FOCUS: Nursing Informatics

Nursing Admissions Process Redesigned to Leverage EHR

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ABSTRACT

Among the challenges facing nurses in acute care facilities are duplicate documentation, complex rules for coordinating care, and pressure to accelerate patient discharge. Christiana Care, a two-hospital, 900-bed health system in Delaware, redesigned its nursing admissions process to address these issues and provide a centralized source of assessment information. An interdisciplinary team redesigned the assessment process to leverage the clinical documentation, decision support, and workflow tools of Christiana Care’s evolving electronic health record. Nurses use a wireless device at the patient’s bedside to enter admission information. A series of decision-support rules evaluate the information and send electronic referrals to appropriate ancillary departments. Departments electronically document interventions that can be tracked by nursing, closing the loop. A dedicated rollout coordinator and system-generated audit reports were critical to early identification and resolution of several implementation problems. The new process has not only simplified the work of nursing but led to more appropriate referrals to the ancillary departments. More than 25 percent of the patients have information imported from a previous encounter, eliminating duplicate documentation and improving patient satisfaction.

Admission information also is being used to monitor and support a variety of quality efforts, including core measures.

KEYWORDS

- Clinical documentation
- Decision support
- Nursing informatics
- Electronic health record
- Clinical workflow

The admission assessment provides the most critical information regarding the needs of the patient. The information gathered during this initial encounter determines the future needs of the patient via referrals for ancillary department services. This process is one of the increasingly complex documentation requirements today’s nurses must meet in their daily work routine.

Standards set by the Joint Commission on Hospital Accreditation and the Centers for Medicare and Medicaid Services outline specific criteria that must be included in the assessment documentation for each patient.1 Hospital policies and practices dictate when patients should be referred for ancillary services. An effective inpatient nurse referral process involves coordinating a series of communications among many interdisciplinary groups. This process requires a unique set of patient information as well as access to common components of the patient medical record.4

Computerized documentation, done at the bedside during
the initial nursing admission assessment, can help nurses organize information, improve workflow, and provide data that is immediately accessible to other clinicians. The storage of and ability to retrieve basic patient information, from the present encounter and previous encounters, can greatly improve patient satisfaction by eliminating redundant questioning related to baseline data. Electronic charting offers the ability to give patient-centered care, enabling all disciplines to make decisions in an efficient manner.

Today’s nurses are acutely aware that patient discharge planning begins at admission. Rising pressure for increased patient safety, additional patient services and decreased length of stay require nurses to accurately assess patient needs. Complex guidelines also determine which of the hospital’s services are available to meet those needs, and which ancillary departments will provide those services.

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The assessment and referral process also is considered an important part of the electronic health record (EHR). The key defining standard for the EHR is the functional model developed by Health Level Seven. This model sets information system standards for managing assessments under the direct care function (DCF 1.4), managing referrals (DCF 1.9.5), utilizing decision support to facilitate assessments and referrals (DCF 2.1, 2.4.4), and workflow to support these functions (DCF 3.1.1).

This article addresses how a hospital system sought to improve patient care and satisfaction, aid nurses in meeting regulatory requirements, and improve efficiency by implementing an electronic admission and referral process. A summary of how documentation was leveraged, and the utilization of decision-support and workflow capabilities of its evolving EHR is provided. It describes the organizational and technical environment of the facility, the design of the electronic assessment process, implementation challenges, and both anticipated and unanticipated benefits.

**Christiana Care Profile**

Christiana Care is a two-hospital healthcare system located in the Wilmington, DE, area, comprising a large suburban hospital with 680 staffed beds and an urban hospital with 220 staffed beds. Total inpatient admissions in 2004 totaled 52,148, and there were 416,218 outpatient visits. The house staff of 1,100 mostly community-based physicians is supported by 230 residents. The Level One Trauma certified emergency department handles 137,038 visits annually and accounts for about 60 percent of inpatient admissions. Large surgical and cardiology practices are other major contributors to admissions. The system also has a large women and children health service that accounted for 7,241 births in 2004 and is supported by a 50-bed special care nursery.

A total of 40 nursing units operate across the two hospitals. Nursing relies on patient-centered standards of care, which are clinical practice guidelines that are research-based, and standards of nursing practice to guide nursing care. Nursing processes across the two hospitals are standardized. Christiana Care is actively pursuing a goal of becoming certified as a magnet hospital by the American Nurses’ Credentialing Center.

**The Electronic Health Record Evolution**

As with most acute care facilities, Christiana Care is on a journey to implement a fully functional and robust EHR. In 2000, Christiana Care took a major step in its journey when it selected a vendor to provide a core suite of EHR products. In 2001, it implemented the clinical data repository, which includes encounter information, lab results, radiology reports, and transcribed documents. In 2003, the surgical scheduling and pharmacy components of the EHR suite were implemented, along with electronic assessments in the special care nursery.

The legacy order management and the clinical documentation systems that had been in place since the early 1990s were replaced in 2004. This involved implementing clerk order entry, the use of worklists by most ancillary departments, and charging from worklists for these departments. Some clinical documentation was implemented along with decision support rules.

The technical infrastructure supporting the EHR has kept pace with the functionality it supports. In the early 1990s, a very flexible network was built seamlessly connecting the Windows-based workstations across the two hospitals with the ability to "push" applications out to workstations. Nursing units were generally well-equipped with fixed workstations. A wireless infrastructure was installed in 2002, with early use limited mostly to physicians using notebook devices. Remote access to the EHR as well as other applications was also made available.

In 2003, as utilization of the EHR increased and its impact on patient care grew, an initiative to improve the availability and recovery of the system was put in place. In 2005, a single sign-on and context management product was implemented, providing desktop integration of the core EHR software with the Picture Archiving and Communication System and document imaging systems on the desktop.
Before the replacement of the orders and documentation system in 2004 and implementation of the new nursing admission referral process, the heaviest users of the EHR had been physicians, who used it for maintaining patient lists and accessing results. Ancillary departments used a legacy order management system for worklists and charging.

For the most part, nurses did not use the legacy system, instead relying on clerks for the majority of order entry. The exception to this was an online social functional assessment form that was completed by nurses within 24 hours of admission. While this form enabled nurses to make referrals to ancillary departments, it also had become a source of considerable frustration. From a nursing perspective, it did not fit well with the overall workflow surrounding the admission of patients. From an ancillary department perspective, it resulted in both unnecessary referrals and duplicate referrals.

Clinical users, management and information services staff recognized an opportunity to improve this process. With key EHR features already in place—forms, workflow tools, decision support, and the wireless infrastructure—users already had some experience in electronic documentation, and the process itself seemed poised for redesign. As a result, instead of simply duplicating the social functional assessment functionality as part of the new orders and documentation system, a parallel project, the Electronic Admission Referral Process, or EARP, was initiated to fully re-engineer the nurses’ admission and referral process.

### The EARP Design Process

Designing the new EARP began with an interdisciplinary team convened to perform a current-state analysis of the inpatient admission process, to include the social functional assessment and the admission database. Both areas were addressed because they are critical in determining patients’ needs when they arrive at the unit and for discharge planning. The team comprised a project manager/clinical analyst and representatives from each department involved or affected by the process. Both management and staff members were represented. Also included in the analysis were departments that were not affected by the process being examined, but which would potentially be a part of the future process as a result of process improvements.

The team found that the selection of the predefined criteria populated in the electronic social functional assessment system was based on the results of nurses’ observations and interviews with patients and their families or others familiar with the case. These observations and interview information also were documented on the paper admission database. Based on the selected criteria in the assessment, notifications would be generated via e-mail, remote printers, verbally, or through paging, phone, and facsimile transmission to notify specific departments that a need for a referral has been identified and requested.

Throughout the analysis process, the team’s goal was to identify strengths and problem areas of the existing process and to determine the feasibility of processes that were to follow.

The team reviewed the baseline data and found that there was considerable duplicate documentation in nurses’ workflow and that ancillary departments were being flooded with inappropriate referrals via numerous notification methods. The departments spent a significant amount of time reconciling paper referrals, causing unnecessary delays in service. To address the issues, each step of the current state process was documented using detailed flow diagrams. Opportunities for improvement that were identified included decreasing double documentation, aiming for a single source of referrals, increasing efficiency for nurses and supporting departments, decreasing the time needed to notify ancillary departments, and ensuring that pre-defined criteria are standardized and appropriate.

After the current-state analysis, four objectives for improving the process were identified. They were replacing the social functional assessment with an admission process that provides a centralized source of admission data and assessment information in the EHR; ensuring data sharing from previous visits and forms; implementing point-of-care documentation using wireless technology; and incorporating automated, rule-based referrals to notify specific ancillary departments based on admission data entered in the EHR.

The project manager/clinical analyst, with the help of a part-time consultant, worked with each ancillary department and the nursing department to review, refine, and eliminate criteria in the electronic social functional assessment system. Data that was being collected on the paper nursing admission database form was updated, and a determination was made on data that could be shared from other admission forms in the EHR. Existing policies and procedures also were reviewed to ensure that they correlated to the new process.

### An EARP Scenario

To illustrate how the new system would work, here is a scenario involving a fictitious patient that highlights the features of the EARP.

* “…there was considerable duplicate documentation in nurses’ workflow and that ancillary departments were being flooded with inappropriate referrals via numerous notification methods.”*
Mary Smith is an 83-year-old patient who came to the emergency department via ambulance at 10 a.m. April 16, 2005, with breathing problems. Emergency care staff determined at noon that Ms. Smith should be admitted as an inpatient with an admitting diagnosis of congestive heart failure. She arrived on the nursing unit at 12:45 p.m. and was fully assessed by the nurse at 2 p.m.

The nurse wheeled a computer on wheels into the patient’s room, accessed Ms. Smith’s online chart and initiated the EARP. When the form loaded, it pulled in data on Ms. Smith’s clinical history from her previous inpatient admission that had occurred in February. This historical information was reviewed and updated with the patient and the patient’s daughter. Required data related to the current admission also was entered.

Ms. Smith’s responses to a question concerning healthcare services that she currently uses at home indicated that she needed oxygen and a wheelchair. The nurse also noted that Ms. Smith had significant weight loss in the past month. Figure 1 shows the section of the EARP electronic form where these needs were documented. During the interview, the patient also asked to see a priest and receive communion while in the hospital (Figure 2). When completed and signed, the form triggered a set of rules that created orders for pastoral care, case management, respiratory, nutrition, and a reminder to the nurse to evaluate the patient for receiving the pneumococcal vaccine.

Figure 3 shows the patient-specific worklist for Ms. Smith, reflecting all the referrals that were triggered by the rules that fired against the data entered in the form. Pastoral care, case management, respiratory, and nutrition found on their respective worklists a new task for Ms. Smith along with the assessment information that triggered the referral, including demographic details. When the pastoral care rule evoked an order for “pastoral care—Catholic,” it generated a task on the Catholic tab on the worklist to alert the pastoral care staff that this patient should be seen by a priest.

When the referral departments arrived to see Ms. Smith for their assessments, they clicked off the task as complete. The completed task shows the nurse, as part of the original order, that the departments had addressed this referral. The reminder for the nurse for the evaluation of the pneumococcal vaccine on discharge appeared under Ms. Smith’s active orders on the orders tab in the EHR. All of the refer-
rals for Ms. Smith were completed and discharge planning was initiated by 5 p.m. on the first day of her inpatient admission.

**EARP Features and Design Challenges**

Figure 4 depicts the major features and flow of the EARP highlighted in the scenario. There are four key steps to this process—data collection, decision support, workflow integration, and closing the process loop.

**Point-of-care data collection and sharing.** The most significant change in the process was integrating the social functional assessment with the nurse’s overall admissions assessment. When patients are admitted to the hospital in an inpatient status, the admission nurse gathers and documents the necessary admission data within eight hours of the admission. Currently, nursing does not use an electronic worklist so there is no system prompt to initiate the assessment. The nurse uses a wireless computer at the patient’s bedside to enter the assessment information online while interviewing the patient and reviewing hard-copy documentation available in the chart.

The data is collected on an online form that includes 80 data items in four categories—a comprehensive medical history, review of systems, documentation of allergies, and identification of special problems. The approximate time to assess is 12 to 18 minutes. Data from the patient’s previous admissions is pulled forward into many of the fields, reducing the documentation burden for the nurse. When completed, the online form remains in the system and can be accessed electronically if needed. The electronic form is considered part of the legal medical record and is printed for record requests.

There were numerous design challenges in developing the online and integrated form. Some questions appearing on the nurses’ documentation form were formulated by ancillary departments, and they required intense collaboration to ensure that what was being collected would meet the needs of both groups. Existing forms in several other clinical areas were reviewed after the data design of the EARP. Two electronic admission forms used in the cancer center and pre-surgical areas had to be standardized with the EARP to ensure common data, such as current medications and surgical and medical history, would default across forms as well as visits.
Standardized language for shared data elements needed to be negotiated with users and agreed on by each clinical area. A special interdisciplinary documentation committee that reviews and approves all electronic forms played a key role in refining the electronic form and facilitating the sharing of data elements and definitions.8

**Decision support and context-sensitive referrals.**

When the nurse electronically signs the online form, a series of decision-support rules automatically fire against the data entered in the form. The 50 criteria defined in these rules determine what referrals should be generated and which of the 11 ancillary departments should be notified. The rules automatically generate referral orders, which, in turn, create tasks that appear on the worklists of the ancillary departments.

Design challenges included eliciting referral criteria from users that would utilize information that could be reasonably charted by the nurse. The more information collected by the nurse, the more exacting the rule could be written, resulting in more appropriate referrals to the ancillary department. This had to be balanced with the amount of time that a nurse can spend collecting and documenting information.

It was also crucial that both nursing and the ancillary departments agreed on the naming of the specific data elements and the definitions of the data being collected. The downstream notification process set in place needed to seamlessly pass the appropriate information to the supporting departments. Because those departments were not collecting the data, they needed to understand what the nurses’ needs are during admission to be able to discern the meaning and context in the notifications. Another challenge was configuring the vendor’s decision support tool to meet the unique requirements of clinical documentation rules and referrals.

**Integrating with the workflow of the ancillary department.** Many ancillary departments receive and manage other orders on their online worklists in addition to the nurse referrals from the EARP. These electronic worklists were incorporated into the design for several reasons. First, they could be accessed from any location, making responses timelier. Second, they appeared with other items on the department’s worklist, enabling staff to prioritize the referrals against other work. Finally, they provided accountability; tasks could not be lost or easily ignored without detection.
Each department-specific worklist also is designed to ensure that the department’s defined teams have their own lists for the appropriate unit or specific work assignments. This pre-sorted design facilitates the immediate scheduling of the service without additional clerical support. Reasons for the referrals also are listed on the worklist and can be sorted by the user to help prioritize patient needs.

Closing the loop in the interdisciplinary system. As a task is completed on the department’s worklist, the original order that was automatically generated upon admission is updated as “complete,” notifying the nurse and other clinicians of the service delivered. This instant notification of the need for service and then the resulting completion of service to the appropriate caregivers ultimately fosters the collaboration of patient care. The EARP referral orders also appear on a “current orders” report that is printed on every unit at the beginning of shifts. This report supports nurses in planning care for the patient, both for that shift and for the entire patient stay.

Implementation Challenges

The EARP was rolled out across 31 nursing units over a period of six months and represented a very significant change for nurses. It introduced to nursing a more complex type of electronic documentation using wireless devices while interviewing patients at the bedside. Each one of these features was a major change to existing nursing practice. As a result, a dedicated rollout coordinator who was an RN was assigned to manage the implementation.

The rollout coordinator was responsible for ensuring that the hardware deployment, network accessibility and necessary training processes were in place for the rollout to each unit. Consideration was given to the fact that nurses would be learning both a new order entry system as well as new methods of documenting nursing admission information and requesting referrals. Two high-volume nursing units—one surgical and one medical-surgical—were selected as pilot units, based on their staff’s previous history of embracing innovative technologies.

After an introduction of the EARP to each nurse manager, training was initiated the week before rollout. The staff development specialist and superusers for each pilot unit were familiarized with all aspects of the EARP form and assumed responsibilities for training individual nurses. The
rollout coordinator arranged time to speak at staff meetings and held impromptu education sessions on all shifts. This training scenario proved to be successful, and it was used on each unit as the EARP was progressively rolled out.

A few noteworthy problems occurred during implementation. Several issues were related to the computers on wheels. The first laptops were equipped with touchpads, following advice from a study that found clinical staff preferred the touchpad over a mouse. Almost universally, nurses strongly complained that they could not efficiently use the touchpad. After a month-long trial period, a mouse was installed on each cart. Maintaining the battery charge was also an issue. It was clarified with the nursing staff that this was not a technical problem but was the responsibility of the unit; improvements resulted after managers were educated and fliers were placed on the units.

The EARP presented the first critical use of the wireless network, and a number of dead spots were found that previously had not been identified. In addition, sporadic loss of wireless signals occurred on the unit doing the most documentation. Nurses became very frustrated because the loss of signal resulted in the loss of any data previously entered on the form. Everything from the transport helicopter to the microwave in the nurses’ break room was blamed. Eventually, a bug was found in firmware of the wireless network, and once it was resolved, no further problems were observed.

A few nurses said they believed that entering data in the computer while interviewing the patient interfered with the professional nurse-patient relationship. Some nurses were simply uncomfortable with using the computer in front of the patient. These nurses would write patient admission information on a sheet of paper and later enter the data into the system outside the room. Nurse managers were instrumental in explaining the safety benefits of directly documenting in the system, and most of the noncompliant nurses eventually adapted to using the computer at the bedside.

Compliance audits were an important tool for ensuring the effective use of the EARP. Both automated and manual process audits were developed. On a daily basis, an audit report identified patients who had not had an EARP completed within eight hours; the report sorted data by unit, so the implementation coordinator could follow up with the nurse manager or SDS. In addition, every six months, nurse managers review all admission forms for patients on their units, report their results and take appropriate action. Currently, compliance is more than 90 percent, but it is recognized that ongoing monitoring is essential to maintaining this level of performance.

Lastly, fine-tuning of decision-support rules was necessary during the rollout. As careful as ancillary departments were in initially defining referral rules, not all contingencies could be anticipated. For example, a key nursing principle throughout the organization is that “discharge planning begins at admission.” As a result, a larger-than-expected number of nurses selected the option to request “Discharge Planning” on the EARP electronic form. These referrals have flooded the case management worklist with general criteria, making it difficult to prioritize assignments. This and other rules continue to be analyzed and refined to better ensure that the departments are receiving appropriate and specific referrals.

Benefits

The analysis of the effectiveness of the new EARP was primarily achieved through two surveys—one was completed by nurses and the other by ancillary department leaders. The nursing survey was voluntary and administered electronically after the redesign of the system. It asked nurses to rate their level of satisfaction with various dimensions of the EARP. Responses were received from 202 nurses. The ancillary survey was a paper questionnaire completed by the key leader in the department after redesign. Responses were received from nine departments. The survey results and related observations identified and confirmed a number of benefits for the delivery process.

More timely care by ancillary departments. A survey of ancillary department staff revealed that almost 90 percent believed that patients were being seen in a timelier manner as a result of the new process. Overall use of ancillary resources was improved, with 44 percent indicating that the decision-support rules reduced the number of inappropriate referrals. The new system’s ability to integrate referrals with the normal workflow and worklists used by departments appeared to be responsible for these benefits. Some departments reduced efforts by two hours daily by minimizing the time required to sort and manage referrals.

Improved interdisciplinary communication and coordination. The structured documentation of the online form, rules, and use of workflow tools with orders and worklists improved communication between nursing and ancillary departments. Previously, nursing provided more general information on the patient, and once the referral was made, sometimes lost track of the referral. With the new process, ancillary department staff know specifically what led to the referral. Because orders are created that generate worklists, nursing easily can monitor the status of the order to determine what the ancillary department has done. Fewer duplicate referrals are made, and the overall communication and efficiency of the process is better.

Improved clinical documentation compliance, workflow and nurse satisfaction. One of the most important benefits of the revised process involved improvements in clinical documentation and nurse satisfaction. The use of a single standardized form integrated with the workflow of the nurse improved documentation compliance. Almost 80 percent of nurses surveyed indicated that the EARP was an
improvement over the old process. In addition, 50 percent of nurses surveyed found that the EARP took less time than the previous process, while 23 percent felt it took about the same time.

**Reduced duplicate documentation.** One important benefit for nursing was a reduction in duplicate documentation from encounter to encounter. By default, the EARP form includes information, such as the medical history, from earlier encounters where the EARP or similar admission forms were used. This enables the nurse to review the information with the patient instead of redundantly collecting and re-entering information. Currently, more than 25 percent of the EARP forms generated have defaulted information; this is expected to increase to 50 percent as the archive of historical EARP forms grows.

**Reduced length of stay.** Reducing length of stay by accelerating referrals to ancillary departments and improving patient satisfaction through reducing redundant data collection were among the benefits proposed by the project that could not be validated with available data collection tools. Even with such tools, it is unlikely that the impact could be statistically significant in light of the many variables that affect length of stay in a large hospital. Anecdotal evidence suggests this goal was achieved.

**Support for core measures and medication reconciliation.** The information on the patient that is documented in the EHR by the EARP process also has provided other downstream benefits. Other initiatives have leveraged the information collected through the process. For example, data from the EARP now is used to support the CMS core measures for pneumococcal vaccination and smoking cessation. If patients indicate that they have not been administered a vaccine or it is unknown, an order is generated to advise nursing to do an evaluation to vaccinate. The EARP also documents the delivery of smoking cessation materials to patients. If patients indicate that they smoke, there is a field that conditionally activates, requiring the nurse to indicate that smoking cessation materials have been given or the reason that the educational materials were not provided. Data collected through the EARP on home medications are used to provide a printed report to support the JCAHO standard on medication reconciliation.

**Next Steps**

While the EARP was deemed to be a very successful initiative, there were several areas where future enhancements are planned. First, there were a few areas of the hospital such as rehabilitation and pediatrics that were unable to adopt the EARP because of concerns in their specialties or the use of another electronic system, which was the case in the women and children department. Admission referral automation in these areas will be a project for the future. In the meantime, to provide a single source of referrals for ancillary departments, the team designed and created an order set that would be required on admission. When these orders are manually entered in these areas, a task is automatically generated and placed on the specific ancillary worklist.

Data integration between the EARP and other admission forms was largely but not completely achieved. The medical history taken on the admission form for surgical patients did not align with the EARP, and this will be addressed by a future project. In addition, duplicate documentation could be reduced by providing “pre-EARP” documentation in the emergency department, and this is a step that also will be considered in the future. Finally, there are other opportunities to use the EARP to jump-start the care delivery process, such as through problem lists and initiating care plans.

**About the Authors**

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