Systematically Improving Physician Assignment During In-Hospital Transitions of Care by Enhancing a Preexisting Hospital Electronic Health Record

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BACKGROUND: The nationwide expansion of the hospitalist movement brings rapid change in communication and work processes in many hospitals. While our fast-growing hospitalist program has greatly improved length of stay and quality measures, it has also faced complex operational challenges affecting the whole organization rather than just our division: assigning and tracking hospitalist coverage of admitted patients was one of these challenges.

METHODS: We integrated a system of algorithms and interface solutions into our hospital's preexisting electronic health records (EHR) program to act as a decision support tool and computerized safety net during admission and patient distribution. Its main structural elements include: (1) algorithms that identify patients for hospitalist coverage and monitor coverage during transitions of care; (2) EHR data fields that enable hospitalists to assign and update each patient's coverage information in real time; and (3) a combination of display solutions to inform users of coverage arrangements and alert for potentially misassigned patients. Our system assists with correct attending selection on admission. It also assures continuity of coverage during transitions within the hospitalist program and across care settings.

RESULTS: Our enhancements to the EHR received unanimously positive assessment by users and added an important layer of patient safety and organizational efficiency for our hospitalist program.

DISCUSSION: Adaptations of our tools may provide similar opportunities for improvements in a variety of hospitalist settings; an integrated computerized physician order entry (CPOE) system is not a prerequisite. We demonstrate how the presented innovations can be used to enhance other EHR functions as well. *Journal of Hospital Medicine* 2009;4:308–312. © *2009 Society of Hospital Medicine.*

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Preserving continuity of care and assuring patient safety are core values of the hospitalist movement.[1] Communicating clinical information to the patient, the primary care provider (PCP), and hospital-based providers has been recognized in the hospitalist literature as an important domain of quality assurance.[2–9] Correctly identifying a patient's inpatient physician during admission and later in the hospital course is essential to achieve these goals. This initial step has not been specifically addressed in the literature, though the complexity of this process can create significant challenges for larger hospitalist programs.

Rochester General Hospital (RGH) is a 528-bed community teaching hospital. Our hospitalist program evolved from the general medicine unit (GMU) faculty that traditionally cared for most "unreferred" patients; ie, those whose PCPs had no admitting privileges. In 2004, we began covering patients of privilege-holder "partnering PCPs." Within 3 years, more than 120 privileged PCPs decided to refer all their admissions to us, though unreferred cases still make up the majority of our 10,000 annual admissions. GMU hospitalists either round as teaching attendings or attend patients on nonteaching services. Many PCPs continue to admit their own patients.

As our program began to work with numerous partnering PCPs, it became difficult to decide which patients the hospitalist team should be called to admit, and which should be admitted to the PCP. Having the emergency department (ED) providers page the PCPs or their call partners of the PCPs for attending service decisions proved infeasible and unreliable. Additionally, similar challenges emerged later in the hospitalization when patients were transferred from one service, floor, or provider to another, especially from the intensive care unit (ICU) to "the medical service."

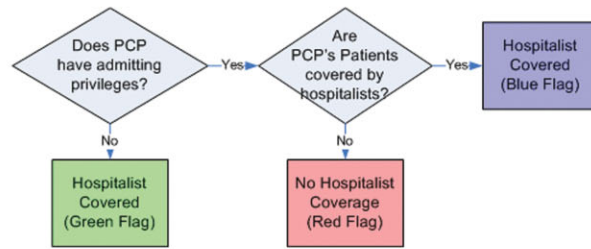**FIGURE 1.** Snapshot of the "Assignment Monitor" special-function census is shown in the middle section. The top section describes the innovations, while the bottom section illustrates how cases on this alert list should be handled in the system (once the potential coverage errors are clarified and the patient's care is appropriately directed).

Errors regarding admissions to the hospitalist service can be classified as:

- Type-I errors: The PCP provides inpatient care but the patient is erroneously admitted to a hospitalist, creating discontinuity of care and dissatisfaction.

- Type-II errors: The PCP refers to the hospitalists but is erroneously identified as the inpatient attending physician. As the hospitalist team is not notified about these cases, admitted patients may go without physician services for a period of time.

TABLE 1. Assignment Monitor Census Algorithms and Definitions

Algorithms

This special census includes patients who meet any of the following criteria:

- Attending physician is a **GMU-MD** and GMU-dr is {*blank*}
- Attending physician is a **GMU-MD** and GMU-status is *GMU-cons, temp-ICU,* or *non-GMU*
- Attending physician is not an **GMU-MD** and GMU-dr is not {*blank*} and GMU-status is not *GMU-cons, non-GMU, or temp-ICU*
- Attending physician is an **ICU-MD** and patient's location is not ED or ICU and GMU-status is not *non-GMU*
- Patient's status is INT (internal medicine in-bed) and PCP has no privilege or is a **GMU-PCPCP** and GMU-dr is {*blank*} and Attending physician is not an **ICU-MD** and GMU-status is not *temp-ICU* or *non-GMU*
- PCP has admission privilege and PCP is not a **GMU-PCPCP** and GMU-dr is not {*blank*} and GMU-status is not *non-GMU or GMU+*
- GMU-status is *temp-ICU* and patient's location is not ED or ICU
- GMU-dr is {*blank*} and GMU-status is *GMU-cons, GMU-ALC or GMU+*
- GMU-dr is -*TBA,* or -*TRD* and present time is between 8 AM and 4 PM

Definitions

Attending physician and PCP refers to the physicians assigned as attending and PCP, respectively in the core EHR system.

Physician categories are defined by listing all belonging members on centrally maintained, up-to-date databases:

- GMU-PCPCP: partnering community PCP physicians who refer their patients to the GMU hospitalist service
- GMU-MD: a GMU hospitalist attending physician
- ICU-MD: a critical care physician who attends in ICU, and automatically transfers most patients to hospitalists upon discharge from ICU

GMU-dr signals acceptance to GMU hospitalist service, and names the hospitalist in the EHR. Temporary assignments (TBA or TRD) are used when the patient is accepted to the hospitalist program, but the rounding physician is not yet known (eg, a patient seen by the night hospitalist in the ED, or waiting reassignment from a weekend). Options include:

- A physician's acronym (from last name and first initial) identifies the rounding hospitalist
- TBA = "to be assigned:" accepted to GMU but not yet assigned to a rounding attending (used for new patients during evening and night hours while under the care of the on call team)
- TRD = "to redistribute" from an attending's care who is leaving service (used for patients whose follow-up coverage is distributed in the next morning by the call team)
- A blank field means no hospitalist service for the patient

GMU-status signals "irregular" rounding relationship with the patient. The following options are used:

- Non-GMU: patient will not be covered by GMU hospitalists (eg, signing off consult, admission to subspecialist service)
- Temp-ICU: patient will not be covered by GMU while in ICU (will automatically accept to GMU upon transfer to floor)
- GMU-cons: patient is on consultation service (GMU is not the attending service)
- GMU-ALC: patient is on "alternative level of care" (skilled nursing needs: no daily rounding by GMU hospitalist)
- GMU+: patient is covered by GMU (despite the PCP not normally referring to GMU)

Methods

RGH has a widely used, clinically focused EHR system that does not offer full CPOE functionality. The EHR includes a database of physicians with admitting privileges, so we decided to store information on the system regarding PCPs' hospitalist coverage. Initially, we simply uploaded a list of our partnering PCPs. However, looking up information from files proved too cumbersome for busy ED providers and hospitalists. Additionally, this solution lacked a feedback loop to alert for errors.

Therefore, we designed a system with 3 main functional elements to identify and display each patient's:

1. candidacy for hospitalist coverage;
2. actual hospitalist coverage; and
3. mismatches between the above statuses.

These steps are explained below, followed by a description of the system's actual utilization. In addition to the text, we demonstrate the concept of and provide detailed information on our system in Figure 1 and Table 1.

First, to identify a patient's candidacy for hospitalist coverage, we created a PCP "color coding" algorithm, based on whether the PCP has admitting privileges at RGH and/or

has arranged hospitalist coverage for her/his patients. Whether or not hospitalist coverage is expected for a given patient's PCP is displayed on the EHR.

Second, a data field called "GMU-dr" was created to describe whether the patient is actually assigned to a hospitalist. The GMU on-call physician assigns a "GMU-dr" to all appropriate patients (ie, updates the field's value). This step acknowledges hospitalist coverage for a given patient and also identifies the hospitalist physician. It simultaneously adds the patient to the appropriate rounding censuses. The "GMU-dr" data field is updated every time the rounding physician changes (eg, for weekend coverage).

Third, the EHR's "assignment monitor" algorithm compares the expected and actual hospitalist coverage (based on PCP "color coding," "GMU-dr," admission type, location, time of day, etc.) and displays mismatches on the "assignment monitor" census. We created this special-function census to include patients with the more dangerous type-II coverage errors that would not show up on our rounding censuses.

The "assignment monitor" census is regularly reviewed by the call physicians and should be cleared of patients.

Unaccounted patients showing up on this census are handled with urgency equal to that of an unseen admission. Most patients on the "assignment monitor" census have missing or incorrect information: correcting that information removes the patient from this alert list. However, some patients with correct information are captured due to an "unusual" relationship with the hospitalist program; eg, consultation or individual exceptions from coverage arrangements. The "GMU-status" field was created to "explain" such situations and remove these patients from the alert list.

Results

According to a survey that was distributed to the 19 eligible hospitalists and returned by 17 (89%), this system greatly improved our admission and patient distribution process, with the following results:

- PCP "color coding" prevents type-I and type-II coverage identification errors more than once a week according to 94.1% and 88.2% of hospitalists, respectively. Ninety-four percent agreed (absolutely or strongly) that "color coding" is a convenient tool to identify PCP referral status.
- The "assignment monitor" identifies patients more than once a month that would have been lost in the preintervention era, according to 94.1% of the hospitalists. All hospitalists surveyed believed that this alert list had several times prevented potentially life-threatening complications, and that the system is more useful than burdensome.
- The "GMU-dr" data field correctly identifies the hospitalist while the attending is misassigned in the core EHR system more than once a week, according to 93.7% of surveyed hospitalists (80% of these stated it happens daily). None believed the system would provide incorrect information with that frequency. Every hospitalist agreed that the "GMU-dr" and "GMU-status" tools are efficient methods for distributing patients, keeping track of attending designations, and maintaining a unit census and personal rounding censuses: cumulatively 85.7% absolutely agreed, while 12.7% strongly agreed.

We also assessed how promptly the call team responded to the "assignment monitor" alerts by correcting the information in the system (the census is recorded every 4 hours). Due to the intensity of the ED call, physicians often just scan this alert list (and take clinical action on the captured patients as needed) without updating the EHR fields until the end of their shifts. Measuring the speed of clearing patients from the census may grossly underestimate the actual usage of the list, though this data is useful to access a worst-case scenario.

During the first week of September 2007 we cared for 270 patients: 52 were captured on the "assignment monitor" before a "GMU-dr" was assigned or the patient was deemed "non-GMU." No patient was recaptured on the list more than 8 hours after the initial appearance.

Discussion

Since we enhanced a widely-used program, our intervention required minimal training. As our innovation was designed and underwent trial by hospitalists, immediate feedback assured user-friendly implementation, good acceptance, and improved workflow.

- "Color coding" eliminated the time-intensive and error-prone lookup of coverage arrangements.
- Updating "GMU-dr" and "GMU-status" in the EHR takes very little time and provides immediate benefits (eg, clearly defined rounding censuses). This task has been integrated into our signout tool, making these functions even more intuitive.
- Using the "assignment monitor" census is fundamental for patient safety, but correcting EHR information creates some additional work for busy call physicians. Implementing this step required active change-management: writing policies, designing metrics, and considering incentives. The call physicians (3 shifts per day) are officially responsible for patient distribution, including clearing the screening census before passing the call pager to the next shift.

We identified some potential limitations, though these issues generally apply to any information technology (IT) implementation: Setting up the program requires an adaptable EHR and close collaboration with the IT department. The system's accuracy depends on correctly identifying the patient's PCP in the EHR. Maintaining and coordinating the data regarding PCP privileges and hospitalist coverage requires a central database has been created.

Meanwhile, we found these tools very useful in solving problems beyond patient distribution:

- PCP "color coding" can export information to other applications about hospitalist coverage and assist ED and nonmedical services to contact the proper medical service for admissions and consults.
- "GMU-dr" and "GMU-status" can be used to create personal rounding censuses, provide billing lists to third-party applications, and support proprietary applications, thus assisting patient distribution decisions and guiding hospital staff to call the patient's correct provider 24/7.
- Special function censuses (defined by algorithms) are now used as alert lists for different patient issues (eg, observational patients staying beyond their allotted time) and by nonhospitalist services.

We presented hospitalist-specific EHR concepts (patient coverage algorithms, special-function censuses, and patient tracking by provider-entered information) and their specific applications in our hospital. We believe our tools can be implemented in various locations and EHRs. Though the challenges may differ from setting to setting (eg, patient distribution between coexistent hospitalist programs, or responding to limitations of resident duty hours), these solutions are highly adaptable and have the potential of providing additional benefits beyond hospitalist coverage issues.

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