly customize their Epic EHR system, a time-intensive and financially
costly endeavor. Epic could work with ICHOM, the International Consortium for Health Outcomes Measurement, in order to determine a set of standard outcomes measures that most organizations could use. Epic could also review the requests for custom data elements that organizations make and turn the ones that are most commonly requested into standard data fields.

For smaller health systems that cannot invest the same amount of resources to outcomes measurement, a wider variety of tools for outcomes measurement as part of the standard Epic build would allow health organizations to more easily obtain outcomes. UCSF mentioned that MyChart currently does not support a lot of survey functionality, such as branching. In addition, the limited reporting capabilities of Clarity drove organizations such as TCH and Stanford to develop their own enterprise data warehouse for combining data from different sources, but building an enterprise data warehouse represents an extremely resource-intensive task. Most physicians cannot easily extract data from Clarity, since it contains thousands of data tables and thus requires someone with expertise in SQL to extract data (Manion, Harris, Buyuktur, Clark, An, & Hanauer, 2012).

Educational Materials & Client Communication

Vendors should ensure that their clients understand the full capabilities of their system, and prompt clients to consider goals such as outcomes measurement before moving forward with building the EHR system, since changes are much more difficult and costly to make once the system has been built. The Epic team commented that there was no typical conversation between organizations and Epic team members during the EHR design and implementation process, but that the discussions between MD Anderson and Epic, involving representatives from both Epic, the MD Anderson project team, as well as stakeholders from management, were ideal for facilitating the development of a system that would suit the needs of MD Anderson. If clients do not take the initiative to arrange these meetings, Epic should encourage them to do so.

In addition, Epic should provide more educational materials about the different tools it provides as part of its EHR. Surprisingly little has been written in terms of guides that describe the differences between structured templates, document flowsheets, and Smart Forms, even though this information is important for deciding which to use to collect data, since each provides different advantages and disadvantages involving time investment as well as the discreteness of data collected.

Furthermore, Epic should promote the sharing of ideas and experiences between its users, to develop best practices that can benefit everyone. Epic has made some strides in this discussion in working to arrange focus groups and a round table with larger customer groups, but more action is necessary to consolidate the individual learning that each organization makes, so that different organizations do not make the same mistakes over and over, at an extremely high cost to the U.S. health care system as a whole.

Recommendations for Policymakers

Policymakers should require that health care organizations measure outcomes, because organizations will not obtain outcomes unless they make it a priority to do so. Currently, other regulatory requirements prevent most organizations from focusing on outcomes measurement.

Current Meaningful Use Requirements

Meaningful Use objectives include a set of required core objectives as well as a set of menu objectives. Hospitals and health care providers must fulfill all of the core objectives and choose some of the menu objectives to fulfill. As part of the core objectives for Meaningful Use Stage 1, only one objective contains an outcomes measure, and another objective may or may not contain an outcomes measure depending on the patient’s specific condition.

The objective with an outcomes measure requires hospitals to record demographics including gender, ethnicity, as well as date and preliminary cause of death in the event of mortality. This last data point about the date of the death is an outcome measure, because it describes survival of a period of time. However, this is one of the most basic possible outcome measures, and the objective only requires recording this if the patient dies within the hospital itself. The other possible outcome measure required by the Stage 1 criteria is within the objective that asks hospitals to record changes in vital signs such as height, weight, blood pressure, and BMI. For some conditions, such as malnutrition, vital signs such as height can demonstrate the health status achieved by the patient, and the change in BMI over time of an obese patient could demonstrate sustainability of health. However, for most conditions, these vital signs would not measure outcomes. Many of the Stage 2 criteria are similar to Stage 1, except that they extend further and require more use of EHRs. However, none of the core objectives for Meaningful Use Stage 2 require more outcomes measurement than the Stage 1 criteria.

Possibilities for Meaningful Use

Currently, Stage 3 for Meaningful Use is slated to begin in 2017. Meaningful Use Stage 3 Recommendations add a new core objective: the collection of patient-provided data (Meaningful Use Work Group, 2014). Since most outcomes depend upon patient input, requiring hospitals to build the capability to send electronic surveys to patients moves towards the direction of PRO collection. However, under the current recommendations, hospitals can survey patients on many items aside from outcomes to fulfill the objective; they can also send screening questionnaires and intake forms. Policymakers should ensure that this core objective specifies that hospitals must collect PROs in order to complete the objective.

Future Directions

Several limitations of this study should be mentioned. This was not a comprehensive overview of all health care organizations; instead, we identified health care organizations that were using Epic and utilized our networks to reach out to these organizations. Thus, specifics related to Epic’s technical capabilities may not apply to organizations using EHRs from other vendors. Furthermore, as a descriptive study, the factors we observed can only be associated to effective or ineffective outcomes measurement by correlation, not causation. Future studies could examine health care organizations using EHRs from other vendors, or more comprehensively study the organizations using Epic.

References

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