Strategies for Optimizing an EHR System

Checklist

Provided By:

The National Learning Consortium (NLC)

Developed By:

Health Information Technology Research Center (HITRC)

STRATIS Health

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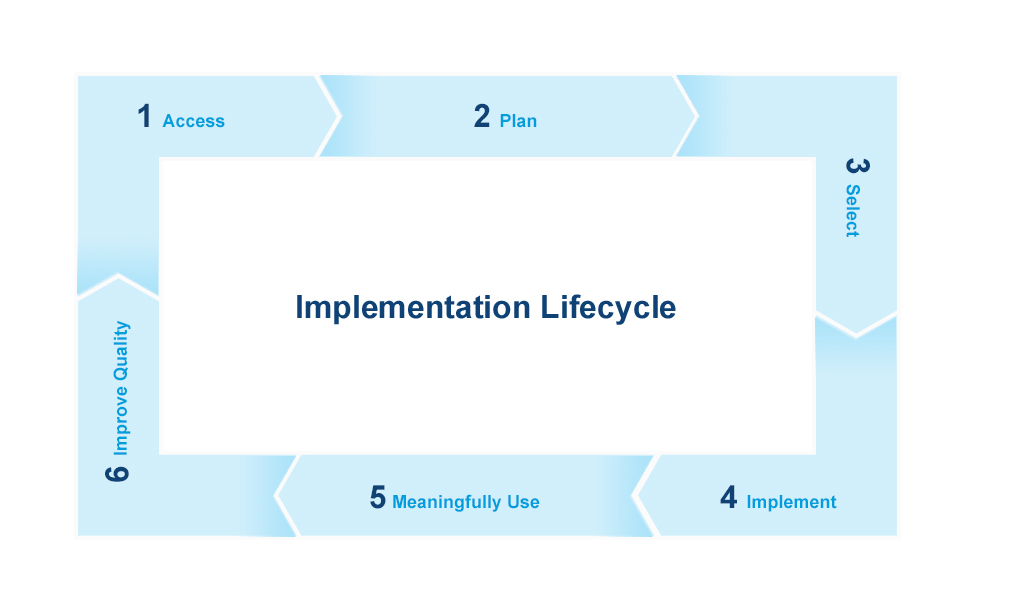
National Learning Consortium

The National Learning Consortium (NLC) is a virtual and evolving body of knowledge and resources designed to support healthcare providers and health IT professionalsworking towards the implementation, adoption and meaningful use of certified EHR systems.

The NLC represents the collective EHR implementation experiences and knowledge gained directly from the field of ONC’s outreach programs ([REC](http://www.healthit.gov/providers-professionals/regional-extension-centers-recs), [Beacon](http://www.healthit.gov/providers-professionals/beacon-community-centers), [State HIE](http://www.healthit.gov/providers-professionals/state-health-information-exchange)) and through the [Health Information Technology Research Center (HITRC)](http://healthit.hhs.gov/portal/server.pt/community/healthit_hhs_gov__rec_program/1495) Communities of Practice (CoPs).

The following resource is an example of a tool used in the field today that is recommended by “boots-on-the-ground” professionals for use by others who have made the commitment to implement or upgrade to certified EHR systems.

**EHR Implementation Lifecycle**



Description & Instructions

The Strategies for Optimizing EHR System checklist is intended to aid providers and health IT implementers with enhancing the EHR system post-live.

This resource includes a checklist to help electronic health record (EHR) users make the cultural shift to using the system at the point of care (POC). It also covers clinical decision support (CDS), computerized provider order entry (CPOE), and electronic medication administration record (EMAR).

The users are primarily the nurse at the bedside, the physician rounding in the hospital, and both the nurse and physician in an examining room in an emergency department or clinic.

EHR users also may include any person required to use the system at the same time they are administering to a patient, such as patient registration personnel, phlebotomists, pharmacy technicians, and therapists.

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# Optimizing Strategies for Point of Care Charting

1. Determine whether you are focused on POC charting in the hospital or in a physician office/clinic environment. While you may need interoperability between these, the settings have differences in workflow and processes that make POC strategies somewhat different.
2. If you have not done so already, engage all stakeholders in the process of system selection and implementation—especially surrounding configuration of data entry templates, clinical decision support, and how the system will be rolled out. Staff will be trained on how to use the system, but optimizing use of the EHR at the POC starts before training and continues after training and go live to ensure effective use of the systems.
3. Determine the need for optimization strategies through these various means:

Complaints are often a sign that new approaches may be necessary to help users overcome concerns.

Walkthroughs allow for casual observations—look to see if workarounds are being used.

Track and review simple health information technology (HIT) adoption statistics, such as user logins, every intended user should be logging in; volume of dictation, expected to go down; printer usage, may go up if someone doesn’t want to use the computer; scanning, number of handwritten forms should decrease; staff working overtime, continuing to enter data; and others.

Lack of goal achievement relative to patient safety and quality improvement often points to underlying EHR utilization issues. For example, you may have issues if the number of calls to physicians from the pharmacist concerning drug contraindications increases or fails to decrease, the number of calls does not decrease from retail pharmacy concerning prescriptions that are off-formulary for a patient or to which the patient is allergic, patients are sent home without applicable computer-generated instructions; and if the organization lacks documentation supporting improvement in preventative care services (such as failure to check that a patient has had pneumococcal vaccination), lacks medication reconciliation (such as for a patient taking warfarin and is scheduled for a surgical debridement of a wound), has inappropriate use of services (such as an MRI for acute low back pain), and duplicates use of services (such as performing a second chest x-ray when unaware that a first had been performed earlier in the day).

Once the need for an optimization strategy is identified, consider the most appropriate strategy to gain optimal use of the EHR. This will vary with the nature of the issue. For example, helping a nurse use the computer at the bedside requires a different strategy than correcting a medication reconciliation issue. The following are some strategies to select from. Develop others as appropriate. The key is to spot the need for an optimization strategy early and not hesitate to apply the strategy. The issue you encounter will most likely become worse without taking action.

## Strategies

Consider the following strategies when seeking to optimize use of EHR at the point of care.

Map the workflow and process as they are being performed today. Compare this with the “improved with EHR” workflow and process map that is intended to be performed. Discuss with the individuals performing the process what the issues are and have them identify ways to either adopt the improved workflow and process or to revise it so it is easier to perform, but still ensures optimal use of the EHR.

Directly observe how the individual is using the EHR. Any number of factors can cause issues, many of which can be easily corrected with additional training or some slight modification of the system, such as need for reinforced training on the application, need for improvement in general computer skills, need for redesign of a template, need for data capture aids in the application (i.e., copy and paste, favorites lists, larger font size), need for greater sensitivity of clinical decision support (only “important” alerts fire so they are not ignored), need for a longer cable on the barcode wand, and many others.

Consider the physical environment. One complaint that sometimes arises when implementing barcode medication administration record systems is that nurses believe they are walking more. Physicians may complain that they have to wait for someone to stop using a computer so they can get onto the computer to enter orders. Reviewing the physical layout of the nurses’ station or the entire unit may reveal the need for changes. Often issues arise with when and where unit doses of medication are placed on the unit. Some nurses believe that pushing a wireless computer on wheels takes more effort than walking between the nurses’ station and patients’ rooms. You may need additional workstations or portable devices.

Role-play with individuals to make them feel comfortable with changes in how work is performed in front of a patient. This has become an important strategy a number of vendors are employing to make people more comfortable in using a computer in front of a patient. Using your test environment, play the role of various kinds of patients, including those who are hard of hearing, those with nosey relatives, those who fear for the privacy and security of their information, and those who simply don’t care whether you are using a computer—which is likely to be many more than most new users expect. Discuss and agree how best to handle each type of patient.

Script how to introduce the EHR to patients, introduce a helper who may need to be called into the area for technical support, and even acknowledge that you are new to the EHR and may need to take a bit more time or may need to focus a bit more closely on the documentation. Most patients won’t mind if you explain this to them; some may even offer to help.

Evaluate data requirements. Many clinicians complain that they are expected to collect and record much more data in the EHR than when they were using paper charts and completing paper chart forms. In some cases the lack of data collection in the past has caused problems—more complete documentation in the EHR is generally considered good. More-complete documentation will take more time and may not always be necessary. Be aware that the system may be asking for some data that are rarely needed, changing them from required to optional may be in order. As the need for an evaluation of data requirements arises, evaluate all uses of the data (i.e., data element impacts the performance of a clinical decision support rule or is required for claims processing). A team of clinicians and others should conduct the review and make these decisions.

Evaluate if there are alternative sources for data that would reduce the data entry burden. For example, if a patient is in the hospital and has previously been a patient in any area of the facility since the EHR has been in place, trace whether certain data could flow from a previous admission, an emergency department visit, or a clinic visit. The patient’s gender, birth date, much of the family history, past medical history, allergies, and other data that rarely changes should not have to be collected again. If it has to be recollected, discuss this system problem with the vendor. Even the history of present illness and review of symptoms may be able to be pre-populated if the both patient encounters are for the same problem, such as when a patient was seen in the clinic then is admitted to the hospital for more intensive workup of the condition. In some cases, evaluate if your system enables patients, or their relatives or caregivers, to enter data themselves. Utilities are available that lead the patient through the series of context-sensitive questions (i.e., specific to their gender, age, chief complaint, etc.) for which you want data collected; the data can then flow to your EHR. These are more commonly used in an ambulatory environment, but are also feasible for nurse assessments or physician history-taking in the hospital. Clinicians will want to validate the data when they are ready to interview the patient, but they don’t have to enter the data that appears appropriate. Some of these utilities provide data capture for a patient to use from home through a secure Web-portal, or via a stationary or portable kiosk that can be supplied in the examining room or at the bedside.

Supply value for the data collected. Data collection can appear meaningless if clinicians required to enter data see no apparent purpose. For example, your hospital may have decided to improve disease prevention in the community by collecting data on whether patients have had their seasonal flu shot, pneumococcal vaccination, colorectal cancer screening, mammography, PSA, etc. If many patients report the procedures have been performed elsewhere or decline such procedures at the time of their hospitalization, clinicians may question the value of collecting this data. At a minimum, clinicians should be involved in deciding what data to collect and should be provided aggregate results (e.g., showing benchmarks, baseline, and improvements). If the results do not show little value, fine tune the practice to be more pertinent, which may require a modification to the EHR, or consider discontinuing the practice and instituting others that have greater value.

Re-evaluate. Continue to work on any issues identified and on identifying other issues. Even when all appears to be working well, new issues may arise or old issues resurface. If issues are permanently resolved, take the time to celebrate. Celebrating success, acknowledging that an issue has been overcome, and inquiring if the data entry seems to be going more smoothly are all elements critical to success.

# Optimizing Strategies for Computerized Physician Order Entry (CPOE)

1. Determine whether you are focused on POC charting in the hospital or in a physician office/clinic environment. While you may need interoperability between these, the settings have differences in workflow and processes that make POC strategies somewhat different.
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# Optimizing Strategies for Clinical Decision Support (CDS)

Clinical decision support (CDS) is a hallmark of the enhanced utility provided by electronic health records (EHR). When thought of as only alerts and reminders, clinicians often consider it an annoyance. Evaluate the CDS embedded in the EHR and determine if and how it can be set to the desired level of sensitivity.

This tool describes the types of CDS and the levels of CDS complexity available in EHRs It also stresses the importance of applying proper change control techniques to determine when it is appropriate to make changes and to track the changes made over time.

## Types of Clinical Decision Support

In general, EHRs have two main types of CDS with respect to how the support displays to the user and whether a response is required. The nature of response and associated documentation are important considerations.

**Active CDS** includes features that require a response by the user, such as alerts, reminders, required fields and templates, and pager messages. The greater the integration of information from multiple sources within the active CDS, the more the intrusiveness is tolerable, as it is better focused on specific patient care needs. The most active CDS requires action either to complete or override the request. If a required field will not permit the user to close the document without action, clinicians often consider it a great annoyance because of the many times they get interrupted. A required field could be turned into a less active request by becoming an unobtrusive reminder that merely displays on a dashboard or is highlighted in color.

**Passive CDS** includes features that do not require a response, such as patient data readily available, and access to knowledge sources, context-sensitive documentation guidance in the form of templates, infobuttons which are context-specific links to topic-specific resources, and hypertext links. The most passive CDS requires no action. For example, an infobutton may appear during data entry the first time a new drug on the market or class of drugs is selected by a user. The icon that appears can be clicked to acquire additional information, but it does not require action.

A number of gradations of activity or passivity are possible. Most users are happy with a template that provides context-sensitive guidance for data entry. The template must have flexibility in data entry requirements, provide for both structured data entry and narrative data entry (in the form of typing, dictation, or speech recognition), permit multiple problems to be addressed simultaneously, and be consistent with the clinical requirements of the practice. Two levels of CDS guidance are generally available:

* Evidence-based CDS is based on actual evidence- or research-based best-practice data. For templates, the evidence is used to identify the appropriate data to be collected, and often includes prompts or reminders to perform certain procedures or suggestions to provide certain treatment regimens. When associated with alerts, if/then algorithms (rules) are based upon and often referenced to a library of medical information (knowledge database). Drug knowledge databases are commonly used in e-prescribing alerts. Some providers consider evidence-based guidance too rigid and others describe it as being non-intuitive. Newer evidence-based guidance often encourages shared decision-making with patients, which some clinicians are not comfortable with. The primary purpose of evidence-based guidance is to ensure that clinical practice is up-to-date and patient-focused.
* Normative-based CDS is generally incorporated into an EHR in the absence of accepted best-practice data. In this case, employ a panel of experts to establish the guidance. A step beyond experts would be to use expert systems (i.e., special statistical processes) to stratify actual results and make clinical inferences that can be useful in guidance for subsequent cases. Most EHRs use a mix of evidence-based and normative-based CDS, but rarely incorporate the expert system technology to improve upon normative-based guidance or to contribute to evidence-based guidance.

Categorizing CDS by describing the functions that EHRs perform, beyond mere documentation, stresses the importance of using the EHR at the point of care, optimizing the potential benefits. Many clinicians make global statements suggesting they don’t like CDS because it is annoying, without recognizing the many forms of CDS that are very helpful and do not create an annoyance.

## Levels of CDS Sophistication

Exhibit 1 Sample Table with Banded Rows

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Data Display | Data Retrieval | Workflow | Data Entry | Decision Making |
| * Data always available * Flow sheets (e.g., problem list, medication list) * Maintain longitudinally * Across continuum * Dynamic displays * Flow sheet/graphic/ table/narrative - helps review data * Clinical imaging integration * Search tools * Query support * Summaries/abstracts * Quickens access, supports continuity of care | * Single sign on (for multiple applications) * Overcomes interface vs. integration (through one system or repository) issues * Ease of navigation aids adoption * Density of screen * “Flip-ability” * Avoids getting lost in drill downs * Specialized formats focuses information * Customized screens * Standards vs. personal preference | * In-basket * Reminders in support of timeliness, compliance * Schedule/patient list * Patient status continuously * Workgroup tools * Easy handoffs * Refills timely/accurate * Referrals timely * Integrated clinical/financial * Overcomes inability to pay for treatment * Telephony, email, instant messaging * Quick response | * Context-sensitive templates guide documentation * Immediate access to active decision support * Improve productivity * Timely care * Can be intrusive * Structured data * Contributes to downstream knowledge * Issues * Screen size * Device weight, heat, placement * Intuitive support | * Invokes supply of knowledge - access to information/resources on a topic * Drug and other rule-based alerts * Reminders * Clinical guidelines and pathways * Chronic disease management * Patient/family preferences * Diagnostic decision support * Use of epidemiologic data * Real-time surveillance |

## Leveling CDS

Active forms of CDS must be appropriately engineered to find the balance between annoying clinicians and enhancing patient care and safety, and improving measurement. Many EHR users advise turning off all CDS, then slowly add what you need. Instead, be judicious about active alerts, monitor utilization including monitoring overrides and complaints, and improve the quality of CDS by appropriately leveling the sensitivity of active alerts.

Some complaints commonly heard about active alerts include:

* May be too general, textbook-like
* May not be actionable.
* Contains too much information that is distracting and time consuming, interfering with clinical judgment
* Does not blend into care processes
* Considered to contribute to extra and unnecessary work
* Complicated to use
* Multi-layered, time-consuming input and query functions
* Problems with inconsistent architectures, insufficient bandwidth, non-standard deficient data, incompatible workflows, and not intuitive
* Incompletely implemented, often in response to resistance

One obstetrician describes prescribing Tucks pads for virtually all deliveries and always getting the alert that indicates “witch hazel should not be administered orally.” An extra click is needed to override the alert. Unfortunately the alert has become routine and an annoyance. This obstetrician suspects that important alerts are ignored as a result.

While not unlike implementing the EHR itself, taking the following steps can be helpful to improve your CDS:

Engage stakeholders.

* Recognize their role in reviewing, approving, and making changes to CDS.
* Understand stakeholders’ clinical goals and objectives, including time constraints, human failings, and human capabilities computers do not have.

Translate clinical goals and objectives into specific CDS.

* Describe desired actions CDS should perform.
* Obtain baseline of performance if necessary to convince stakeholders of importance (e.g., number of times a pharmacist calls that the patient is allergic to a medication should convince a provider using e-prescribing to accept an allergy alert).
* Anticipate desired outcomes. Consider the most important alerts needed and focus on those first.
* Annotate rationale and potential obstacles for instituting each CDS alert type.

Ensure CDS leveling exists in the EHR and use it to set the appropriate level of sensitivity for active alerts. Leveling may include:

* Ability to set drug/drug contraindication alerts as categorized by the drug knowledge database company (minor, moderate, major, never).
* Drug/allergy alerts might be set in accordance with the nature of the reported allergic response to the drug. That information then must be captured in addition to the general name of a drug to which the patient claims to be allergic. Some CDS users prefer as a yes/no setting. Often hospitals prefer to describe each response as minor, moderate, or major and set alerts accordingly.
* Duplicate drug therapy is an alert that seems like it should be easy to manage, but actually requires a sophisticated medication list management process. For example, if a prescription will expire five days from the date of the visit in which the prescription is renewed, an alert is likely to fire as duplicative therapy. It may be desirable to set such alerts for only certain categories of drugs, and/or within certain windows of time. Alternatively, the CDS alerting capacity may be at the drug name level rather than the drug category level and not recognize when a duplicative alert should fire.
* Generic versus brand name drug alerts are becoming increasingly popular. Some practices find this generates so many alerts that they have actually set their e-prescribing to automatically change any brand name drug to a generic unless overridden by the provider. This is an alternative way to level alerts, but must be clear to all users that this is happening and they are on their own to make a change.
* Alerts for duplicative lab and other diagnostic studies testing are becoming popular, especially when clinics are part of a large, multi-specialty group; integrated delivery network; or health information exchange (HIE) where the results of such studies are available from other providers. These alerts may need to incorporate time sensitivity, and have greatest acceptance when test results actually display rather than only receiving an indication that the test was performed elsewhere. If the patient is being seen within the same organization or even HIE, you should be the ability to set consent directives that enable opt-out of some data sharing or provide consent for exchange.
* Preventative care service reminders may or may not be active alerts. Some are designed to simply be present on a dashboard, perhaps marked by a symbol or red lettering when past due. Others are more active, requiring a response. For instance, if the patient is due for colorectal cancer screening, an active alert would trigger a response enabling documentation of the screening, patient report of having had the procedure elsewhere, or procedure declined. The documentation should remain visible and the next related prompt would occur when the system calculates the next screening is due. If the patient declines and it is the policy of the organization to continue asking, you may want to refrain from making that an active alert and manage by policy only. This alert also should enable flexibility in setting the next due date, as conditions may indicate to perform the colorectal cancer screening sooner than the typical requirement. The alert should also enable recording the type of colorectal cancer screening performed and timeframes associated with each.
* Chronic care reminders are often the most difficult to level appropriately. Because patients often return frequently, an alert to perform a diabetic foot exam every three months may be considered annoying by some. The frequency of the visits can prove the alerts most valuable. Evaluate whether the alert should be active or turned into a passive reminder instead. Either way, the ability to generate recall lists or follow up letters for patients due for various chronic and preventative care services is very important and any leveling of the CDS should not impact the ability to generate these.

Ensure all data necessary to support the CDS is available, including adoption of vocabulary standards to increase positive matches between data entered and alerts that are fired. Be cautious of required template fields getting turned off because they are annoying; this may impact the CDS alert that draws from that data source. If a field to capture data is turned off and comments are able to be made in the field, non-standard data likely will be entered, also disrupting the CDS rules.

Describe, select, and build CDS interventions needed to achieve goals at various points in clinical workflow:

* It may be necessary to develop a table of CDS interventions and identify where in the workflow the data to support the CDS is captured and where in the workflow the alert, reminder, or other intervention is intended to occur.
* Evaluate who is best suited for capturing the data needed for CDS—which may be the patient, nurse, or other clinician, rather than the provider.
* Evaluate whether preventative care service reminders should display on a screen typically viewed early or later in the visit based on when such services most likely be discussed with a patient. If a reminder displays too early and it is not an active alert, it can be forgotten. An active alert can be overridden with the intention of actually addressing it later, and then forgotten or require a correction.
* CDS is often considered primarily for clinical care or preventative services, but may also include elements such as positive patient identification, necessary consents, next appointments, distribution of patient educational material, etc.

Review, test, validate, and gain approval for specifications for CDS. This documentation may seem burdensome, but if an EHR has a sophisticated set of CDS provisions and changes are made to it, documenting becomes essential to show that the CDS was reviewed, tested, and approved, and changes made agreed upon by all stakeholders. If changes are made, constructing a test is essential to ensure that any changes anywhere do not negatively impact other functionality.

Train users, implement, and obtain and resolve issues.

Measure and report results, evaluate effectiveness, celebrate success, refine program as needed. Monitoring alert overrides is particularly important. Unintended consequences can occur from misuse of CDS – both in having too much and too little. Processing anything by exception is always prone to error, and making changes often results in a period of time when exceptions or workarounds or only the learning curve can introduce errors that are difficult to work with. These can destroy confidence in CDS – even in the most supportive user. Use a tool such as the table that follows to track overrides, their reasons, and interventions you want to pursue (example in italics).

Exhibit 2 Tracking CD-overrides

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Alert Overridden | By Whom | Circumstance/ Reason | Action | Intervention |
| Duplicate lab test | 0247 | Test performed at a lab not commonly used by clinic | Alert ignored | Determine objection to lab; counsel or set policy |

Ensure CDS is kept up-to-date at all times. For example, if the US Food and Drug Administration has just issued an alert concerning a drug, that alert should factor into the CDS system within 24 hours of issuance. Most e-prescribing systems include a subscription to a drug knowledge database that is updated daily, so CDS alerts from e-prescribing systems generally provide such responsiveness. Not all computerized provider order entry (CPOE) systems in hospitals are connected to such a subscription service, or may not be updated as frequently. Clinics that have providers using CPOE systems in hospitals should be especially attuned to differences so that not all EHRs systems are universally maligned.

**Change Control**

Change control is the process of documenting all changes to information systems. In large organizations, the change control process serves to provide a means to make formal requests for changes, obtain approval for the change to be made, to prioritize the requests if not all can be performed within the timeframe designated, as well as to document exactly what change was made. For smaller organizations, some of these functions may not be necessary, or only may be necessary when the change is requested from the vendor. Documenting what changes were made is vitally important for several reasons:

* A change could have a harmful effect on a patient. You may need to ensure the ability to determine when the change was made, who approved it, under what circumstances the change was made, etc. in order to take corrective action or mitigate risk.
* A change may impact the ability of an interface or other application to work properly. Even after testing to validate a change, you may find that the change has an effect only on an unusual, but potentially harmful event. Or, the change may have been tested in one environment and not another, so that once it is rolled out fully, service may be disrupted until corrected.
* One person, group, or department may ask for changes much more frequently than others. Pinpointing this through documenting all changes may result in further investigation that finds other factors contributing to the change requests that need to be addressed.
* When you receive an upgrade from the vendor, you will need to translate the changes made in the old version to the new version. Having changes documented makes this task much easier. If the vendor is required to make the changes for you, documenting the vendor’s approval for the initial change may reduce disputes.

# Optimizing Strategies for Electronic Medication Administration Record (EMAR)

1. Determine the nature of EMAR you are implementing. The form of EMAR greatly drives the capabilities, as well as the policy and procedure changes you may need to make.
2. If you have not done so already, engage all stakeholders in the process of implementation. While the predominant user of EMAR is nursing, individuals who provide pharmacy, risk management, quality assessment, and procurement services are important to have on board. Even if it is necessary to obtain the services of a pharmacy consultant or more time from someone who can fill in for your pharmacist (a locum tenens), this can be a valuable investment. A physician champion can also be beneficial in ensuring that the physician community understands the new processes and how nurses will be utilizing the system in the administration of medications, monitoring patient reactions, and documenting their activities. Ensuring the proper stakeholders can reduce confusion and increase trust in the new system.
3. Conduct workflow and process improvement mapping to determine how the application being implemented may change current workflows and processes. Ideally you already have mapped, in detail, current workflows and processes and can now identify processes you want to be sure are included in the new application and how improvements can be made. Standardization will be needed, and some processes that may support patient safety will be a bit foreign for staff to implement.
4. Provide the opportunity for all nursing staff and others to be fully trained. Many hospitals report that they brought the pharmacist into the picture too late. Having both nursing and pharmacy involved in the training on the EMAR can ensure that changes are appropriately made in floor stocking, distribution, and other related processes.
5. Determine if your organization has the applications, technology, and operational elements in place to move forward to the bar code medication administration record (BC-MAR) form of EMAR when that may be desired.

## Forms of EMAR

This tool uses the term EMAR to describe a general class of applications relating to electronic assistance with medication administration and its documentation. Several possible forms of applications are listed below, going from the simple to the sophisticated.

**Electronic MAR forms.** These paper forms provide the medication and its administration information printed along with the typical MAR flow sheet structure. The general intent is for pharmacy staff members to generate this form for nursing as a result of entering medication orders in the pharmacy information system. The primary benefit is that these forms should reduce nursing transcription errors, where previously nursing staff would have to record the medications ordered on the MAR and then administer medications and document against the transcribed information. In small and rural hospitals (or long term care facilities), with limited pharmacy staff, nursing staff may generates these forms. The end result is some reduction in transcription errors because the transcription is performed closer in time to the ordering process. The forms also may save nursing time because not every shift has to enter the medication orders as they are administered.

**Bedside medication verification (BMV) systems.** These systems are unique applications (as opposed to a by-product of another process, as is true for the electronic MAR forms). In these applications, the pharmacy system contributes the medication orders to the BMV and nursing staff is prompted when to administer medications, and is able to record the documentation directly into the system. In addition to reducing transcription errors, the timing reminders should aid in timely administration of medications. Other patient safety features in these products may include the ability to visually compare the medication being given against a picture on the computer; provide nursing staff with alerts to potential contraindications as another check between the provider, pharmacist, and nurse; and enable drug knowledgebase (DKB) reference. Some BMV systems may be designed to provide a unit dose dispensing drawer.

**Bar code MAR (BC-MAR) systems.** These systems add the dimension of positive patient identification and thus the medication five rights: right patient, right drug, right time, right dose, and right route. This is accomplished through an application that is similar to the BMV in that it alerts the nursing staff to when medication administration should be performed, provides the clinical decision support on potential medication contraindications, and reference to a DKB. When the system reads the patient’s bar coded wrist band, the bar coded unit dose of the medication, and the nurse’s bar coded identification badge, the checking for right patient, right drug (including dose and route), and right time (scanning the bar codes creates both a time stamp and documents the administration).

## Challenges to Capabilities

All of these systems depend on the right medication having been ordered and the order correctly populating the EMAR system.

If the hospital does not yet have computerized provider order entry (CPOE) system, the transcription into the pharmacy information systems and EMAR system still must take place manually. Ideally this would only need to occur once if the pharmacy and EMAR systems are integrated or interfaced.

The BC-MAR system also depends on the ability to have bar-coded unit doses available. For small and rural hospitals, this can be a significant challenge. You may not be purchasing drugs in unit dose form, which is generally more expensive. You may not stock all the drugs being ordered, as their utilization may not be frequent enough and their shelf life too short to warrant retaining in inventory. Many small and rural hospitals have to supplement their drug inventories with drugs from local retail pharmacies. You can purchase a unit dose drug packaging system, but this is yet another application that adds cost and time to the process. Finally, not all drugs are easily bar coded. Drugs administered through IV bags, for example, can be challenging.

Another challenge, and the reason to engage a pharmacist early in the process, is that the naming conventions of the drugs used in the EMAR may not be the same as the drug names in the pharmacy system. Pharmacy systems generally record drug names using the National Drug Code (NDC), which is a naming convention used in naming packages of drugs. The name of the manufacturer, brand name, serial number, and other such information are all elements embedded in this code. However, when providers enter medications into CPOE systems and when nurses record these medications on a MAR, they may use terminology that is more clinically relevant. A closed-loop medication management system with CPOE, up-to-date pharmacy system, and BC-MAR, would enable mapping to occur automatically for equivalency between the two naming conventions. If the systems are standalone or only generated from a pharmacy system without the mapping on the naming conventions, the result can be confusing.

## Policy and Procedure Changes

When any form of EMAR is adopted, the hospital typically finds a higher reporting of medication errors. The American Hospital Association lists the following as some common types of medication errors:

* Incomplete patient information (e.g., not knowing about patient allergies, other medicines they are taking, previous diagnoses, and lab results).
* Unavailable drug information (such as lack of up-to-date warnings).
* Miscommunication of drug orders, which can involve poor handwriting, confusion between drugs with similar names, misuse of zeroes and decimal points, confusion of metric and other dosing units, and inappropriate abbreviations.
* Lack of appropriate labeling as a drug is prepared and repackaged into smaller units.
* Environmental factors, such as lighting, heat, noise, and interruptions that can distract health professionals from their medical tasks.

Review policies in advance of the implementation of EMAR, and other components of medication management, such as CPOE and medication reconciliation, define terms very carefully. Recognize that actual errors may not have increased more, but the higher number may be due to better reporting. Errors should also be classified by their type, including those that are not errors, but adverse reactions that may have been anticipated and near misses. Different hospitals use different definitions for these concepts, often driven by required reporting systems. The following definitions are supplied by the Agency for Healthcare Research and Quality (AHRQ).

* Adverse drug event, in some reporting systems, is a widely encompassing term referring to actual errors, near misses, and adverse drug reactions. In other reporting systems, adverse drug event refers solely to harm caused by an actual error in medication management. The source of the error may be from one or more sources, as described above. In implementing an EMAR system, one of the most frequent increases in error is due to timing. Many EMAR systems identify a timing error as one with a very narrow window. Reaching agreement on what an acceptable window of time is important; and if the window is smaller than previously due to other reporting requirements, workflow and processes should be studied to determine the impact of this change in definition.
* Near miss is an event or situation that did not produce patient injury, but only because of chance. This good fortune might reflect robustness of the patient (e.g., a patient with penicillin allergy receives penicillin, but has no reaction) or a fortuitous, timely intervention (e.g., a nurse happens to realize that a physician wrote an order in the wrong chart). EMAR systems may be able to identify some of these near misses when an alert or reminder is invoked in the clinical decision support component of the application.
* Adverse drug reaction is an adverse effect produced by the use of a medication in the recommended manner. These effects range from nuisance effects (e.g., dry mouth with anticholinergic medications) to severe reactions (e.g., anaphylaxis to penicillin).

In addition to policies that define errors, another area of policy that should be considered is that relating to adherence to procedures. As the EMAR systems become more sophisticated and especially where they more significantly change workflow, you need to (1) engage nursing staff in all aspects of workflow and process changes during implementation, and (2) ensure that these changes are monitored, either for adherence or for potential need to make adjustments. Unfortunately, many systems are installed with a specific workflow change that staff has not been engaged in understanding or had any input into. As a result, staff finds workarounds to solve either real or perceived problems in workflow. The result can be significantly less patient safety improvement than anticipated and even increases in productivity issues. Be flexible in studying these issues and working through necessary changes, while still putting critical changes into place and solidifying them.

## Assessing Readiness

While the readiness of your hospital for BC-MAR should be assessed long before implementation, many hospitals recognize the need to understand the differences and account for them as they are actually rolling out the system. Determine if your organization has the applications, technology, and operational elements in place to move forward. The publication *Assessing Bedside Bar-coding Readiness,* is an excellent resource for managing your MAR implementation, [www.medpathways.info/medpathways/tools/content/3\_2.pdf](http://www.medpathways.info/medpathways/tools/content/3_2.pdf), developed by the American Hospital Association, Health Research Trust, and the Institute for Safe Medication Practices.