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Informatics and Evidence-Based Medicine: Prescription for Success

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Abstract

This article reports on the experience of one organization between 2004 and 2009 to develop an effective people-process-technology system to better manage the quality of health care. The creation of this system started with creating a strategic plan for quality and then establishing a structure to implement the plan. The next phase consisted of establishing a number of simultaneous steps that ranged from identifying and leveraging the appropriate informatics tools to the oversight process, and from the implementation team to strategies for working with clinical groups. The outcome as of 2009 is a well established evidence-based quality process and team in place. There are over 450 evidence-based medicine quality sets. More than 52% of all patients are admitted on quality evidence-based medicine pathways and protocols. This article reflects a successful prescription for combining informatics and evidence-based medicine to improve the quality of health care.

Keywords:

Evidence based medicine, Informatics, Quality of health care, Medical order entry systems, Leadership

Introduction

There are many imperatives for organizations focusing on quality improvement. Health care delivery is not as good as it could be and progress toward a system that reliably delivers high-quality outcomes still has significant challenges [1]. Health care workers (clinical providers and ancillary staff) would like to improve, but achieving high-reliability, quality care cannot be achieved by simply working harder [2]. A new system of care must be created, but it is difficult to move from current practices without organizational leadership to sanction the needed changes and to ensure the importance of this direction [3].

Developing a new system of care is a significant change management/transformation process. This article reflects the experiences of one organization over five years (2004-2009) to improve the quality of health care through an organizational change process [4-6].

Vanderbilt University Medical Center (VUMC) is a comprehensive healthcare facility located in Nashville, Tennessee. VUMC consists of four hospitals: Vanderbilt University Hospital, Monroe Carell Jr. Children's Hospital at Vanderbilt, Psychiatric Hospital at Vanderbilt, and the Vanderbilt Stallworth Rehabilitation Hospital. It is home to the region's only Level I Trauma Center as well as the region's only Level IV Neonatal Intensive Care Unit. There are over 100 ambulatory specialty practices within the Vanderbilt Medical Group and the Vanderbilt-Ingram Cancer Center is Tennessee's only Comprehensive Cancer Center.

During this time period, Vanderbilt's Chief Medical Officer (CMO) had responsibility for the quality of patient care, for oversight and partnership in quality improvement efforts, and in developing systems to sustain high-quality care processes through time. To develop and implement an improved system, the CMO engaged the medical staff, resident physicians, nurses, nurse practitioners, dieticians, social workers, pharmacists, financial counselors, etc. to collaborate in on the goal of creating the most effective quality patient care delivery system possible [7,8].

Methods

In order to create a comprehensive quality effort, the CMO developed a strategic plan with input from multiple VUMC stakeholders. Based on this plan, quality committee structure included a new Quality Council and an Evidence-based Medicine (EBM) Committee, to better support quality-related goals and objectives.

One component of the quality plan was to identify all externally reported measures and develop internal methods for improving all of those metrics. To accomplish this, the following were included as key elements of the plan:

- assigning accountabilities
- developing internal metrics
- creating incentives for the organization
- working on motivation for those involved
- reinforcing our infrastructure to support these efforts

In addition to establishing operational accountability for quality-related items, infrastructure was needed to support achieving institutional goals. This infrastructure included support for determining best evidence applied to particular populations, determining the standardized practice that would be needed to deliver this care in a reliable fashion, and

electronic systems to support the delivery of desired care and also to monitor real-time status of patients with respect to desired care. To this end, an evidence-based medicine committee was established to identify opportunities for improvement, remove barriers to progress, and provide a forum to jump start moving from evidence to practice.

Pre-existing infrastructure was utilized as a platform on which to disseminate and implement evidence-based care pathways. Vanderbilt hospitals had used patient care pathways and order sets for a Clinical Provider Order Entry (CPOE) system for a number of years, but the order sets were not necessarily standardized, nor fully based on evidence. The informatics systems (such as CPOE) provided a platform to more uniformly implement and disseminate evidence-based care pathways to directly impact day-to-day care decisions. Thus, the Informatics organization was a significant component in creating a sustainable system of care that reliably delivers quality care.

With a quality strategic plan developed and a Quality Council in place, it was important to begin an effective organizational implementation process. A key component of the quality strategic plan was ensuring Vanderbilt's order sets and pathways were evidence-based. The initial goal was to begin to transform the organization away from expert-based care, where a lack of standardization can lead to unnecessary variability, to one of standardized, evidence-based care where every patient receives the care that he or she should receive for a given clinical situation, while still allowing appropriate variability to account for differences between patients. To kick-off the initiative, the organization established several simultaneous components to set the stage for success:

Ensured that the appropriate informatics tools and informational resources were available:

- Content creation tools and resources (e.g. order set creation).
- Content "vetting" tools that make comparing and contrasting current evidence with current practice simple and efficient.
- Expert assistance from an Evidence-based librarian to aid in evidence searches where answers are not found in off the shelf resources.

Created an oversight team which was responsible for:

- Approval Process
- Clinical sounding board to help prioritize the work
- For Vanderbilt, this group was the EBM Committee which consisted of the Chief Medical Officer, The Chief Nursing Officer, the Chiefs of staff for the various hospitals, Case Management leadership, and Informatics Leadership.

Established a support model for clinical teams:

- An integrated support team to facilitate this effort was essential. Clinical teams consisted of physicians, nurses, pharmacists, librarians, and informatics professionals we termed "Evidence-based Medicine (EBM) Specialists" to facilitate the work.

Created guidelines for facilitating change with clinical groups:

- Processes were established for contacting the teams, what information to share, sign-off sheets, communication strategies, etc.
- Created operational agreements to promote smooth functioning of work across business units (e.g. timely pharmacy review of orders to facilitate rapid development)

Identified areas of concentration:

- There were over 120 possible concentration areas. These were classified into current stages of "completeness." The eventual stages that evolved were: (1) Promised; (2) Preliminary Work; (3) Well along; (4) Ready for Oversight Group approval; (5) Ready for Case Management and Informatics Implementation; and (6) Completed. As we started "test-driving" this system a significant number of items from the "promised" category were eliminated to enable concentration on those topics that had the highest probability of success.

Alignment of informatics to actively support the initiative:

- CPOE – Content creation, and content clean up. New functionality to improve access to order sets (e.g. the creation of an "admission wizard" as a final common pathway to display order sets related to the admission service as a part of the admission process)
- Enterprise Data Warehouse – Data integration with other systems to track usage and outcomes related to pathway use
- Pharmacy Informatics – to develop clinical decision support to aid in the order creation process (e.g. creating a simplified renal dosing algorithm based on clinical indication for levofloxacin, rather than having the content duplicated across numerous order sets)
- Advanced Analytics – to aid in data analysis (e.g. opportunities for further work, analysis of impact outcomes)
- Content tools (e.g. "canned" evidence-resources such as Zynx Evidence)

The Process

The key in any successful program is not just to start but to think about the barriers, the desired end goal, and begin to design a process that people can understand and that can be used repeatedly. At the beginning of this initial phase, the needed products were purchased, the appropriate tools were created, and appropriate staff were engaged. This became a team effort. In order to identify efficient methods of developing evidence-based pathways and order sets, multiple development models were tried, with the idea that one of the models would prove superior to the others. Models that were tried included ones where multiple physician "leads" were involved, a model with a single physician lead researching evidence and creating the practice, and a model that utilized a team to facilitate the evidence discussion and content creation with the clinical team. The facilitative model proved most successful in terms of efficiency of time for the clinical

experts, as well as the ability to rapidly achieve consensus around a standard "Vanderbilt" practice. This model served as the basis for all ongoing work to support the EBM order set effort, and is still in place.

Developing and implementing content, however, is only part of the story. A major challenge is whether or not clinical teams view the content as their own, or whether they view it as owned by informatics or operations. If the former, clinicians are much more likely to use the order sets. Critical to achieving this view was the approach taken by the EBM Specialists while facilitating the clinical teams. The approach was one where the EBM Specialist asked the question "What to you defines good care for this patient population" and the resultant practices specified by the clinical team were then implemented. We found that by taking this approach, we mitigated fear by the clinical team that the EBM process would dictate care, and we also reassured the team that the organization would support what they considered to be best care. In other words, informatics, operations, and the clinical staff formed a partnership for success, with all parties focused on an end goal of reliable, high-quality care. In following this process, all evidence-based considerations were included, but were voiced first by the clinical team, thus establishing direct ownership of content by the team rather than informatics. The approach also consisted of a structure to support this ownership strategy [9].

The Clinical Teams

Each clinical work group consisted of physicians, nurses, a pharmacist, a librarian, and an EBM specialist. The EBM specialist facilitated clinical team meetings and built evidence packets that linked evidence directly to orders in current order sets (e.g. our current practice). The evidence packets focused helped clinicians focus discussion on desired practice. In addition to the evidence packets, a key feature of the teams was to assign a single physician lead. The lead was chosen strategically, and was specifically not a person who was viewed by peers to be a "techy" person. It was critical to find a leader who was clinically respected and whom others could identify with. Once selected, the physician lead served as the broker of agreements with other physicians to standardize practice where practice might vary but where standardization could prove beneficial. This was done outside of the team meetings in a one-on-one fashion and proved very successful. Previous to this, physicians often felt a need to justify practice differences, which lead to difficulty in coming to consensus. The "off-line" nature of the new model, greatly improved establishing a consensus, as well as fostered further "ownership" by the clinical team.

To more effectively facilitate arriving at a standardized "Vanderbilt" practice, evidence is presented to the clinical teams in a focused way. This allows the work group team to come to consensus on how they will treat a particular population of patients. The focus was not on "follow this guideline," but rather on "based on this evidence what would you like to do in taking care of these patients?" To accomplish this part of the process there were three key components:

1. Identifying the members of the clinical work group team, defining everyone's roles and structuring the team for more effective outcomes
2. Having evidence resources available that streamlined the looking at the evidence related to an orderable and order sets
3. Feeding back information on order set usage and performance to the clinical teams, so they can track to the kind of care they intended to deliver.

We were strategic about how the clinical teams were structured. For example, the physician lead is someone who needs to be respected by the other physicians in that group, someone whom other physicians would follow. The desire was to have other physicians trust and identify with the leader such that they would say, "Yes, that's a good way – I could do that as well." This physician then brokers any areas where there is disagreement among physicians or other members of the clinical team. Division chiefs or the department chairs were to identify the work needed, to help to prioritize, and identify the leaders. This was to ensure that the effort had upper level ownership. Residents and/or fellows were also included on the team. When needed, an Evidence-based Librarian completes more extensive searches.

Evidence Resources

For streamlined evidence resources, the EBM Specialists create "Evidence Packets" that list available evidence from a variety of sources, and organize the evidence around a template order set. Directly listing evidence for specific orderable items allows the clinical teams to focus their discussion, rather than having to deal with an entire corpus of evidence all at once. This process helps in developing consensus.

The CPOE System

Vanderbilt University Medical Center has a computerized provider order entry (CPOE) system. CPOE is an excellent mechanism to embed evidence-based guidelines and display to clinicians at the time of they are implementing orders. This is accomplished mainly through order sets that are lists of individual items that someone might want to use at a particular phase of patient care. For example, on admission to the hospital for congestive heart failure (CHF) exacerbation, there are a set of things that need to be initiated. A CHF admission order set is targeted to that particular phase of care to make the "right thing" easy to do. Later when the patient is moved to another phase of care another related order set is available and finally at discharge yet another order set is available. Making these order sets evidence-based was one of the avenues for affecting our inpatient care and we wanted consensus from the clinical teams about practice.

Reports to show actual performance with respect to desired performance

Feedback is provided for those items that clinical teams identified as key elements of the evidence-based care pathways. For example, one group explicitly added an evidence-based pain management section to their post-op order sets. This usage information could be provided to the clinical team that showed how often various pain management items

within the order set were being used. This allowed the clinical team to address potential issues with appropriate management of post-op pain.

Results

To date the process has been very successful. There are over 450 evidence-based order sets in the system with new ones being created all the time. Over 52% of all patients are admitted on EBM order sets. The basic process from four years ago continues and is built on a foundation of agreeing to a standard "Vanderbilt" practice that is based on evidence. Once agreement is reached, the order sets are created, utilization is monitored, and the data are provided to clinical teams to optimize use and performance within the desired practice. Data are reported to clinical teams to a) ensure that the order sets are being used; b) ensure that components of the order set are used in the manner that was planned; and c) to track to desired patient outcomes.

Monitoring is a critical component that enables the Evidence-based Medicine Specialists to serve in a facilitative partnership role with clinical teams helping them deliver correct and desired care to patients and drive that care toward desired outcomes. Utilization data is critical to promoting appropriate use and further promoting ownership of the content by the clinical teams. For example, a new order set may be created but after a few months it may not have been used. The reasons for this could be several, including the fact that people may not be able to find it in the system. Each of our order sets has synonyms associated, and it is possible that commonly entered terms that relate to a particular order set may not bring up the order set in the list of search results. For example, "Succinylcholine" is ordered for certain types of intubation protocols, but when typed in by a physician, order sets that pertain to these protocols were not showing in the search results. Adding Succinylcholine as a synonym resolves this issue, making the order set easier to find.

Order set usage data are important to ensure that the content is being used, but order set usage does not tell the story of *how* the content is being used. Order Set *Performance* is monitored to show the utilization of individual orders within an evidence-based order set. This can be viewed for a single patient (i.e. which elements did a single patient receive) and also in aggregate to see what percentage of the time certain elements are used across patients. For example, when the stroke admission order set was examined, orders for aspiration precaution were not utilized as often as the clinical team preferred. The patient population being evaluated had 100% of the patients on the clinical pathway but only 38% of those patients had orders for aspiration precautions. These data when presented to the clinical team caused them to investigate what elements of care workflow needed to be changed in order to ensure high performance with desired care. Discussion included whether or not this should be a standard of care for the unit and therefore did not need an order or whether they wanted an order "in the chart" for aspiration precautions to drive appropriate care. This case illustrates that with only simple order set utilization information, we could have been satisfied that 100% of the patients that came in with stroke were on the stroke pathway. However, after investigating the details of the performance with the desired care for these patients it was discovered that we were not at the 100% level and had additional work to accomplish this goal.

Our system allows us to know if an order set is being used, and also if we are performing as desired with respect to key evidence-based elements of the order set. However, once all is performed as planned, what does that mean for patient outcomes? This is a more difficult item to track. Looking at common outcome measures such as risk-adjusted observed to expected mortality, observed to expected readmission rate, and observed to expected length of stay is one major approach. Another approach that is being pursued is to have clinical teams and other groups define measures of clinical quality and build in capture of these data wherever possible, including using physician note templates, and automated capture from devices and other clinical systems such as bar-code medication administration systems. The plan is to aggregate these data and develop a more comprehensive picture of quality outcomes that extend across the inpatient-outpatient paradigm, and then associate performance and practice data with outcomes. This is the final piece in closing the loop for quality and is proving a challenge to accomplish. However, this is critical in ensuring that the desired care leads to desired outcomes. Each component of data feedback cycles back into the desired practice to inform whether or not changes are warranted. This basic approach for creation of evidence-based content in the form of order sets has been utilized for more complex evidence-based advisors that include complex logic within the order entry system as well as initiatives to reduce ventilator associated pneumonia, and other "hospital acquired conditions," such as pressure ulcers, falls, and reduction of adverse drug events. The Evidence-based Medicine Team is truly a partnership between IT and clinical teams to identify, establish, and implement standard practices and ensure reliable, high quality care that tracks to desired patient outcomes.

Discussion

It is easy to say that you would like to start an evidence-based medicine program so that the majority of patients are admitted to the hospital or treated in an ambulatory area using evidence-based practices. From a leadership perspective there are barriers that arise that make this difficult. The following are a few of the barriers.

Getting Started

Our first attempt with starting this effort was to hire a retired physician who had worked with evidence in the past to head this program. This was not successful. At this point an internal person from informatics with the leadership skills and the process knowledge to basically take what she called "going through the rainforest with a machete" to figure out where the roads actually could be or should be. She started a process that helped align people in the direction desired.

Agreeing on the resources

When starting this we did not know how many staff were needed, what type of electronic resources were required, etc. It

took several attempts at creating evidence-based medicine packets to know the needed resources. For example, library and pharmacy professionals needed to be included in the core team. The team needed to be staffed by nurses who were in the "bridge" role between the evidence based medicine information and the practitioners in the clinical areas.

The right leadership

The evidence-based medicine process needed the right leadership to be in charge of it. After an initial start it was determined that there was an informatics based physician who understood this process, had a personality to engage clinical and non-clinical staff, and had the style to create teams. That person was selected to lead this effort on an on-going basis and has demonstrated excellence in this area for a number of years.

Converting the doubters

When you live in an academic institution everyone is certain that they are the "world expert" and therefore evidence-based medicine is what they are creating or what they are doing. It was extremely important to show that the experts can make changes in their practices that would ensure and drive higher quality. To this end, the approach in achieving clinician ownership of order sets and pathways, coupled with ongoing support through data reports and iterative improvement established a new way of working that built momentum over time. People who started off on the sidelines saying "Evidence-based Medicine is cookbook medicine" began to say "Why didn't you work with me first?"

Conclusion

To have a successful link with informatics and evidence-based medicine requires leadership at the senior levels of the organization and at the process/operational level. It requires process metrics, measures of *performance*, and clinical teams that understand and respect feedback to enable the highest quality of patient care. Further, links to clinical outcomes are critical to ultimately assess the effectiveness of the implemented order sets and pathways. The implementation methodologies used, created a framework in which trust developed between clinical teams and informatics, and enabled true partnerships to flourish in which the pursuit of clinical excellence and excellence in patient outcomes is the goal.

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