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Hospital Medicine

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Abstract & Commentary

Does Your Patient Have a Central Venous Catheter?

Nathaniel R. DeFelice, MD, and Jennifer A. Best, MD

Dr. DeFelice is Clinical Instructor, Division of General Internal Medicine, Harborview Medical Center, University of Washington, Seattle, and Dr. Best is Associate Professor, University of Washington School of Medicine, Seattle

Drs. DeFelice and Best report no financial relationships in this field of study.

SOURCE: Chopra V, et al. Do clinicians know which of their patients have central venous catheters? A multicenter observational study. *Ann Intern Med* 2014;161:562-567.

Central venous catheters (CVCs) are essential to providing optimal care to many hospitalized patients. While traditionally limited to critical care patients with triple-lumen catheters inserted into the subclavian, internal jugular or femoral veins, the expanding use of peripherally inserted central catheters (PICCs) has created an environment where most CVCs are now found in non-ICU patients. The increase in their use throughout the hospital is not surprising as they offer many benefits to patients, physicians, phlebotomists and nurses ranging from pain-free blood draws to hemodynamic measurements guiding clinician decision-making. However, even as CVCs (especially PICCs) become more common on general medicine floors, we are becoming increasingly aware of their associated risks. These risks include costly and potentially life-threatening central line-associated bloodstream infection (CLABSI) and venous thromboembolism (VTE). While we know that the risk of these complications increases with time, a growing body of evidence has demonstrated that the inappropriately prolonged use of CVCs is not uncommon.

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Suspecting that provider unawareness of the presence of CVCs in hospitalized patients contributes to unnecessarily prolonged use, Chopra and colleagues conducted an elegant multicenter, cross-sectional study to assess clinician awareness of their patients' CVCs. The authors randomly selected hospitalized patients and their responsible providers at 3 academic medical centers in the U.S. Between April 2012 and September 2013 the investigators conducted patient interviews and performed focused exams before morning rounds where they noted presence or absence of a PICC or non-tunneled triple-lumen catheter placed in the neck, chest or groin (other types of specialty catheters were excluded). Then, after the team rounded on their patients, the providers (n=990) were asked to identify which of their patients had a CVC.

The investigators hypothesized that clinicians who are most "proximal" (such as interns or hospitalists) would be more likely to know which of their patients have CVCs. They also postulated that providers such as critical care physicians who often insert lines or oncologists who often consciously deliberate on the choice of vascular access would be more likely to remember that their patient has a CVC. When appropriate, they used Chi-square tests to compare differences between interns, residents, general medicine teaching attendings, and hospitalists. Additionally, differences between critical care, subspecialty and general medicine services were explored.

Across all sites, CVCs were present in 21% (209/990) of patients, the majority (60.3% [126/209]) of which were PICCs. In composite, providers believed that a CVC was absent when it was present in 21.2% (90/425) of cases, while another 5.6% erroneously believed a CVC was present and another 9.1% admitted they were unaware of the presence or absence of a CVC.

Contrary to the study's initial hypothesis, investigators identified hospitalists as the worst offenders — unaware of CVC presence 30.5% of the time (18 of 59). Interns were better, but still almost 1 and 5 of them were unaware of the presence of a CVC in their patient despite being the most likely to write orders (19.1% [22 of 115]). At 13.8%, residents were not significantly better than interns (P=0.027). General medicine teaching attendings and hospitalists were significantly more often unaware of the presence of CVCs when compared to interns, residents and non-physician providers (27.3% vs. 16.4%; P=0.006). As expected, critical care providers were much less likely to be unaware of CVC presence than general medicine or hospitalist physicians (12.6% vs. 26.2%; P=0.003). Subspecialty providers who were felt to be more likely to deliberate about access were not significantly better than their general medicine and hospitalists colleagues at identifying which of their patients had CVCs (22.5% vs. 26.2% were unaware of CVC presence; P=0.48).

The study had several limitations including determination of provider awareness at only a single point in time. Additionally, it remains to be proven whether lack of awareness correlates with patient outcomes or length of stay.

In their discussion, the authors suggest that the larger patient volumes of hospitalists compared to their ICU and house staff colleagues combined with the absence of a culture of paying attention to these lines outside the ICU may explain why hospitalists lacked relative awareness of their patients' CVCs. A shift in hospital culture and systems to ensure that providers are more mindful of the presence of CVCs was encouraged, but further research is needed to explore what types of interventions are effective and if knowledge of CVCs improves outcomes in patients.

In conclusion, providers and particularly hospitalists are frequently unaware of the presence of CVCs in their patients, which could lead to inadvertent prolonged use and potentially dangerous complications. Further research is warranted to determine the impact provider unawareness of CVCs has on patients and what interventions best address this awareness deficiency. ■

Abstract & Commentary

Transient Ischemic Attacks: A Missed Opportunity

By Deborah J. DeWaay, MD, FACP

Assistant Professor, Medical University of South Carolina, Charleston, SC

Dr. DeWaay reports no financial relationships in this field of study

SYNOPSIS: Patients with transient ischemic attacks were not given evidence-based secondary prevention for stroke at discharge from the hospital as often compared to patients with stroke, thus creating a missed opportunity to decrease the incidence of future stroke and cardiovascular disease.

SOURCE: Bangalore S, Schwamm L, Smith E, Singh I, Liang L, Fonarow G, Bhatt D. Secondary Prevention after Ischemic Stroke or Transient Ischemic Attack. *Am J Med*. 2014; 127(8):728-738

Patients who experience a transient ischemic attack (TIA) have an 11% chance of developing a stroke within 90 days and a 13% chance of having another TIA. Almost 25% of patients who have a stroke experience a TIA prior to the stroke, usually within days of the stroke. Therefore, there is a small amount of time to prevent future ischemic events in a patient who experiences a TIA. Patients who experience a TIA have the same rate of major cardiovascular events as those who experience a stroke, 22% within one year. The American Heart Association/ American Stroke Association (AHA/ASA) guidelines recommend aggressive secondary prevention following stroke or TIA to reduce the risk of recurrent stroke as well as to decrease cardiovascular morbidity and mortality. This study evaluated the implementation of and adherence to secondary prevention measures at the time of discharge between 2007 and 2011.

The data source for this study was the Get With The Guidelines-Stroke Program (GWTG) database. This Internet-based system, in which hospitals volunteer to participate, includes patient demographics, medical history, in-hospital diagnostic work-up, treatment, discharge medications, counseling, and disposition on patients admitted for TIA or stroke. Previous validation studies have confirmed reliability of the data. Patients diagnosed with a TIA or ischemic stroke were included in the study. Patients were excluded if there were missing data, a transfer between hospitals took place, the stroke occurred in hospital, discharge data were missing, they left AMA, or they were discharged to hospice.

Researchers used multivariable logistic regression analyses to determine the adherence rates of guideline-based care in patients with TIA and stroke. Specifically, the authors looked at the following metrics at the time of discharge: antithrombotic agent (antiplatelet or anticoagulant), anticoagulation for atrial fibrillation, smoking cessation, stroke education, intensive statin therapy, LDL documentation and lipid-lowering agent for patients with LDL >100, weight loss education for those with a BMI >25, treatment of hypertension and diabetes education. In order to account for in-hospital clustering and adjustment for baseline patient characteristics, the Generalized Estimating Equation was used. Since the study period was several years, a time-trend analysis was also performed to account for any changes over time.

Of the 1.4 million patients with stroke or TIA, 858,835 patients met inclusion criteria. Thirty percent had a TIA and 70% had a stroke. The two patient populations were not equivalent. Patients with TIAs were more likely to be white women with a history of prior stroke or TIA and hyperlipidemia on a lipid-lowering agent compared to those with stroke. They also scored lower on the NIH stroke scale and were more likely to ambulate on admission. Stroke patients, on the other hand, were more likely to have atrial fibrillation, diabetes, hypertension, and tobacco abuse.

Patients with TIAs received secondary stroke prevention statistically less often than their stroke counterparts in the following areas: antithrombotic therapy (96.3% vs. 97.7%), anticoagulation for atrial fibrillation (90.6% vs. 93.7%), statin for LDL <100 mg/dL (75.0% vs. 82.8%), stroke education (73.5% vs. 79.4%) and weight loss counseling (52.2% vs. 55.1%). Patients with TIAs were also less likely to have anti-hypertensives and intensive statin therapy prescribed at discharge. Adherence to guidelines improved over time in both groups, although adherence in the TIA group did not improve as much over time as the stroke group.

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Stroke is a leading cause of disability and death in the U.S. Forty percent of stroke patients have moderate to severe impairments, which costs the healthcare system billions of dollars. Approximately 1 in 4 strokes are recurrent, and for this reason it is critical to adhere to secondary prevention measures. This was illustrated in the EXPRESS (Early use of eXisting PREventive Strategies for Stroke) study, which demonstrated an 80% decrease in stroke in patients with TIA who were appropriately following risk-reduction strategies. Subsequent hospital bed-days, acute costs and 6-month disability were also significantly reduced. The current study illustrates that TIA patients are not receiving guideline-based therapy at the rate of their stroke counterparts, suggesting that their morbidity and mortality could be improved if this gap in their care could be closed.

This study is also a useful reminder to hospitalists that adherence to AHA/AHS guidelines is important for patients with TIA or stroke. Of the secondary prevention measures, it should be noted that rates of statin administration for LDL <100, stroke education, and weight loss counseling are not optimal for patients with either diagnosis. This opportunity to improve care for all patients being discharged after TIA and stroke could decrease the incidence of future stroke and cardiovascular disease. ■

ABSTRACT & COMMENTARY

Benefits of NIV in COPD Supported in Routine Clinical Practice

By Leslie A. Hoffman, RN, PhD

Professor Emeritus, Nursing and Clinical & Translational Science, University of Pittsburgh

Leslie Hoffman reports no financial relationship in this field of study.

This article originally appeared in the February 2015 issue of Critical Care Alert. *It was edited by Betty Tran, MD, MS, and peer reviewed by William Thompson, MD. Dr. Tran is Assistant Professor of Medicine, Pulmonary and Critical Care Medicine, Rush University Medical Center, Chicago, and Dr. Thompson is Associate Professor of Medicine, University of Washington, Seattle. Drs. Tran and Thompson report no financial relationships relevant to this field of study.*

SYNOPSIS: In a large cohort study, patients with chronic obstructive pulmonary disease managed with noninvasive ventilation had lower inpatient mortality, shorter length of stay, and lower costs compared to those managed with invasive ventilation.

SOURCE: Lindenauer PK, et al. Outcomes associated with invasive and noninvasive ventilation among patients hospitalized with exacerbations. *JAMA Intern Med* 2014;174:1982-1993.

Prior studies, including several meta-analyses, have concluded that nonivasive ventilation (NIV) can reduce the need for intubation and improve short-term survival of patients experiencing a chronic obstructive pulmonary disease (COPD) exacerbation. Little is known, however, about the effectiveness of NIV in routine clinical practice. To determine effectiveness, this study compared outcomes in 25,628 patients hospitalized with a severe exacerbation of COPD who received mechanical ventilation on the first or second ICU day in 420 U.S. hospitals. Patients were included if they were > 40 years of age, had a principal discharge diagnosis of COPD, or a secondary diagnosis of COPD with a principal diagnosis of acute respiratory failure (determined by ICD-9 codes). Patients were excluded who were not treated with short-acting bronchodilators or systemic corticosteroids (to reduce misclassification), received palliative or hospice care, or were diagnosed with sleep apnea. Data retrieved from electronic medical records were used to compare outcomes in patients managed using NIV (n = 17, 978; 70%) or invasive mechanical ventilation (IMV), and subgroups were defined by age, comorbidity, and comorbid pneumonia. Two additional analyses were performed to address differences among hospitals and control for unmeasured confounders.

The primary study outcome was in-hospital mortality. When compared with those initially managed with IMV, NIV managed patients were older, more likely to have been admitted for COPD in the past year, and had a lower comorbidity score. The incidence of NIV failure was 15.3%. NIV was associated with a lower risk of mortality than IMV (odds ratio [OR], 0.54; 95% confidence interval [CI], 0.48-0.61), lower risk of hospital-acquired pneumonia (OR, 0.53; 95% CI, 0.44-0.64), a 19%

shorter length of stay (OR, 0.81; 95% CI, 0.79-0.82), and 32% lower costs, which averaged $5673 per patient (OR, 0.68; 95% CI, 0.67-0.69). There was no difference in 30-day all-cause readmission (OR, 1.04; 95% CI, 0.94-1.15) or COPD-specific readmission (OR, 1.05; 95% CI, 0.91-1.22). The benefits of NIV were similar in a sample restricted to patients younger than 85 years. Benefits were less for patients with higher levels of comorbidity and comorbid pneumonia, but remained significant. Using the hospital as an instrumental variable, the strength of association between NIV and mortality was modestly less (OR, 0.66; 95% CI, 0.47-0.91). In sensitivity analyses, the benefit of NIV was robust in the face of a strong hypothetical unmeasured confounder.

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A major strength of this study is the use of a large, externally generalizable population. Patients were recent admissions (January 2008-June 2011) to 420 geographically diverse hospitals; all were participants in a fee-supported data repository designed to support quality improvement (Premier Healthcare Informatics). This data-sharing repository enabled access to an extensive database and sophisticated analytic techniques.

Findings supported benefits reported from randomized, controlled trials. NIV was associated with lower mortality, a lower risk of hospital-acquired pneumonia, a shorter hospital length of stay, and no increase in COPD-specific or all-cause readmission within 30 days of discharge. Although NIV has been strongly endorsed in clinical guidelines, surveys suggest that many eligible patients are not managed using NIV. One frequently cited reason relates to concern that benefits seen in a carefully selected sample of patients managed by experienced clinicians might not transfer to the "real world" of clinical practice. Successful implementation of NIV requires appropriate patient selection, 24-hour availability of an experienced team, close patient monitoring, and the ability to quickly to convert to IMV if NIV fails.

In this study, patients spent a median of 2 (range 1-4) days on NIV and 3 (range 2-5) days on IMV. In-hospital mortality rates were 4.8%, 8.6%, and 13.8% among those initially treated with NIV, IMV, and those who failed NIV, respectively. The higher mortality rate in those who fail NIV supports the need for careful patient selection. Notably, the relative advantage of NIV was less in patients with COPD if pneumonia was present at admission, a finding that has potential clinical significance. Unlike an acute exacerbation of COPD, patients with pneumonia are less likely to experience a rapid reversal of acute respiratory failure. In such situations, NIV may not be the optimum choice, given the likely longer recovery interval and higher patient acuity. Findings of this study are subject to the limitations of all observational studies, namely inability to identify causality. They suggest that, among patients hospitalized for a COPD exacerbation, NIV is a prudent initial choice given its many benefits with the caveat that benefits may be more limited or absent when pneumonia is present at admission. ■

ABSTRACT & COMMENTARY

Multicenter Quality Improvement Project Resulted in a 23% Reduction in Medical Errors

By Leslie A. Hoffman, RN, PhD

Professor Emeritus, Nursing and Clinical & Translational Science, University of Pittsburgh

Dr. Hoffman reports no financial relationships relevant to this field of study.

This article originally appeared in the February 2015 issue of Critical Care Alert. *It was edited by Betty Tran, MD, MS, and peer reviewed by William Thompson, MD. Dr. Tran is Assistant Professor of Medicine, Pulmonary and Critical Care Medicine, Rush University Medical Center, Chicago, and Dr. Thompson is Associate Professor of Medicine, University of Washington, Seattle. Drs. Tran and Thompson report no financial relationships relevant to this field of study.*

SYNOPSIS: Implementation of a quality improvement project focused on handoffs reduced medical errors by 23% and preventable adverse events by 30%.

SOURCE: Starmer AJ, et al. Changes in medical errors after implementation of a handoff program. *N Engl J Med* 2014;371:1803-1812.

Numerous studies have tested strategies to improve handoff communication. Most were conducted in a single center and, therefore, the ability to generalize findings remains unclear. The goal of this study was to test the ability of a resident-handoff improvement program to reduce error rates when implemented as a multicenter approach. The nine selected pediatric residency programs ranged in size from 36 to 182 residents and were located in the United States and Canada. The intervention included a mnemonic to standardize oral and written handoffs, handoff and communication training, a faculty development and observation program, and a sustainability campaign. Impact of the program was measured for 6 months pre- and 6 months post-intervention by comparing the number of medical errors, preventable adverse events and miscommunications, as well as resident workflow. Error rates were measured through active surveillance. Handoffs were assessed using printed documents and audio recordings. Workflow was assessed through time-motion observations. In 10,740 patient admissions, the medical error rate decreased by 23% pre- to post-intervention (24.5 vs 18.8 per 100 admissions, $P < 0.001$); preventable adverse events decreased by 30% (4.7 vs 3.3 events per 100 admissions, $P < 0.001$). There was no change in non-preventable adverse events (3.0 vs 2.8 events per 100 admissions, $P = 0.79$). Institution-level analyses showed significant error reduction at six of nine sites. Across all sites, increases were observed in the inclusion of key elements during handoffs (nine written, five oral elements; $P < 0.001$). There was no change pre- to post-intervention in duration of oral handoffs (2.4 and 2.5 minutes per patient, respectively; $P = 0.55$) or in resident workflow, including patient–family contact and computer time. Length of stay, medical complexity and patient age did not differ between the pre- and post-intervention period.

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The intervention developed for this study, termed the I-PASS Handoff Bundle, included seven elements: the I-PASS mnemonic (I = Illness Severity, P = Patient Summary, A = Action Items, S = Situation Awareness and Contingency Plans, S = Synthesis Restatement by Receiver), a 2-hour workshop to teach communication skills and handoff techniques, a 1-hour role-playing and simulation session to practice skills from the workshop, a computer module to allow for independent learning, a faculty development program, tools to provide feedback to residents, and a process and culture change campaign that included a logo, posters, and materials to promote program adoption. All components are available at no cost through the website (http://ipasshandoffstudy.com).

Measurement was rigorous, including review of medical records, orders, and formal incident reports on study units by a research nurse. Reports were solicited from nursing staff on study units, and daily medical error reports from residents. Two physician investigators, unaware of the time records were collected, classified incidents as preventable or non-preventable. Time and motion data were also collected to determine the time residents spent in various activities. Findings indicated a significant error reduction without an increase in time required to conduct handoffs or a decrease in direct contact time with patients.

A characteristic of this study, which can be viewed positively and negatively, relates to the comprehensive nature of the intervention and extent of time and institutional commitment required for its implementation. This suggests that handoff communication can be positively influenced, but to achieve this goal, there must be a major effort, including education, practice, availability of online and written support materials, and an institutional effort designed to promote culture change. Of note, error rates did not change significantly at three of the nine institutions. Reasons were unclear, given there was significant improvement in written and oral handoff processes at these institutions. This finding highlights the challenges too often encountered when attempting to change behavior — systematic initiatives can be successful but may not be equally so in different institutions that are influenced by different variables. ■

Peramivir: A Newly Approved Antiviral for Treatment of Influenza

By Samaneh Pourali, PharmD, BCPS

Dr. Pourali is a clinical pharmacist at Stanford Healthcare in Stanford, CA

Dr. Pourali reports no financial relationships relevant to this field of study.

This article originally appeared in the February 2015 issue of Infectious Disease Alert. *It was edited by Stan Deresinski, MD, FACP, FIDSA, and peer reviewed by Patrick Joseph, MD, FIDSA, FSHEA. Dr. Deresinski is Clinical Professor of Medicine, Stanford University, Associate Chief of Infectious Diseases, Santa Clara Valley Medical Center, and Dr. Joseph is Associate Clinical Professor of Medicine, University of California, San Francisco, Chief of Epidemiology, San Ramon (CA) Regional Medical Center. Dr. Deresinski has served as a one-time consultant for Cubist and Bayer, and Dr. Joseph is laboratory director for Genomic Health and Siemens Corp.*

Peramivir (Rapivab™) was recently approved by the FDA in December 2014 for treatment of acute uncomplicated influenza within two days of symptom onset. This newly approved antiviral is a neuraminidase inhibitor (NI) similar to oseltamivir and zanamivir but the first to be approved in an injectable formulation.[1] Peramivir has been licensed in Japan (as Rapiacta) and South Korea (as PeramiFlu) since 2010. In addition, it has been used in the United States on an emergency basis during the 2009 H1N1 flu pandemic.

The antiviral activity of peramivir was tested in laboratory strains and clinical isolates of influenza virus A and B. Cross-resistance within the NI class has been observed in biochemical assays and cell cultures, likely conferred by amino acid substitution in the viral neuraminidase or hemagglutinin proteins; however, clinical impact of reduced susceptibility is unclear.[1] However, no single amino acid substitution has been identified that could confer cross-resistance among the NI class and the M2 ion channel inhibitor class (amantadine and rimantadine).

In terms of pharmacokinetics profile, peramivir reaches peak concentrations shortly after the end of the 30-minute intravenous infusion. Protein binding is less than 30%, and the drug is not metabolized by hepatic CYP450 enzymes. Peramivir has a half-life of approximately 20 hours, and the majority of the drug (~90%) is eliminated by the kidneys via glomerular filtration as unchanged drug. In addition, hemodialysis was effective in reducing systemic exposure of peramivir by 73% to 81%. Therefore, peramivir dosing recommendations are based on a patient's renal function (CrCl).[1]

Efficacy of peramivir was established in a randomized, double blind, multicenter, placebo-controlled trial evaluating a single intravenous dose of peramivir 300 mg or 600 mg vs. placebo in 297 adult patients with uncomplicated influenza. Overall, subjects receiving peramivir 600 mg experienced alleviation of their influenza symptoms at a median of about 12 hours sooner compared to placebo.[2] In addition, two randomized, multicenter, double-blind clinical trials also compared the efficacy of peramivir with oseltamivir and demonstrated non-inferiority with peramivir for treatment of influenza.[3-4]

However, efficacy of peramivir in patients with serious influenza requiring hospitalization has not been established. A randomized, double-blind, multicenter, placebo-controlled trial was conducted in 338 subjects with serious influenza. Patients were randomized to receive peramivir 600 mg daily for 5 days plus standard of care versus standard of care plus placebo within 72 hours of symptom onset. The median time to clinical resolution was 42.5 hours (95% CI 34-57.9) for peramivir versus 49.5 hours (95% CI 40-61.9) for placebo (P = 0.97). Thus, peramivir plus standard of care did not improve median time to clinical resolution compared to standard of care alone. However, there was trend toward larger treatment effect for patients who received therapy within 48 hours of symptoms or were admitted to ICU at baseline. This study was terminated for futility after a preplanned interim analysis.[5]

Adverse effects were evaluated in five randomized, double-blind, controlled trials; 1,399 subjects with acute uncomplicated influenza received peramivir at doses up to 600 mg daily. The most common adverse effects of peramivir were diarrhea, insomnia, constipation, and hypertension. Rare but serious skin and hypersensitivity reactions including Stevens-Johnson syndrome, as well as neuropsychiatric events including delirium and abnormal behavior were also reported in post-marketing reports.[1]

A comparison of average wholesale prices for a course of therapy between NIs found that zanamivir costs approximately $70.80 for a 5-day course, oseltamivir is $144.72 for a 5-day course, and peramivir is $950 for a 1-day course for an average patient with normal renal function.

In conclusion, peramivir is a single-dose intravenous neuraminidase inhibitor approved for treatment of acute uncomplicated influenza. Data did not show any benefit in resolution of symptoms for treatment of complicated influenza in hospitalized patients. However, given availability of peramivir for intravenous administration provides an advantage in patients with difficulty with contraindications for enteral administration of oseltamivir or contraindications or inability to administer inhalation formulation of zanamivir. ■

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CME QUESTIONS

1. Which group of providers were found to be the least likely to know their patient had a central venous catheter when queried after rounds?

a. Interns

b. Residents

c. General medicine teaching attendings

d. Hospitalists

e. Critical care physicians

2. What is the risk of a patient with a TIA having a major cardiovascular event within a year?

a. 12%

b. 22%

c. 50%

d. 75%

3. Compared to patients managed with invasive mechanical ventilation, patients hospitalized with a COPD exacerbation who were managed with non-invasive ventilation (NIV) experienced which of the following outcomes:

a. A lower risk of mortality

b. A lower risk of hospital-acquired pneumonia

c. A shorter length of stay

d. Lower costs

e. All of the above

CME OBJECTIVES

Upon completion of this educational activity, participants should be able to:

- discuss pertinent safety, infection control and quality improvement practices;
- explain diagnosis and treatment of acute illness in the hospital setting; and;
- discuss current data on diagnostic and therapeutic modalities for common inpatient problems.

[IN FUTURE ISSUES]

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