

Curriculum Development: The Venous Thromboembolism Quality Improvement Resource Room

Sylvia McKean, MD¹
 Jason Stein, MD²
 Greg Maynard, MD³
 Tina Budnitz, MPH⁴
 Alpesh Amin, MD⁵
 Scott Johnson⁴
 Larry Wellikson, MD⁴

¹ Department of Medicine, Brigham and Women's Hospital, Harvard Medical School, Boston, Massachusetts

² Department of Medicine, Emory University Hospital, Emory University School of Medicine, Atlanta, Georgia

³ Department of Medicine, University of California at San Diego Medical Center, University of California, San Diego, California

⁴ Society of Hospital Medicine

⁵ Department of Medicine, University of California at Irvine Medical Center, University of California Irvine College of Medicine, Irvine, California

The VTE Resource Room was supported in part by an unrestricted educational grant from Sanofi-aventis.

Dr S. McKean received speaking honoraria from Sanofi-aventis.

Dr A. Amin is a consultant for Sanofi-aventis and serves on its speakers' bureau. He received no direct financial support for the VTE resource room project or for this article.

BACKGROUND: The role of the hospitalist has evolved over the last decade, with hospitalists increasingly being asked to lead systems-based initiatives to improve the quality of inpatient care. The educational strategy of the Society of Hospital Medicine (SHM) includes development of practice-based resources to support hospitalist-led improvement in clinically important measures of hospital care quality.

OBJECTIVE: To develop a resource at the SHM Web site to present quality improvement (QI) principles for systems-based care in the hospital and to help individual hospitalists improve specific patient outcomes.

DESIGN: The SHM defined the role of the hospitalist in QI, performed an assessment of the educational needs of hospitalists, and executed a Web-based educational strategy to address these needs. The organization identified the most common cause of preventable inpatient deaths, hospital-acquired venous thromboembolism (VTE), and prioritized the need to improve prophylaxis.

RESULTS: This new resource at the SHM Web site presents principles for conducting QI in the hospital. To enable learning that is practice based, the VTE Quality Improvement Resource Room (QI RR) features Ask the Expert, an interactive discussion community, and an original Improvement Workbook, a downloadable project outline and tutorial that hospitalists can use to guide and document steps in an effort aimed at reducing hospital-acquired VTE.

CONCLUSIONS: This QI resource serves as a template for the development of subsequent hospital-based resources. User feedback will refine the QI RR and its format so that similar offerings can target other significant inpatient problems. Additional research is needed to evaluate learning and the clinical impact of this quality improvement resource on hospital performance measures and patient outcomes. *Journal of Hospital Medicine* 2006;1:124–132. © 2006 Society of Hospital Medicine.

KEYWORDS: curriculum development, quality improvement, web-based education, hospitalist.

The goal of this article is to explain how the first in a series of online resource rooms provides trainees and hospitalists with quality improvement tools that can be applied locally to improve inpatient care.¹ During the emergence and explosive growth of hospital medicine, the SHM recognized the need to revise training relating to inpatient care and hospital process design to meet the evolving expectation of hospitalists that their performance will be measured, to actively set quality parameters, and to lead multidisciplinary teams to improve hospital performance.² Armed with the appropriate skill set, hospitalists would be uniquely situated to

lead and manage improvements in processes in the hospitals in which they work.

The content of the first Society of Hospital Medicine (SHM) Quality Improvement Resource Room (QI RR) supports hospitalists leading a multidisciplinary team dedicated to improving inpatient outcomes by preventing hospital-acquired venous thromboembolism (VTE), a common cause of morbidity and mortality in hospitalized patients.³ The SHM developed this educational resource in the context of numerous reports on the incidence of medical errors in US hospitals and calls for action to improve the quality of health care.⁴⁻⁷ Hospital report cards on quality measures are now public record, and hospitals will require uniformity in practice among physicians. Hospitalists are increasingly expected to lead initiatives that will implement national standards in key practices such as VTE prophylaxis².

The QI RRs of the SHM are a collection of electronic tools accessible through the SHM Web site. They are designed to enhance the readiness of hospitalists and members of the multidisciplinary inpatient team to redesign care at the institutional level. Although all performance improvement is ultimately occurs locally, many QI methods and tools transcend hospital geography and disease topic. Leveraging a Web-based platform, the SHM QI RRs present hospitalists with a general approach to QI, enriched by customizable workbooks that can be downloaded to best meet user needs. This resource is an innovation in practice-based learning, quality improvement, and systems-based practice.

METHODS

Development of the first QI RR followed a series of steps described in *Curriculum Development for Medical Education*⁸ (for process and timeline, see Table 1). Inadequate VTE prophylaxis was identified as an ongoing widespread problem of health care underutilization despite randomized clinical trials supporting the efficacy of prophylaxis.^{9,10} Mirroring the AHRQ's assessment of underutilization of VTE prophylaxis as the single most important safety priority,⁶ the first QI RR focused on VTE, with plans to cover additional clinical conditions over time. As experts in the care of inpatients, hospitalists should be able to take custody of predictable complications of serious illness, identify and lower barriers to prevention, critically review prophylaxis options, utilize hospital-specific data, and devise strategies to bridge the gap between knowledge and

TABLE 1
Process and Timelines

Phase 1 (January 2005–April 2005): Executing the educational strategy

One-hour conference calls

- Curricular, clinical, technical, and creative aspects of production
- Additional communication between members of working group between calls
- Development of questionnaire for SHM membership, board, education, and hospital quality patient safety (HQPS) committees

Content freeze: fourth month of development

- Implementation of revisions prior to April 2005 SHM Annual Meeting

Phase 2 (April 2005–August 2005): revision based on feedback

- Analysis of formative evaluation from Phase 1
- Launch of the VTE QI RR August 2005

Secondary phases and venues for implementation

- Workshops at hospital medicine educational events
- SHM Quality course
- Formal recognition of the learning, experience, or proficiency acquired by users

The working editorial team for the first resource room

- Dedicated project manager (SHM staff)
 - Senior adviser for planning and development (SHM staff)
 - Senior adviser for education (SHM staff)
 - Content expert
 - Education editor
 - Hospital quality editor
 - Managing editor
-

practice. Already leaders of multidisciplinary *care* teams, hospitalists are primed to lead multidisciplinary *improvement* teams as well.

Available data on the demographics of hospitalists and feedback from the SHM membership, leadership, and committees indicated that most learners would have minimal previous exposure to QI concepts and only a few years of management experience. Any previous quality improvement initiatives would tend to have been isolated, experimental, or smaller in scale. The resource rooms are designed to facilitate quality improvement learning among hospitalists that is practice-based and immediately relevant to patient care. Measurable improvement in particular care processes or outcomes should correlate with actual learning.

The educational strategy of the SHM was predicated on ensuring that a quality and patient safety curriculum would retain clinical applicability in the hospital setting. This approach, grounded in adult learning principles and common to medical education, teaches general principles by framing the learning experience as problem centered.¹¹ Several domains were identified as universally important to any quality improvement effort: raising awareness of a local performance gap, applying the best current evidence to practice, tapping the experience of

others leading QI efforts, and using measurements derived from rapid-cycle tests of change. Such a template delineates the components of successful QI planning, implementation, and evaluation and provides users with a familiar RR format applicable to improving any care process, not just VTE.

The Internet was chosen as the mechanism for delivering training on the basis of previous surveys of the SHM membership in which members expressed a preference for electronic and Web-based forms of educational content delivery. Drawing from the example of other organizations teaching quality improvement, including the Institute for Healthcare Improvement and Intermountain Health Care, the SHM valued the ubiquity of a Web-based educational resource. To facilitate “on-the-job training,” the first SHM QI RR provides a comprehensive tool kit to guide hospitalists through the process of advocating, developing, implementing, and evaluating a QI initiative for VTE.

Prior to launching the resource room, formative input was collected from SHM leaders, a panel of education and QI experts, and attendees of the society’s annual meetings. Such input followed each significant step in the development of the RR curricula. For example, visitors at a kiosk at the 2005 SHM annual meeting completed surveys as they navigated through the VTE QI RR. This focused feedback shaped prelaunch development. The ultimate performance evaluation and feedback for the QI RR curricula will be gauged by user reports of measurable improvement in specific hospital process or outcomes measures. The VTE QI RR was launched in August 2005 and promoted at the SHM Web site.

RESULTS

The content and layout of the VTE QI RR are depicted in Figure 1. The self-directed learner may navigate through the entire resource room or just select areas for study. Those likely to visit only a single area are individuals looking for guidance to support discrete roles on the improvement team: champion, clinical leader, facilitator of the QI process, or educator of staff or patient audiences (see Figure 2).

Why Should You Act?

The visual center of the QI RR layout presents sobering statistics—although pulmonary embolism from deep vein thrombosis is the most common cause of preventable hospital death, most hospitalized medical patients at risk do not receive appro-

priate prophylaxis—and then encourages hospitalist-led action to reduce hospital-acquired VTE. The role of the hospitalist is extracted from the competencies articulated in the Venous Thromboembolism, Quality Improvement, and Hospitalist as Teacher chapters of *The Core Competencies in Hospital Medicine*.²

Awareness

In the Awareness area of the VTE QI RR, materials to raise clinician, hospital staff, and patient awareness are suggested and made available. Through the SHM’s lead sponsorship of the national DVT Awareness Month campaign, suggested “Steps to Action” depict exactly how a hospital medicine service can use the campaign’s materials to raise institutional support for tackling this preventable problem.

Evidence

The Evidence section aggregates a list of the most pertinent VTE prophylaxis literature to help ground any QI effort firmly in the evidence base. Through an agreement with the American College of Physicians (ACP), VTE prophylaxis articles reviewed in the ACP Journal Club are presented here.¹² Although the listed literature focuses on prophylaxis, plans are in place to include references on diagnosis and treatment.

Experience

Resource room visitors interested in tapping into the experience of hospitalists and other leaders of QI efforts can navigate directly to this area. Interactive resources here include downloadable and adaptable protocols for VTE prophylaxis and, most importantly, improvement stories profiling actual QI successes. The Experience section features comments from an author of a seminal trial that studied computer alerts for high-risk patients not receiving prophylaxis.¹⁰ The educational goal of this section of the QI RR is to provide opportunities to learn from successful QI projects, from the composition of the improvement team to the relevant metrics, implementation plan, and next steps.

Ask the Expert

The most interactive part of the resource room, the Ask the Expert forum, provides a hybrid of experience and evidence. A visitor who posts a clinical or improvement question to this discussion community receives a multidisciplinary response. For each



FIGURE 1. QI Resource Room Landing Page.

question posted, a hospitalist moderator collects and aggregates responses from a panel of VTE experts, QI experts, hospitalist teachers, and pharmacists. The online exchange permitted by this forum promotes wider debate and learning. The questions and responses are archived and thus are available for subsequent users to read.

Improve

This area features the focal point of the entire resource room, the VTE QI workbook, which was

written and designed to provide action-oriented learning in quality improvement. The workbook is a downloadable project outline to guide and document efforts aimed at reducing rates of hospital-acquired VTE. Hospitalists who complete the workbook should have acquired familiarity with and a working proficiency in leading system-level efforts to drive better patient care. Users new to the theory and practice of QI can also review key concepts from a slide presentation in this part of the resource room.

From the "Improve" section, download and print the **QI Workbook: VTE**. Put it into a 3-ring binder and use it both to sequence and document your improvement effort. Hospitalists new to quality improvement may wish to view key concepts in QI Theory from the 60-slide **QI Theory** presentation.

From the "Lead With" section, use any content that meets your local needs. Adapt an array of tools to raise institutional awareness. Review a synopsis of the VTE literature. Learn from the experience of others by downloading varying models of VTE protocols and by reading the lessons profiled in the shared improvement stories. Any specific question can also be posted, prompting a response from SHM's panel of VTE and QI experts. The panel responses are carefully constructed with input and review from pharmacists, subspecialists, and hospitalists with VTE or QI expertise.

From the "Educate" section, download the VTE slide presentation compiled and maintained by an SHM content expert. Adapt it to lecture students, residents, or other hospital staff. Hospitalist-Educators can enhance their bedside teaching of VTE by reading ward-based teaching pearls submitted by SHM members.

FIGURE 2. Suggested uses of content areas in the VTE QI Resource Room.

Educate

This content area profiles the hospital medicine core competencies that relate to VTE and QI while also offering teaching materials and advice for teachers of VTE or QI. Teaching resources for clinician educators include online CME and an up-to-date slide lecture about VTE prophylaxis. The lecture presentation can be downloaded and customized to serve the needs of the speaker and the audience, whether students, residents, or other hospital staff. Clinician educators can also share or review teaching pearls used by hospitalist colleagues who serve as ward attendings.

DISCUSSION

A case example, shown in Figure 3, demonstrates how content accessible through the SHM VTE QI RR may be used to catalyze a local quality improvement effort.

Hospitals will be measured on rates of VTE prophylaxis on medical and surgical services. Failure to standardize prophylaxis among different physician groups may adversely affect overall performance, with implications for both patient care and accreditation. The lack of a agreed-on "gold standard" of what constitutes appropriate prophylaxis for a given patient does not absolve an institution of the duty to implement its own standards. The challenge of achieving local consensus on appropriate prophylaxis should not outweigh the urgency to address preventable in-hospital deaths. In caring for increasing numbers of general medical

and surgical patients, hospitalists are likely to be asked to develop and implement a protocol for VTE prophylaxis that can be used hospitalwide. In many instances hospitalists will accept this charge in the aftermath of previous hospital failures in which admission order sets or VTE assessment protocols were launched but never widely implemented. As the National Quality Forum or JCAHO regulations for uniformity among hospitals shift VTE prophylaxis from being voluntary to compulsory, hospitalists will need to develop improvement strategies that have greater reliability.

Hospitalists with no formal training in either vascular medicine or quality improvement may not be able to immediately cite the most current data about VTE prophylaxis rates and regimens and may not have the time to enroll in a training course on quality improvement. How would hospitalists determine baseline rates of appropriate VTE prophylaxis? How can medical education be used to build consensus and recruit support from other physicians? What should be the scope of the QI initiative, and what patient population should be targeted for intervention?

The goal of the SHM QI RR is to provide the tools and the framework to help hospitalists develop, implement, and manage a VTE prophylaxis quality improvement initiative. Suggested "Steps to Action" in the Awareness section depict exactly how a hospital medicine service can use the campaign's materials to raise institutional support for tackling this preventable problem. Hospital quality officers

The Problem (AHRQ): Underutilization of VTE prophylaxis in hospitalized patients

A Progressive Perception (from a physician leader of a community hospital): “VTE prophylaxis among hospitalized patients merits a closer look with each passing year. As the hospitalized patient population becomes progressively more aged and debilitated, and prophylaxis options become more numerous and better defined, a percipient and succinct resource on the subject assumes even greater importance.”

A Contrasting Perception (from an attending physician): “We always prophylax our patients for venous thromboembolism.”

The Gap Between Knowledge and Practice (DVT-Free Registry): This prospective study of medical inpatients, who subsequently developed VTE at 183 sites when hospitalized for another reason, showed that in 50% of the cases prophylaxis was omitted and in the other 50% prophylaxis was inadequate, (despite three randomized clinical trials demonstrating clear benefit from pharmacologic prophylaxis: MEDENOX 1999, ARTEMIS 2003, PREVENT 2004).

The Regulatory Reality (JCAHO): In 2004 JCAHO announced ten national pay-for-performance principles, adding an alignment of structured incentives for provider performance to traditional accreditation requirements. By 2007 U.S. hospitals may be viewing mandatory VTE risk assessments as either a pay-for-performance “core measure” or a requirement of accreditation.

The Role of the Hospitalist (Core Competencies in Hospital Medicine): Lead, coordinate, or participate in quality improvement initiatives to improve primary prevention of VTE in the hospital setting, and diagnosis and treatment of VTE.

FIGURE 3. Case example: the need for quality improvement.

can direct the hospital’s public relations department to the Awareness section for DVT Awareness Month materials, including public service announcements in audio, visual, and print formats. The hold music at the hospital can be temporarily replaced, television kiosks can be set up to run video loops, and banners can be printed and hung in central locations, all to get out the message simultaneously to patients and medical staff.

The Evidence section of the VTE QI RR references a key benchmark study, the DVT-Free Prospective Registry.⁹ This study reported that at 183 sites in North America and Europe, more than twice as many *medical* patients as *surgical* patients failed to receive prophylaxis. The Evidence section includes the 7th American College of Chest Physicians Consensus Conference on Antithrombotic and Thrombolytic Therapy and also highlights 3 randomized placebo-controlled clinical trials (MEDENOX 1999, ARTEMIS 2003, and PREVENT 2004) that have reported significant reduction of risk of

VTE (50%-60%) from pharmacologic prophylaxis in moderate-risk medical inpatients.¹³⁻¹⁵ Review of the data helps to determine which patient population to study first, which prophylaxis options a hospital could deploy appropriately, and the expected magnitude of the effect. Because the literature has already been narrowed and is kept current, hospitalists can save time in answering a range of questions, from the most commonly agreed-on factors to stratify risk to which populations require alternative interventions.

The Experience section references the first clinical trial demonstrating improved patient outcomes from a quality improvement initiative aimed at improving utilization of VTE prophylaxis.¹⁰ At the large teaching hospital where the electronic alerts were studied, a preexisting wealth of educational information on the hospital Web site, in the form of multiple seminars and lectures on VTE prophylaxis by opinion leaders and international experts, had little impact on practice. For this reason, the inves-

tigators implemented a trial of how to change physician behavior by introducing a point-of-care intervention, the computer alerts. Clinicians prompted by an electronic alert to consider DVT prophylaxis for at-risk patients employed nearly double the rate of pharmacologic prophylaxis and reduced the incidence of DVT or pulmonary embolism (PE) by 41%. This study suggests that a change introduced to the clinical workflow can improve evidence-based VTE prophylaxis and also can reduce the incidence of VTE in acutely ill hospitalized patients.

We believe that if hospitalists use the current evidence and experience assembled in the VTE QI RR, they could develop and lead a systematic approach to improving utilization of VTE prophylaxis. Although there is no gold standard method for integrating VTE risk assessment into clinical workflow, the VTE QI RR presents key lessons both from the literature and “real world” experiences. The crucial take-home message is that hospitalists can facilitate implementation of VTE risk assessments if they stress simplicity (ie, the “sick, old, surgery” benefit), link the risk assessment to a menu of evidence-based prophylaxis options, and require assessment of VTE risk as part of a regular routine (on admission and at regular intervals). Although many hospitals do not yet have computerized entry of physician orders, the simple 4-point VTE risk assessment described by Kucher et al might be applied to other hospitals.¹⁰ The 4-point system would identify the patients at highest risk, a reasonable starting point for a QI initiative. Whatever the model—CPOE alerts of very high-risk patients, CPOE-forced VTE risk assessments, nursing assessments, or paper-based order sets—regular VTE risk assessment can be incorporated into the daily routine of hospital care.

The QI workbook sequences the steps of a multidisciplinary improvement team and prompts users to set specific goals, collect practical metrics, and conduct plan-do-study-act (PDSA) cycles of learning and action (Figure 4). Hospitalists and other team members can use the information in the workbook to estimate the prevalence of use of the appropriate VTE prophylaxis and the incidence of hospital-acquired VTE at their medical centers, develop a suitable VTE risk assessment model, and plan interventions. Starting with all patients admitted to one nurse on one unit, then expanding to an entire nursing unit, an improvement team could implement rapid PDSA cycles to iron out the wrin-

kles of a risk assessment protocol. After demonstrating a measurable benefit for the patients at highest risk, the team would then be expected to capture more patients at risk for VTE by modifying the risk assessment protocol to identify moderate-risk patients (hospitalized patients with one risk factor), as in the MEDENOX, ARTEMIS, and PREVENT clinical trials. Within the first several months, the QI intervention could be expanded to more nursing units. An improvement report profiling a clinically important increase in the rate of appropriate VTE prophylaxis would advocate for additional local resources and projects.

As questions arise in assembling an improvement team, setting useful aims and metrics, choosing interventions, implementing and studying change, or collecting performance data, hospitalists can review answers to questions already posted and post their own questions in the Ask the Expert area. For example, one user asked whether there was a standard risk assessment tool for identifying patients at high risk of VTE. Another asked about the use of unfractionated heparin as a low-cost alternative to low-molecular-weight heparin. Both these questions were answered within 24 hours by the content editor of the VTE QI RR and, for one question, also by 2 pharmacists and an international expert in VTE.

As other hospitalists begin de novo efforts of their own, success stories and strategies posted in the online forums of the VTE QI RR will be an evolving resource for basic know-how and innovation.

Suggestions from a community of resource room users will be solicited, evaluated, and incorporated into the QI RR in order to improve its educational value and utility. The curricula could also be adapted or refined by others with an interest in systems-based care or practice-based learning, such as directors of residency training programs.

CONCLUSIONS

The QI RRs bring QI theory and practice to the hospitalist, when and wherever it is wanted, minimizing time away from patient care. The workbook links theory to practice and can be used to launch, sustain, and document a local VTE-specific QI initiative. A range of experience is accommodated. Content is provided in a way that enables the user to immediately apply and adapt it to a local context—users can access and download the subset of tools that best meet their needs. For practicing hos-



TABLE of CONTENTS

1. Reviewing the Literature (and What Others Have Done).....	4
2. Quality Improvement (QI) Resources.....	5
3. Pulling the team together.....	6
4. Establishing Team Rules.....	8
5. Establish General Aims.....	9
6. What is the Current Process for VTE Prevention?.....	11
7. Failure Mode Effects Analysis – What Could Go Wrong?.....	12
8. Identifying the Impact of Improving VTE (first estimate).....	14
9. Obtaining Support from the Institution.....	15
10. Stakeholder / Committee / Special Group Reporting and Approval Process.....	16
11. Risk Assessment Models for VTE: Adapting the Right One for Your Institution.....	18
12. Contraindications to Pharmacologic Prophylaxis.....	20
13. Choosing the Prophylactic Agents for Each Level of Risk (and More About Choosing Your Risk Assessment Model & Piloting It).....	21
14. Key Metric: Prevalence of appropriate VTE prophylaxis (finalizing Aim #1).....	23
15. Key Metric: Incidence of hospital acquired VTE (finalizing Aim #2).....	25
16. Balancing Measures (and Other Measures).....	28
17. Financial Impact.....	29
18. Building Run Charts (Optional: Statistical Process Control charts).....	31
19. Planning Your Implementation / Intervention.....	32
20. Plan – Do – Study – Act (PDSA) Worksheet.....	36
21. After Your Order Set is Launched: Monitoring and Learning from Variation in the Process.....	37
22. Holding the Gains and Spreading Your Improvement.....	38
Appendix A: Web Resources to Enhance Working Familiarity with Key QI Tools.....	40
Appendix B: Team Ground Rules.....	41
Appendix C: Sample Process Map.....	42
Appendix D: Draft Memo to Administration or Executive.....	44
Appendix E: Risk Assessment Models.....	46

FIGURE 4. Table of contents of the VTE QI workbook, by Greg Maynard.

pitalists, this QI resource offers an opportunity to bridge the training gap in systems-based hospital care and should increase the quality and quantity of and support for opportunities to lead successful QI projects.

The Accreditation Council of Graduate Medical Education (ACGME) now requires education in health care systems, a requirement not previously mandated for traditional medical residency programs.¹⁷ Because the resource rooms should increase the number of hospitalists competently leading local efforts that achieve measurable gains in hospital outcomes, a wider potential constituency also includes residency program directors, internal medicine residents, physician assistants and nurse-practitioners, nurses, hospital quality officers, and hospital medicine practice leaders.

Further research is needed to determine the clinical impact of the VTE QI workbook on outcomes for hospitalized patients. The effectiveness of such an educational method should be evaluated, at least in part, by documenting changes in clinically important process and outcome measures, in this case those specific to hospital-acquired VTE. Investigation also will need to generate an impact assessment to see if the curricula are effective in meeting the strategic educational goals of the Society of Hospital Medicine. Further investigation will examine whether this resource can help residency training programs achieve ACGME goals for practice-based learning and systems-based care.

Address for correspondence and reprint requests: Sylvia C. W. McKean, MD, Medical Director, Brigham and Women's Faulkner Hospitalist Service, 15 Francis Street, Boston, MA, 02115; Fax (617) 264-5137; E-mail: Smckean@partners.org

Received 19 September 2005; revision received 19 January 2006; accepted 5 February 2006.

REFERENCES

1. Society of Hospital Medicine Available at: http://www.hospitalmedicine.org/AM/Template.cfm?Section=Quality_Improvement_Resource_Rooms&Template=/CM/HTMLDisplay.cfm&ContentID=6312
2. Pistoria M, Amin A, Dressler D, McKean S, Budnitz T, eds. Core competencies in hospital medicine. *J Hosp Med.* 2006; 1(suppl 1).
3. Anderson FA, Wheeler HB, Goldberg RJ, Hosmer DW, Forcier A, Patwardham NA. Physician practices in the prevention of venous thromboembolism. *Arch Intern Med.* 1991; 151:933-938.
4. Kohn LT, Corrigan JM, Donaldson MS, eds. *To Err Is Human.* Washington, DC: National Academy Press; 2000.
5. Institute of Medicine <http://www.iom.edu/CMS/3718.aspx>
6. Shojania KG, Duncan BW, McDonald KM, Wachter RM, eds. Making health care safer: a critical analysis of patient safety practices. Agency for Healthcare Research and Quality, Publication 01-E058; 2001.
7. Joint Commission on the Accreditation of Health Care Organizations. Public policy initiatives. Available at: http://www.jcaho.org/about+us/public+policy+initiatives/pay_for_performance.htm
8. Kern, DE. *Curriculum Development for Medical Education: A Six-Step Approach.* Baltimore, Md: Johns Hopkins University Press; 1998.
9. Goldhaber SZ, Tapson VF; DVT FREE Steering Committee. A prospective registry of 5,451 patients with ultrasound-confirmed deep vein thrombosis. *Am J Cardiol.* 2004;93:259.
10. Kucher N, Koo S, Quiroz R, et al. Electronic alerts to prevent venous thromboembolism among hospitalized patients. *N Engl J Med.* 2005;352:969.
11. Barnes LB, Christensen CR, Hersent AJ. *Teaching the Case Method.* 3rd ed. Cambridge, Mass : Harvard Business School.
12. American College of Physicians. Available at: <http://www.acpj.org/?hp>
13. Samama MM, Cohen AT, Darmon JY, et al. MEDENOX trial. *N Engl J Med.* 1999;341:793-800.
14. Cohen, A, Gallus, AS, Lassen, MR. Fondaparinux versus placebo for the prevention of VTE in acutely ill medical patients (ARTEMIS). *J Thromb Haemost.* 2003;1(suppl 1):2046.
15. Leizorovicz A, Cohen AT, Turpie AG, Olsson CG, Vaitkus PT, Goldhaber SZ. PREVENT Medical Thromboprophylaxis Study Group. *Circulation.* 2004;110:874-879.
16. Avorn, J, Winkelmayer, W. Comparing the costs, risks and benefits of competing strategies for the primary prevention of VTE. *Circulation.* 2004;110:IV25-IV32.
17. Accreditation Council for Graduate Medical Education. Available at: http://www.acgme.org/acWebsite/programDir/pd_index.asp