Partnering with Clinical Providers to Enhance the Efficiency of an EMR

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ABSTRACT

Implementing an electronic medical record to replace paper records and associated processes does not guarantee the benefits of an EMR will be achieved. Specifically, it can introduce steps into a provider’s work flow that adversely affect the projected benefits of efficiency, and, ultimately, quality and safety. At Mayo Clinic in Rochester, Minnesota, implementation of the Mayo Integrated Clinical Systems, or MICS, the organization’s EMR, is nearly complete. However, providers perceive inefficiencies in their work flow using MICS. In response, a study was undertaken to enhance MICS and associated processes to improve provider efficiency. Through direct observation and feedback from 101 providers, this study identified seven major themes for enhancements: training; work flow and processes; dual environments; navigation-viewing integration; patient-reported information; clinical problems management; and consolidated medication documentation. This paper reviews the methods used to collect and analyze the data and discusses how improvement opportunities can positively enhance efficiency in using an EMR.

KEYWORDS

- Physician efficiency
- Electronic medical record
- Ethnographic research
- Benefits of an EMR

In the past decade, the healthcare industry has made a significant transition toward the use of electronic medical records. The benefits of an EMR are said to include reduced costs, increased productivity and improved quality of care. Recent studies on the impact of an EMR on provider efficiency have reported mixed results, suggesting that EMR implementation does not necessarily result in improved efficiencies.

Perceived efficiency has been shown to have a significant impact on overall satisfaction with electronic clinical systems; that, in turn, supports wider adoption of the technology. Easy entry and retrieval of pertinent data with appropriate presentation are among the most important characteristics of an EMR. Many EMR systems have been designed around specific tasks—documentation, order entry, results reporting and specialty practice needs, such as
primary care, surgery, emergency department care and medicine—that may result in an inconsistent user interface or a lack of integration. Further refinement of EMR systems to improve provider efficiency will be critical to facilitate adoption of more advanced technology and realization of the full benefit.

Mayo Clinic in Rochester, Minnesota, is a large integrated academic group practice with medical and surgical specialties that work together to care for more than 300,000 unique patients each year. Patient care is provided in a multi-specialty outpatient clinic and two hospitals with nearly 2,000 beds. A staff of more than 1,700 physicians, 1,700 residents, fellows and students, and 24,000 allied health personnel are linked through common systems and the primary belief “the needs of the patient come first.”

Mayo’s electronic medical record, the Mayo Integrated Clinical System, or MICS, is a full-featured system deployed in both outpatient and inpatient practices.1 MICS includes clinical notes, reports, lab results, monitor data, orders, medication administration, pharmacy, messaging, scheduling and billing using both commercial and internally developed applications. Implementation of MICS began in the early 1990s. MICS currently provides a complete EMR in the outpatient setting and a nearly complete system in the hospital—full computerized practitioner order entry and implementation of hospital progress notes should be completed within two years.

Despite using elements of an EMR for more than 15 years, many care providers report they believe they work inefficiently while using MICS. Because of these reports, the executive board of the Mayo Clinic of Rochester established “improving provider efficiency” as a major institutional strategic goal in 2005. This study was undertaken to identify factors that would contribute to enhanced efficiency and to better meet the needs of providers and, ultimately, the patient. Members of this study team included physician and administrative leadership, as well as analysts familiar with MICS applications and associated clinical work flows. Other clinical representatives were involved with developing the solutions and validating the results.

Methods

Because of the large scope of this initiative, the project was divided into two phases, with the first phase focusing on the outpatient practice and the second phase on the inpatient practice. For each of these phases, the same methodology and approach was used. To further reduce the scope, the initial focus was on physicians.

The bulk of the data was collected using principles and techniques of ethnographic research. Ethnography is a set of qualitative research tools, primarily developed within and drawn from anthropology, that seek to describe a culture based on the patterns of communication, action and decision-making of its members.2 Ventres and colleagues3 used ethnographic techniques to evaluate physician-patient dynamics and the use of computers in the exam room.

The primary source of data collected for this study was direct observation of physicians and hospital service teams, which includes the attending physician and any of the following caregivers: resident, physician assistant, physician extender, nurse practitioner, registered nurse or clinical assistant. This was supplemented with informal interviews and follow-up correspondence.

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An observation consisted of following a physician or service team during patient visits or hospital rounds for two to four hours. Observers were drawn from staff responsible for development, implementation and support of MICS and, as a result, they were familiar with the expected functionality of MICS. The observer documented potential inefficiencies as well as best practices in how physicians were using MICS. Observations also included how MICS fit into the physician’s work flow. The observer also collected feedback about perceptions of inefficiencies and enhancement suggestions. The comments made by physicians were captured verbatim wherever possible. The study team reviewed the documented observations and feedback, and individual items were abstracted and entered into a database along with corresponding attributes, such as the name of the observer, clinical department or location.

Additionally, several other sources provided data, including MICS project teams, information technology infrastructure project teams, clinical application support groups and individual practice electronic environment steering groups. Feedback from these groups also was abstracted and entered into the database.

The study team completed the initial review and analysis of the individual items. Issues that were deemed to be “bugs” in the system or that could be addressed with minimal effort were triaged to the appropriate team for prompt resolution. The remaining items were categorized using a series of card-sorting exercises, resulting in an affinity diagram.2 After they were categorized, items that were closely related were condensed into subsets called “improvement opportunities.”

The list of improvement opportunities then was validated and prioritized by physician representatives of the clinical
practice. Multi-specialty physician focus groups were convened and presented with the list and asked to validate and prioritize based on highest clinical value. This was done through the use of multi-voting. Each physician was given the list of opportunities and 10 votes to place on the opportunities they believed would most improve efficiency and add value to their clinical processes. A physician could place as many as 10 votes on a single opportunity but could use no more than 10 votes. The votes were tallied and the opportunities were ranked based on the number of votes. The clinical leaders of Mayo Clinic of Rochester then approved the ranked list.

Improvement opportunities with the highest number of votes were given to the relevant multidisciplinary project teams to estimate timelines and required resources. For opportunities requiring collaboration with external vendors, the teams asked vendors for estimated timelines and required resources. Using this information, the highest ranked opportunities then were chartered as projects. The status of each project was tracked to ensure it was progressing on time.

Various qualitative and quantitative measurements, including time studies, were considered. Each measurement was assessed based on the value provided versus the cost involved in terms of resources, time spent, etc. Also, many opportunities were general-use issues across all practices and variation in the use of MICS can be significant between practices and physicians. In view of the above, it was felt a quantitative evaluation for the study as a whole was not the most appropriate. Project teams were encouraged to perform quantitative evaluations for more focused issues, which are not reported here.

Two primary measurements were chosen to evaluate the success of this study. The first was a simple count of the number of changes and enhancements that have been implemented as a result of the initiative. The second measure was to go back to gather feedback directly from physicians about the impact of the changes in improving their efficiency using MICS.

Results

Data were collected from several sources. For this study, observers actively shadowed 101 physicians, about 8.4 percent of physicians in clinical practice and, where appli-
physicians have a hard time remembering features that are
processes or EMR requirements may differ. Thus, many
rotate between the outpatient and inpatient settings, where
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reducing some of the minor inefficiencies that surface after
application changes that offered significant benefit to a
work flow. Often, these were minor technical changes, such as adding a keyboard navigation keys sequence to activate a pop-up menu. These requests were
passed directly to the project teams, which implemented
them as quickly as possible. While these changes were
relatively simple to implement, they were well received for
using an application repeatedly on a daily basis.
The next step in the analysis was to organize the 769
individual items into similar categories using card-sorting
cardinals, their hospital service teams to document potential
efficiencies to inefficient processes or MICS application
tools. The physicians and service teams were selected to
represent all medical and surgical clinical specialties, both
outpatient and inpatient.
During these initial phases, specialized practice areas,
such as the surgical suite and emergency department, were
not included. In addition, MICS and IT infrastructure project
teams, clinical application support groups, and individual
practice steering groups submitted requests for enhance-
ments to MICS. Together, these sources of data generated
769 individual items.
During the shadowing, observers discovered opportunities
to make quick fixes for physicians. Examples included
desktop systems and printers that were not operating
properly, incomplete software installations, and minor
hardware or software configuration issues. As these opportu-
nities were discovered, they were reported to the appro-
riate team for immediate resolution.
Observers also found a small number of requests for
application changes that offered significant benefit to a
physician’s work flow. Often, these were minor technical
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The next step in the analysis was to organize the 769
individual items into similar categories using card-sorting
exercises. This step resulted in the development of four
main categories—user training, work flow and processes, IT
infrastructure, and MICS applications. The items in the MICS
applications category were further classified into five subcat-
egories. Figure 1 lists examples of individual items and their
count within these categories.
In the user-training category, observers identified some
key application features implemented years earlier were not
being used. The cause of this was determined to be two
common training issues. The first is trying to push users to
learn more than they are able to absorb and sustain.
Although MICS was implemented in phases over several
years, some of the phases required significant changes to
both processes and tools. Classes and other training
resources were made available to physicians at the time of
these changes; however, for some physicians, the quantity of
changes was too great to maintain functional knowledge
over time. The second training issue involved the difficulty
in remembering how to use a specific application feature
when it is used infrequently. At Mayo, many physicians
rotate between the outpatient and inpatient settings, where
processes or EMR requirements may differ. Thus, many
physicians have a hard time remembering features that are
not used frequently. In all, 57 similar user-training items
were collected.
Ninety-one individual items were categorized as work
flow or process issues for using the EMR. Some of these
items were related to the conversion of medical records
from paper to electronic. Despite efforts to improve
processes at the time of conversion, additional improve-
ments in work flows and processes were identified as
opportunities for further enhancement. Other items were
related to practice changes, new regulatory requirements or
new electronic tools.
The third category, IT infrastructure, contained 159
reported or observed items. Most of the items in this
category were requests for better hardware infrastructure to
virtually eliminate the hardware layer between the physician
and the medical record. The physicians did not want
hardware limitations to slow them down or limit them.

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Because the goal of this study was specifically aimed at
improving efficiency for physicians using MICS, it was not
surprising that MICS applications was the largest category,
with 462 individually reported or observed items. Because of
the large number and diversity of items, five subcategories
were identified for further classification. All items in this
category directly related to enhancements to the MICS
applications, and most dealt with either navigating within the
EMR to find specific information or developing new
 customized tools to address specific needs.
After reviewing and categorizing the individual items, the
next step was to identify the improvement opportunities,
which was accomplished by condensing individual items
into unique opportunities. For example, all individual items
related to system or application log-ons were combined into
a single improvement opportunity.
In all, 51 unique opportunities were identified from the
769 individual items. Those 51 opportunities were presented
to two multi-specialty focus groups with approximately 20
physicians each, one following the outpatient observations
and one following the inpatient. Physicians were selected by
the study team and clinical leadership to represent most
medical and surgical specialties within the outpatient and
inpatient practices, including some in leadership positions.
After all opportunities were presented and discussed, the physicians validated and used multi-voting to prioritize them based on their perception of highest clinical value; opportunities were ranked based on the number of votes received.

During focus group discussions, three individual opportunities—patient-reported information, clinical problems management and billing—were noted to be widespread issues and were automatically given top ranking. Tables 1 and 2 show the top 5 ranked items from the outpatient and inpatient focus groups. The ranked lists then were reviewed and endorsed by the Mayo clinical leadership.

Thirty-seven of the 51 opportunities fell within the user training, work flow and process, or MICS applications categories. The final step in analyzing these opportunities was to review the list of priority items with project teams and external vendors to establish timelines and resources. The highest priority opportunities were assigned to the appropriate project teams. These 37 opportunities were tracked to ensure timely progress and to address any subsequent issues. The remaining 14 improvement opportunities were in the IT infrastructure category, which fell outside the purview of this study and were passed to the appropriate oversight group to be prioritized, resolved and tracked.

Initial changes to the MICS applications and processes began about nine months after the study was started. To measure the success of this project, two measurements were planned. The first was a count of the number of changes and enhancements implemented.

Nine months after these initial implementations began the number of changes and enhancements for the 37 opportunities shows significant progress. For example, 11 practices have participated in a new customized and enhanced MICS training program; three new institutional and MICS initiatives have been launched to address significant process and EMR redesign needs; 15 major changes and enhancements have been implemented for MICS applications; and 12 MICS project teams have ongoing projects based on the prioritized opportunities.

Additionally, of the 14 opportunities in the IT infrastructure category, seven have been addressed or tested.

The second initiative to measure success was to gather direct physician feedback about the impact of the changes on their ability to efficiently use MICS. Although a formal study has not yet been conducted, an informal poll of division and practice chairs representing medical outpatient divisions showed about half said they believe the changes have improved their efficiency, while the others reported they had not yet experienced any significant improvement. A formal study is planned to elicit more feedback.

**Major Themes**

Using observation and direct feedback from physicians, this study shows the essential need for an EMR to functionally support a large integrated medical center and hospital practice, while doing so in a way that optimizes work flow and user efficiency. Although the results of this study were drawn exclusively from physicians practicing at Mayo Clinic in Rochester and using MICS, many of the improvement opportunities suggest major themes common for all EMR users.

**User training.** Training for an EMR is an ongoing effort.
When an EMR is initially implemented, training on the basic infrastructure of the new application is a necessity. However, the transition to an EMR from a paper-based medical record is a significant change. Ensuring physicians are adequately trained to use the system efficiently can be challenging.

In addition to the significant amount of new information physicians need to learn, training is complicated by the factors busy physicians have little or no time allocated for training. Because training is often delivered over a relatively short period of time, less obvious or less frequently used functions are not learned or remembered well. So even before new enhancements and changes beyond the basic infrastructure are implemented, most physicians do not have full knowledge of the most efficient way to use an EMR. As enhancements and changes are made, physicians tend to fall further behind, despite efforts to make the EMR more efficient.

The results of this study emphasize the need for ongoing education and the development of creative delivery mechanisms to meet the learning needs of busy physicians. In response to this need, the MICS education unit began offering an onsite training program, customized to the needs of a practice and delivered over a three-month period. The goal of this training program is to enhance the current knowledge of physicians so they are able to more efficiently use MICS when providing patient care.

An important part of this program is to work with the practice to develop and support an ongoing education plan to address their future training needs. For example, some practices now take five to 10 minutes at the beginning of a standing practice meeting to learn about new changes and tips to use MICS more efficiently. This program has been very successful and has highlighted the advantages of physicians training together, which leads to sharing tips and best practices among colleagues. This new program supplements other existing training opportunities, such as traditional instructor-led classes, Web-based interactive training and physician-only class sessions. The MICS education unit continues to explore innovative strategies and delivery mechanisms to support the clinical practice.

**Work flow and processes.** During the initial implementation phases of MICS, paper processes were modified to integrate the electronic tools into a new work flow. However, now that MICS is more fully implemented, this study demonstrated the need to continually study ways to further refine and modify processes to better integrate MICS into the physician's work flow.

For example, because of new regulatory requirements and ways of delivering care, some physicians in the outpatient practice said they believed they were doing clerical tasks that could be more efficiently done by other staff. To address this issue, a new institutional team composed of physicians, nurses, administration, clinical allied health staff and systems engineering analysts has been charged with analyzing and redesigning the care team process, including team members' roles, responsibilities and processes.

**Eliminating dual environments.** In some areas at Mayo Clinic, electronic systems continue to be used in conjunction with paper-based processes. For example, admission notes in the hospital are dictated by attending physicians and appear in the electronic record after transcription. Meanwhile, residents write notes by hand, and those records remain in the paper chart and are not part of the electronic record until they are scanned after dismissal. In other instances, electronic order-entry systems exist alongside paper-based ordering processes.

This study found the existence of dual environments was a major impediment to physician efficiency. The negative effect was seen with both information viewing and entry. For viewing, the primary inefficiency was related to the necessity of checking records in multiple places, both electronic and paper, to get a complete view of the patient's record. For data entry, inefficiencies were a result of having to remember different processes for various documentation systems.

Based on feedback from this study, efforts to make all hospital notes electronic at the point of care have been accelerated. Transcription capacity has been increased, and additional templates to streamline the entry of records like progress notes have been developed. Because of these efforts, all staff physicians are now able to electronically document all admission, daily progress and consult notes via dictation or self-entry, and short timelines have been set to bring the remainder of the staff and resident notes into an electronic format.

Projects are also under way to standardize on a single computerized practitioner order entry system. However, because of process and technical dependencies, the completion of this project is not expected for a few years.

**Navigation, viewing and integration.** Most of the feedback collected centered on navigation, viewing and integration of information and applications, which often are related. For instance, difficulty navigating the record may be best addressed by offering a consolidated view that reduces the need to navigate between screens or applications, or by greater data integration, so information is available where and when it is needed. Potential solutions include improving navigation within individual applications,
developing consolidated viewing solutions, implementing
additional integration strategies, and enhancing training
to further assist with navigation, viewing and integration
challenges.

One change was based on the observation that
completing common tasks within the billing application
was tedious and time consuming, involving too many
mouse clicks and pop-up windows. Physicians, who are
often reluctant to perform coding and billing tasks, had little
patience for the inefficient design. A group was charged to
streamline the navigation within the billing application,
remove unnecessary pop-ups and automatically flag priority
items. A similar project was undertaken to improve the
allergy application. In this case, the project team addressed
longstanding bugs and design limitations that contributed to
an inefficient user interface.

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Another common request was for the creation of new
reporting capabilities. Physicians requested a tool to quickly
review essential information before rounds or off-floor
consults. This information often is pulled together by mid-
level providers and residents, who then copy and paste it
into a table or text document. This is repeated for each
patient and then printed. Setting up this information is time-
intensive and needs to be done immediately before
rounding to ensure data are timely and accurate. As a
response to this need, an electronic service list application
was developed to automatically generate the types of reports
that were previously done manually.

Aside from reports, providers identified the need to have
a high-level entry point to the patient record that enables
them to quickly navigate to information of interest. In
addition, physicians would like this view tailored to contain
the documents and reports most important to their practice.
While there was some infrastructure already in place to
provide a high-level patient summary view, there were
several shortcomings in the implementation. Changes are
under way to enhance this view to add support for viewing
additional document types, including images, as well as to
provide customized data displays based on department
and role.

Recognition of the key role of navigation, viewing, and
integration of information and applications in contributing to
physician efficiency led to the creation of a workgroup to
explore ways to improve and provide more consistent
navigation within MICS. This group has been charged with
reviewing graphical user interface compliance and human-
computer interaction design for consistency of navigation
across all MICS applications. The navigation group has initi-
ated a rapid prototyping project using direct feedback from
the broad user community to gather ideas to improve the
primary viewing applications. In addition, the MICS educa-
tion unit also has enhanced its training programs to specifi-
cally target navigation, viewing and integration issues. For
example, a recent training session titled “Decrease Your
Clicks in 2006” was designed for MICS users to address the
issue of navigating the EMR.

Patient-reported information. Another challenge raised
was effectively gathering information reported directly by
patients and integrating it with MICS so it provides value to
physicians and patients. Patient-reported information at
Mayo Clinic at Rochester currently is captured on paper
forms, scanned into MICS and analyzed with optical
character recognition (OCR) software to provide textual
summary information. OCR is only used to analyze “fill in
the bubble” type answers; handwritten text is not analyzed
via OCR, and physicians refer to the handwritten sections
by viewing the scanned images. Information reported
by patients includes allergies, current medications, family-
social-medical history, immunizations, preventive screening,
authorizations and review of symptoms.

Physicians voiced several concerns with the current
process. The primary issue involved the quality of the
patient-reported data and the inability to annotate or correct
the scanned images and textual information if discrepancies
were found. For instance, if the clinical staff discovered
during the course of an office visit a medication the patient
inadvertently missed, the complete medication list would be
documented in a clinical note, but the original image of the
information reported with the incomplete medication list
would still be visible. There also were concerns about the
legibility of the handwritten sections and the timeliness of
some of the data.

The associated project team was given the task of
addressing these concerns. Their first step will be the devel-
opment of an online Web-based questionnaire that will
replace the paper forms largely. The online entry will enable
greater legibility by eliminating hand-entered text, as well as
provide more accurate and up-to-date information. The next
phase will involve creating the infrastructure to enable the
data to be updated by caregivers and to develop a process
that enables validation of patient-reported information at the
point of care.

Consolidated medication documentation. The
inpatient focus group ranked having a consolidated
medication list as the second highest improvement opportu-
nity. Today, medication lists are somewhat fragmented,
mostly because medication ordering is occurring through the
use of several processes and tools—electronic and paper-
based. At Mayo Clinic in Rochester, electronic orders have been in place in the outpatient practice for more than 10 years; however, the inpatient practice has been mostly paper-based. This study highlighted the need to accelerate the conversion of these paper-based ordering processes to an electronic system.

The facility is currently implementing a new computerized practitioner order entry system in the hospital, which will provide many quality and safety improvements, such as automated drug interaction checking. This new computerized practitioner order entry tool is also expected to replace the tool currently used in the outpatient practice. However, until this is fully implemented in both settings, medication documentation will continue to be fragmented. In the interim, MICS project teams are looking for a solution to provide a consolidated medication list for physicians to enhance efficiency, and ensure quality and safe patient care.

**Clinical problems management.** Today at Mayo Clinic in Rochester, physicians document diagnoses in their clinical notes, enter indications when ordering tests and consults, and select problems for billing. However, in spite of these various types of documentation, a single, integrated and complete electronic clinical problems list is not part of MICS. Physicians said the redundant entry of problems is inefficient, especially as these different documents use different lists, have different mechanisms for selecting terms and do not integrate with the other applications. Also, an integrated clinical problems list should improve the quality of care, assure patient safety and improve efficiency by eliminating manual documentation of problems in several parts of the EMR.

As a result of this study, a team was charged to develop a vision and strategy for a clinical problems list that would provide a single, accurate and robust list for documenting and managing clinical problems. The new vision has been developed and approved, and the team continues with the design of the software and work flow to satisfy the needs of the physicians and other providers. The development of a common problems list across Mayo Clinic in Rochester and MICS lays the groundwork for an enhanced work flow and longitudinal record, and for better quality and safety of care through appropriate clinical decision support.

**Summary**

Feedback regarding the electronic clinical environment typically is given informally, from one physician to another, or in the form of change requests or expressions of dissatisfaction. The methodology used in this study was particularly useful in moving away from anecdotes and toward reliable information as the basis for improvements to the EMR. The direct engagement with the practice also helped to assure concerns MICS project teams were unresponsive to physicians' concerns. This study demonstrated a commitment to improving physicians' efficiency when using MICS and helped to diffuse emotional reactions and frustration with the system.

Another challenge, but an important success factor, was managing the expectations of the practice for resolution of issues raised during observations and the subsequent focus groups. Often, the solutions to the observed issues required changes to be made by the vendor to their software product. Many of the improvements required coordinated process changes in addition to enhancements to MICS.

Further, not everything that was prioritized could be solved easily or directly with current technology. Continued communication with the practice regarding the status of improvement projects has been of critical importance. **Future work.** Additional observation and analysis is needed to identify issues affecting the efficiency of other providers, nursing in particular. This study limited the scope to physicians, but nursing also represents a significant subset of the primary users of the electronic medical record. More study is needed to determine if other providers have the same or new issues that affect their efficiency when using MICS. Also, additional, focused study is needed for specialized practices, such as emergency departments and surgical suites, to identify their specific needs. The study team is planning these future phases.

As improvements are implemented, follow-up evaluation will be conducted to determine the perceived impact on efficiency. The project teams to which the improvement projects are assigned are encouraged to conduct more detailed evaluations to demonstrate measurable, quantitative change from baselines. Although the qualitative assessments obtained by this study yielded useful information, collecting and analyzing quantitative data would provide more insight into the factors of an electronic medical record that significantly affect efficiency. Methodologies for this type of study, such as time-motion analysis, are well described and present an exciting opportunity for further research.

**Conclusion**

Implementing an EMR requires more than simply replacing paper with an electronic application. Even when process redesign is employed to develop new processes for specific tasks, an iterative evaluation of the EMR and how it is used within a provider's work flow is an important aspect. This study helps to identify and resolve potential inefficiencies and variances, share best practices, and leverage iterative learning. Physicians and hospital service teams were studied to understand how they were using MICS in their daily practice. The gathered information then was used to identify improvements to MICS applications, related processes and the training strategy. This initiative also helped identify issues that, if resolved, have the potential to enhance quality of care.

One of the strengths of the study was the fact it derived
information through observing more than 100 physicians and hospital service teams from various practice types—outpatient and inpatient—all using MICS while providing patient care in busy practices. Their insight and experiences identified regularly encountered real-time, application and work flow inefficiencies. Without this observed and direct feedback, several quick fixes, and process and training improvements may have been missed. Further, the direct interaction with providers helped build credibility, critical relationships to enhance learning and lend a human side to what might appear very technical.

Although the study was limited to physicians at the Mayo Clinic in Rochester and their use of MICS, the seven major themes identified—training, work flow and processes, dual environments, navigation-viewing integration, patient-reported information, clinical problems management, and consolidated medication documentation—are universal and applicable to any EMR implementation. Although efficiency was not quantitatively measured as part of the study, actions from this study will positively improve efficiencies and user satisfaction in the use of MICS, which should be evident when clinician observations are repeated. Others should use similar methods to evaluate their EMR systems.

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