The Science and Economics of Improving Clinical Communication

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KEYWORDS

• Patient safety • Clinical communication • Handoff
• Economic evaluation • SBAR

The problem with communication… is the illusion that it has been accomplished.
— George Bernard Shaw

Any consideration of patient safety cannot be considered complete without acknowledging the 1999 landmark report from the Institute of Medicine "To Err is Human." For the first time the nation's medical community, its lawmakers, and its citizens were forced to confront a problem of great magnitude: between 44,000 and 98,000 deaths occur annually because of preventable medical errors.[1] The Institute of Medicine specifically acknowledged that anesthesiology has been an early adopter of patient safety initiatives,[1–3] and the Anesthesia Patient Safety Foundation along with other organizations within the specialty continue to reinforce the need to protect patients from harm.[4] Even as the rapidly changing practice of anesthesia becomes more complicated and continues to present new challenges in the quest for safer patient care, many leaders in anesthesiology assert the specialty has advanced the cause of patient safety more than any other field in medicine.[5–7]

Although the specialty has made great strides to lessen adverse events, a review by Lagasse[8] indicates that anesthesiology continues to have significant morbidity and mortality rates even when previous safety advances are considered. As put by Gaba,[6] a leading anesthesia safety researcher, the cup of patient safety is "half-full," indicating that the need for safety advances is ongoing. Furthermore, myriad targets exist for bettering patient safety, such as reducing adverse drug events, increasing nursing staff ratios, and addressing provider fatigue. Among them, the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) has made

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a priority of improving communication. JCAHO lists poor communication as the most common root cause of sentinel events across medical disciplines from 1995 to 2006 (**Fig. 1**). The organization reports that communication problems also constitute most anesthesia-related sentinel events.[9]

"To Err is Human" and other Institute of Medicine reports have placed emphasis on emerging technologies, such as the Internet and computerized physician order entry, as tools to facilitate improved communication.[2,3] Increasing use of such modalities,

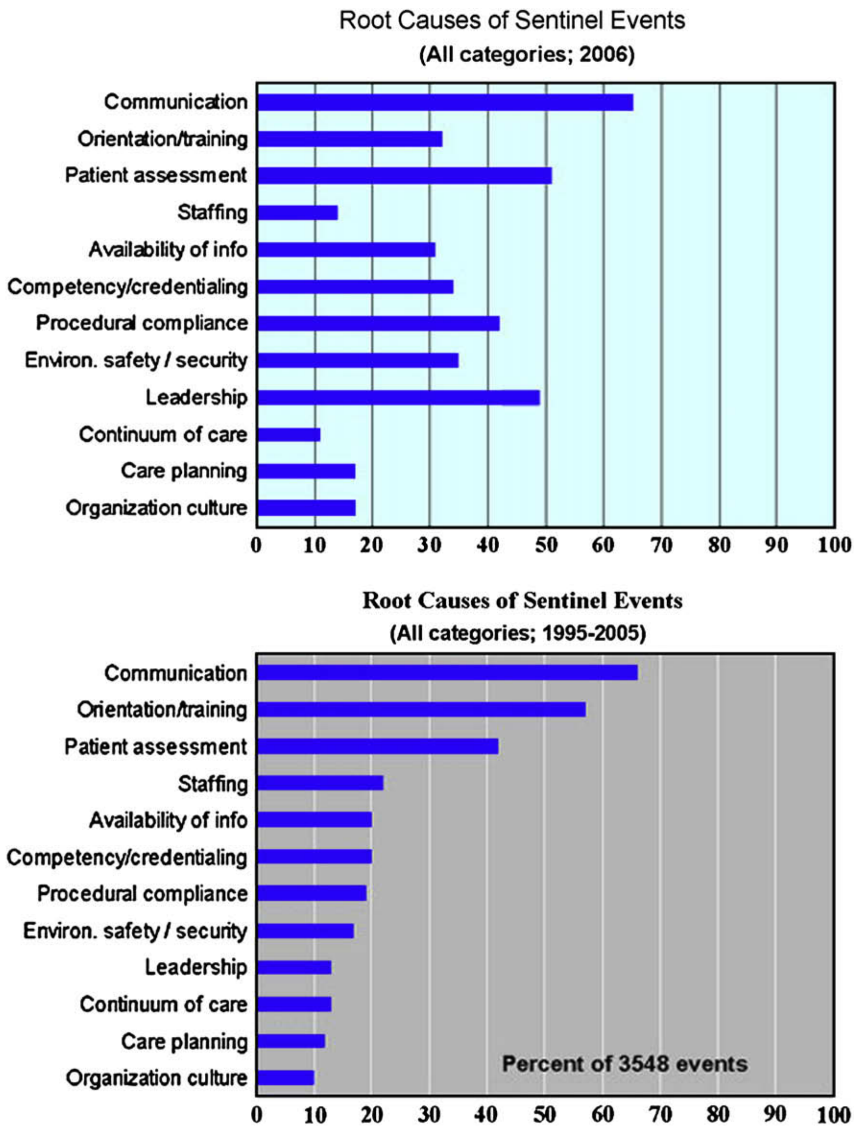

Fig. 1. Root causes of sentinel events. The upper figure lists data for 2006 alone. (*From* Joint Commission on Accreditation of Healthcare Organizations: Sentinel event statistics. Available at: http://www.jointcommission.org/SentinelEvents/Statistics. Accessed December 30, 2007; with permission.)

however, cannot be the only solution for bettering clinician interactions. This is because their medical value may be attenuated if other basic communication faults are not addressed, particularly those that occur during clinical exchanges, such as patient care transfers known as "handoff."

During the past decade improvements in teamwork, safer equipment, and simulation training have resulted in a precipitous decline in anesthesia-related adverse events. Making communication-centered processes, such as anesthesia handoffs and resident sign-outs, more effective would likely further reduce errors and associated costs. Unfortunately, the business case for patient safety initiatives is too often overlooked by the medical establishment, despite the fact that adverse events are expensive.[10] A widely reported study based in Utah and Colorado estimated the total cost of preventable adverse events to be $308 million in 1996 dollars.[11] Patients with medication errors (which often have communication problems at their source) experience longer hospital stays and higher cost of care. Thomas and coworkers[12] placed the cost of preventable errors at a national level at $17 billion.

Regardless of the potential value of cost savings, currently there is a paucity of data to persuade a health care chief financial officer that any sort of communication improvement initiative provides a justifiable return on investment. Kilpatrick and colleagues[12] performed a literature search and analysis and found that only 15 peer-reviewed writings out of nearly 2000 that met criteria for the study (0.75%) contained enough information to calculate a potential return on investment for the safety intervention analyzed. The authors noted that only a single study addressed clinical communication in any form.[13]

With these challenges in mind, this article has several goals. First, the authors present a complex clinical case derived from actual communication breakdowns that may have contributed to patient's death. Theories of communication as they relate to that case are reviewed and the weaknesses in communication arising from system failures are examined. Particular attention is paid to the handoff process and how a lack of formal sign-out procedures or faulty established communication processes contributed to the adverse outcome. The authors also postulate on how medical culture, technology, and care environments impact both communication behaviors and, ultimately, outcomes. A detailed cost analysis of the charges incurred for both standard and escalated care required for the sample case is provided. The discussion concludes with the economic case for improving clinical communication and patient safety using the situation, background, assessment, recommendations (SBAR) tool. Further, a formal scientific and concurrent economic evaluation for the SBAR communication intervention is proposed.

A SENTINEL EVENT CASE SCENARIO

A 56-year-old woman presented for surgical debridement of the right hip joint for known osteomyelitis (**Fig. 2**). She had multiple comorbidities, including obesity; renal insufficiency; coronary artery disease (plus recent percutaneous transluminal coronary angioplasty with bare metal stent placement); and a history of a deep venous thrombosis. She was taking clopidogrel and warfarin along with other medications before surgery, although her anticoagulants had been held before the operation. After induction, the resident anesthesiologist made three attempts to insert a right internal jugular central venous catheter. He was repeatedly unable to pass the wire through the introducer needle. The supervising anesthesiologist next placed a right subclavian central venous line. The patient then underwent debridement of the right hip, which required blood and platelet transfusions.

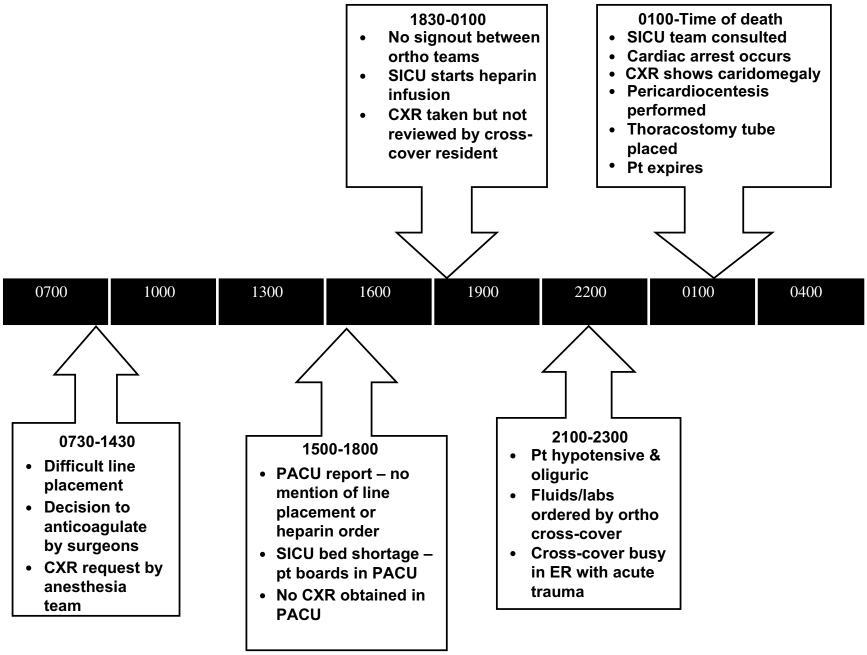

Fig. 2. Timeline for the sentinel event case scenario.

During the procedure the orthopedic surgeons openly discussed the patient's postoperative anticoagulation regimen, expressing concern about her history of bare metal sent and deep venous thrombosis. They decided to prescribe subcutaneous heparin every 8 hours for 24 hours and then seek cardiology recommendations regarding restarting clopidogrel and warfarin.

At the end of the case, while still in the operating room, the anesthesia resident asked the orthopedic resident to include a chest radiograph in his postoperative surgical intensive care unit (SICU) orders. The patient was extubated in the operating room once criteria were met and transferred to the postanesthesia care unit (PACU). She was originally admitted to the SICU but this was precluded by an acute bed shortage.

The orthopedic intern, who was not present during surgery, entered the postoperative orders electronically as verbally dictated to him by the operating resident, including "heparin to prevent a deep venous thrombosis" and a chest radiograph. The intern later reported that he was concerned about the vague heparin order, but did not request clarification. When he typed "heparin" into the hospital's electronic order entry system the first choice that appeared was a heparin infusion with a bolus. He hurriedly selected that option. After the patient arrived in the SICU her nurse activated all the postoperative orders.

Three hours after patient arrived in the SICU the patient's nurse paged the orthopedic night float resident to report oliguria (urine output 25 mL/h); tachycardia (heart rate 110); and hypotension (blood pressure 95/50). Assuming that the patient was hypovolemic and in pain the physician increased the patient's dose of narcotics and ordered a 500 mL intravenous fluid bolus. He also ordered a hematocrit to be drawn and returned to the emergency department to manage a traumatic open fracture.

Because the patient continued to deteriorate over the next hour the patient's nurse consulted the SICU critical care team. She had tried repeatedly to reach the orthopedic resident by pager. The SICU team responded promptly, only to find that the situation required advanced cardiac life support protocols and emergent endotracheal intubation. The chest radiograph was reviewed and suggested an enlarged cardiac silhouette and a large right pleural effusion. The heparin infusion was immediately stopped and an emergent needle pericardiocentesis released 250 mL of fresh, nonclotting blood from the pericardium. A right chest tube was placed, which drained 1200 mL of bright red sanguinous fluid. The patient continued to be resuscitated; however, she progressively deteriorated and died.

Postmortem examination revealed a tear in the superior vena cava, probably as a result of the initial central line attempt, with pericardial tamponade in addition to a massive hematoma at the surgical site.

THE ROLE OF COMMUNICATION IN PATIENT CARE

This case illustrates how faulty communication can result in preventable medical errors. Virtually every activity in a health system involves communication in some form. Often, information interchange between health care personnel is unwritten and informal; very few centers have standardized processes for physicians to communicate with one another or with other members of the medical team. Additionally, clinical communication assumes a myriad of forms: paging, informal hallway exchanges, structured verbal or written end-of-shift sign-outs, and "time-outs" in the operating room are a few examples.[14] It should not be surprising that ineffective communication can result in patient harm.[15]

Although the types of communication events in health care are as varied as the settings in which they occur, studies of non–health care industries can help to standardize and improve these processes. Patterson[16] analyzed the communication patterns from four industrial settings "with high consequences for failure:" (1) space shuttle mission control, (2) nuclear power, (3) railroad dispatching, and (4) ambulance dispatching. They observed that handoffs in these arenas share some common characteristics: (1) they are interactive, (2) they are verbal, and (3) they are face-to-face. These findings are confirmed by the work of Cockburn and others as represented in **Fig. 3**.

This graph shows the least and most effective types of communication. The dashed line represents one-way or no question-answer exchanges, the solid line synchronous (two-way) interactions, with paper being the least and video the most effective of these types. The solid line shows the types of two-way interactions. Note that of the examples presented the "richest" and most effective type is two-way (synchronous) white board communication; this format allows for both verbal and written elements. Effective communication occurs in face-to-face fashion with some way also to provide written information. Note that the graph shows that video exchanges are more effective than email, because the former also has visual elements.

THE IMPORTANCE OF THE HANDOFF IN CLINICAL COMMUNICATION

Arguably, no act of information exchange in medicine is more important than the patient handoff, which occurs whenever any information about a patient is transferred from one caregiver to another.[17,18] Ineffective handoffs are omnipresent in any busy medical center; the PACU, ICU, or patient wards are often seemingly chaotic, noisy places where effective verbal communication of remembered information is rendered difficult if not impossible.[14,18] Although the recent reduction in housestaff duty hours has benefitted both residents and their patients, studies have shown it has also greatly

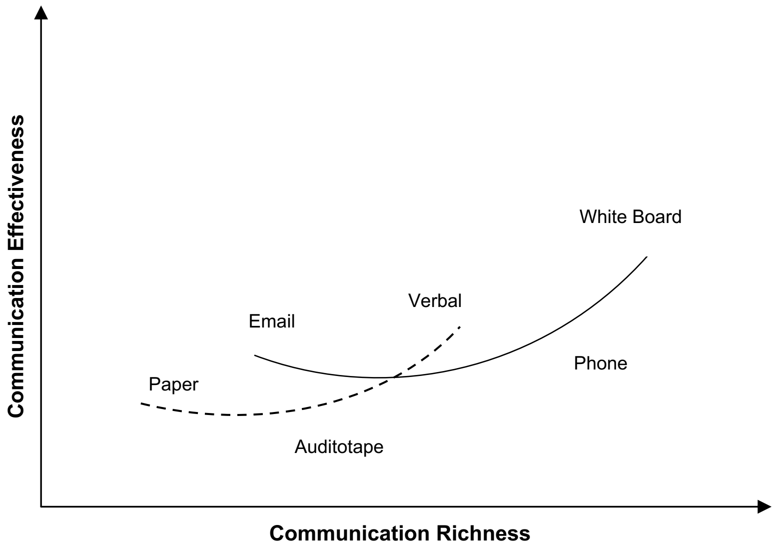

Fig. 3. Types of communication. (*From* Cockburn A. Agile software development. Boston: Addison-Wesley; 2002; with permission.)

increased the number of handoffs in academic medical centers.[19,20] Reduction in errors attributable to resident fatigue may be offset by faulty handoffs because each transfer of care carries a risk of information loss or distortion.[21] Investigators at the University of California, San Francisco, found that the number of handoffs grew by approximately 40% because of the duty hour changes.[22] Handoffs, if performed poorly, are also costly. CRICO/RMF, the medical malpractice company owned by Harvard Medical Centers, reports that since 2002 it has incurred nearly $200 million in losses because of handoff-related incidents.[23]

Despite the potential safety and cost benefits of improving clinical communication, most academic medical centers have not instituted curricular changes in this regard because of uncertainty and disagreement about what elements should be included in the handoff process.[24] Physicians often learn handoff techniques during the latter years of medical school and during internship; very rarely are these skills systematically taught.[19] Moreover, a University of Chicago study found that interns and residents desire both interpersonal handoffs and structured sign-out sheets.[18] Requiring and reinforcing processes for formalized verbal (and written) handoffs early in medical training ingrains appropriate behavior and stylized communication becomes expected of every provider. Arora and colleagues[19] performed a structured interview of interns after "critical incidents" and found that lack of interactive personal communication was cited as a major cause of such events. Unstructured face-to-face sign-outs may suffer from "middle of the list" information loss, however, especially if the information transfer takes place in an interruptive environment. Items in a memorized list are not lost randomly. Those retained most recently or that have been stored the longest tend to remain at the expense of items in the middle of the register.[21] At the very least, an effective handoff process should have both verbal and written elements (see **Fig. 3**).

HANDOFF FAILURES OCCURRING DURING THE EVENT

When viewed in light of effective communication and handoff processes it is apparent that, as the case progressed, a series of breakdowns occurred when care was transferred. First, the problems with line placement were not reported by the anesthesia team to the surgical team. Next, the surgical team did not formally discuss postoperative anticoagulation with the anesthesia team. The overheard conversation became hearsay. For this reason, the anesthesia resident was reluctant to relay the information to the PACU nurse or the orthopedic intern (who came to the PACU to write postoperative orders). A postcase debriefing in the operating room, promoted by some researchers, would have allowed the team openly to discuss the issue.[25]

Postoperatively, faulty communication continued and compounded existing lapses. The surgical intern who wrote postoperation orders perhaps feared to question his superior about the heparin infusion. In this instance, the informal, hierarchical nature of the working relationship between residents prevented effective communication. Leonard and coworkers[15] notes that the “power distance” (or “psychologic size difference”) between team members deters “inferiors” from making themselves heard. Later, the orthopedic intern’s attempts to contact the cross-covering resident about the SICU patient were impeded because the resident was occupied by a trauma. When later contacted by the resident, she merely gave a cursory report of the surgery and told him that the patient was “in the unit but stable.” This exchange highlights the lack of, and need for, improved handoff procedural training for housestaff and improved telecommunication methods[26] to facilitate one-on-one, synchronous (two-way) interactions.[15,19,27–29]

When the patient decompensated and the SICU critical care team was belatedly consulted, the patient’s deterioration was likely irreversible. Once involved, the SICU fellow wasted valuable time reconstructing the patient’s clinical course from the medical record while also concurrently implementing appropriate interventions.

ECONOMIC EVALUATION IN HEALTH CARE: A PRIMER

To understand the economic implications of effective handoffs it is necessary to review briefly economic evaluation in health care. This discipline evolved in Britain during the 1960s and matured along with the implementation of its National Health System.[30] An economic evaluation measures the costs of health inputs (personnel, equipment, medications, and so forth) that compose a health intervention. Examples of interventions include a new medication to treat type II diabetes, a novel surgical technique for prostatectomy, or a bar code system for medication administration. Health outputs include benefits or harm to a population (or society as a whole) that result from the intervention.[31] Input costs are usually straightforward to calculate in monetary units, whereas output costs may or may not be calculable in this way.[30] Robinson,[30] a prominent British health economist, lists three categories of economic costs: (1) health system costs, (2) costs to the patient and family, and (3) costs to society. **Table 1** lists the major economic analyses that health economists use to determine if a health intervention is worth the cost. Costs in health economic studies may be described in simple currency units (dollars) or outcome measures (eg, ventilator-free days), or by a more complex calculation termed “quality-adjusted life years.” Regardless of the methods used, an economic evaluation must be interpreted in light of the perspective from which the analysis is undertaken. If societal effects are of concern, a narrow approach (eg, that taken by pharmaceutical company) is avoided because it does not reflect the benefits or costs to society as a whole.[31] In general, health economists advise

Table 1
Types of economic evaluation in health care[29–31,51–54]

Type of Economic Evaluation	Conditions for Evaluation Type	Evaluation Units	Advantages	Disadvantages	Example
Cost-minimalization analysis	Outcomes are expected to be same or similar	Currency (dollars)	Most simple	Very few indications[56]	Cost of in-hospital versus outpatient stroke rehabilitation[57]
Cost-effectiveness analysis	Outcomes are expected to differ	"Natural units" (eg, hospital-free days, life-years gained)	Can compare differing outcomes	All costs cannot be known with certainty Usually requires concurrent sensitivity analyses and clinical trials	Symptom-free days resulting from use of a new antipsychotic compared with established therapy[58]
Cost-consequence analysis (variant of cost effective analysis)	Same as cost effectiveness analysis	None; a cost-consequence matrix is prepared[50]	It is not clear that an intervention is purely cost-effective or improvements are solely the result of the intervention	Often there is insufficient evidence to perform analysis Same as cost effectiveness analysis	Computerized-physician electronic ordering system
Cost-benefit analysis	Any intervention or policy	Dollars (inputs and outputs)	Most comprehensive and theoretically sound Can determine return on investment or benefits greater than costs	Relies on willingness to pay studies, which are lacking	The benefits of fetal ultrasound
Cost-utility analysis	Outcomes are expected to differ	Quality-adjusted life-years (QALY)	Uses single measure of economic well-being	Requires health state indices, quality-of-life scales, league tables (rarely performed in the United States) SF-36 has been used but not validated	Coronary artery bypass graft versus medical management[30]

Data from references [30–32,52–55].

studying an intervention from the broadest perspective, but studies with a narrower focus may yield data more pertinent to the particular institution or health system.

Economic evaluations should also consider primarily clinical data for the benefit or harm of the planned interventions. It is optimal (but seldom feasible) to perform an economic evaluation of an intervention concurrently with a controlled clinical trial. Without such studies, economists can ascertain the costs of an intervention but have no information as to its risks or benefits and its utility. For example, if the intervention is inexpensive but also ineffective (or vice versa) this impacts the decision to implement the intervention.[31,32]

Health care economic evaluations are usually confined to Britain, Canada, or other countries that have nationalized health care systems. Return-on-investment studies are seemingly more pertinent to health care organizations in the United States, where resource allocation is considered less important than revenue generation. The evolving nature of medical reimbursement, however, has led to formal economic analyses occurring in the United States more frequently. These analyses usually address treatment options (ie, stenting versus surgery for carotid stenosis)[33] or chronic disease states. The few evaluations that focus on patient safety usually target a particular disease outcome, such as ventilator-associated pneumonia.[34] Some researchers have studied computerized physician order entry, a type of clinical communication tool, with regard to economic evaluation.[35,36] Computerized physician order entry has reduced medication errors[37] and implementing computerized physician order entry systems has been a priority for government entities, including the Department of Veterans Affairs[38] and the Agency for Healthcare Research and Quality.[39] The Institute of Medicine also strongly advocates the use of computerized physician order entry.[1] The authors, however, are aware of no economic evaluations of initiatives to improve methods of direct clinical communication.

COST ANALYSIS OF THE SENTINEL EVENT CASE

Because no established format exists on which to base a rigorous economic evaluation of any specific method that improves clinical communications, nonevent charges versus those for the adverse event are compared in **Table 2**, which clearly demonstrates that sentinel events are expensive. It is important to recognize that the amounts listed in **Table 2** reflect actual charges to the patient, rather than activity-based costs,[40] because it is difficult for hospitals to know the true cost of rendering care.[a]

The increased charges for escalated care in the case scenario are solely the result of added time and equipment needed for the SICU stay and management of the fatal hemorrhage. The large cost difference reflects such items as additional tests and equipment, blood products, advanced cardiac life support drugs, and ICU time. Of note, the need for mechanical ventilation alone was billed at $5247, or 30% of the excess amount for the event case. Not taken into account are increased staff payroll costs, physician time charges, or any calculation of sums that could be incurred from litigation. The latter is difficult to include in a cost comparison because legal action is rare and the associated costs are variable.[41]

As the case and charge data clearly demonstrate, the ability to reduce medical errors that result from poor clinical communication has the potential to reap large

[a]In activity-based costing, a dollar amount is assigned to an activity, such as a CT scan, that encompasses all of the resources needed for the activity (eg, equipment depreciation, supplies, and related medications). Currently, Vanderbilt University Medical Center, like many hospitals, does not use activity-base costing.

Table 2
Hospital charges for sentinel event case

Item Description	Charge Unit	Unit Charge ($)	Standard Care ($)	Escalated Care ($)
Surgeon fee	Hours	1056.31	6866.00	6866.00
Anesthesia fee	Quarter hour	100.25	2606.50	2606.50
OR time	Half hour (1st)	2372.00	2372.00	2372.00
OR time	Half hour (2nd +)	1897.00	11,382.00	11,382.00
Central line	Per kit	619.00	1238.00	1238.00
Chest radiograph	Per study	247.00	247.00	741.00
Radiograph interpretation	Per study	35.00	35.00	105.00
Red blood cells	Unit of product	135.00	270.00	1350.00
Blood bank fee	Unit of product	347.00	694.00	3470.00
PACU charge	Day	3600.00	3600.00	3600.00
ICU charge	Day	3125.00	3125.00	6250.00
Resuscitation	Each	745.00	0.00	745.00
Intubation (ICU)	Each	320.00	0.00	320.00
ACLS drugs	Per event	2500.00	0.00	2500.00
Ventilator	Day (1st)	2883.00	0.00	2883.00
Ventilator	Day (2nd +)	2364.00	0.00	2364.00
Pericardiocentesis	Each	500.00	0.00	500.00
Thoracostomy tube	Each	774.00	0.00	774.00
Total			32,435.50	50,066.50
Difference				17,631.00

Abbreviations: ACLS, advanced cardiac life support; ICU, intensive care unit; OR, operating room; PACU, postanesthesia care unit.

financial and societal rewards. In this single case, had the patient received standard care (overnight monitoring in the ICU), she would have incurred charges of $32,435.50 rather than $50.066.50. The total charges for the adverse outcome are 150% higher than would have been incurred with an uneventful postoperative course. It is hardly surprising, given these data, that Dimick and colleagues[42] found that hospital profit margins decreased from 23% to 3.4% when complications arose in a surgical patient. A widely reported University of Utah study found that the average cost of opioid-related adverse drug events approached $1000 per patient.[43] Additionally, death results from 5.6% to 13% of all surgical adverse events, costing hospitals approximately $9 billion annually.[44]

IMPROVING COMMUNICATION WITH THE SITUATION, BACKGROUND, ASSESSMENT, RECOMMENDATIONS TOOL (SBAR)

By incorporating effective communication training, including formal handoff methods, into medical curriculum, physicians become stakeholders in bettering patient safety and reducing medical costs.[24] This might be achieved by using the SBAR tool communication format, which was originally developed by the US Navy and adapted for use in medicine by Kaiser Permanente.[45] SBAR offers potential as a highly reliable tool for interpersonal and interprofessional communication. Furthermore, it is becoming recognized as a standard format that is promoted by leading patient safety researchers[45,46] and safety-oriented organizations, such as the Institute for Healthcare

Improvement (a prominent nonprofit organization with a strong focus on patient safety) and Agency for Healthcare Research and Quality.[47] Institute for Healthcare Improvement has advocated the use of SBAR, and examples of the tool can be found on its Web site.[45]

SBAR provides a communication medium having both interpersonal and structured written elements, which has been shown to be more effective than either verbal or written communication alone (see **Fig. 3**).[48] An electronic version of the tool is shown in **Appendix 1**. Weinger[49] at Vanderbilt University developed the instrument for PACU handoffs, and he is currently studying its effectiveness with a high-fidelity human patient simulator and live patients (Weinger MB, personal communication, 2007). Vanderbilt Medical Center's Center for Perioperative Innovation has integrated it with the existing computerized anesthesia care record system. The need for rapid throughput in a busy operating suite can result in disorganized, rushed handoffs that may lack critical information, leading to preventable errors.[50] The goal of this approach is to minimize the amount of information the anesthesia provider must memorize (and risk forgetting) to report to a receiving caregiver.

Appendix 1 shows a test version of the instrument illustrating the elements in an SBAR handoff report. The current one in use automatically integrates much of the clinical data (vital signs, medications, anesthetic agents, fluid totals, and so forth) from the electronic anesthetic care record. The format can be adapted to other clinical settings, such as the intensive care unit.

THE ECONOMIC EVALUATION OF SITUATION, BACKGROUND, ASSESSMENT, RECOMMENDATIONS TOOL

The authors intend rigorously to validate the Vanderbilt University SBAR intervention in the clinical setting concurrently with a protocol to evaluate whether it also lowers costs. In many instances, however, it is not clear that an intervention is purely cost effective. When one examines the various established methods of economic evaluation (see **Table 1**) it becomes apparent that SBAR is an intervention that is difficult to categorize. The work of McIntosh and Cairns,[51] however, may inform the choice of study design. They point out that nonclinical interventions, such as telemedicine, may produce differences in health outcomes that cannot be expressed in dollars or hospital-free days. It is likely that the new SBAR intervention will incur significant start-up and ongoing costs; however, it may well prevent an unwanted outcome, such as the case discussed previously. In such an instance, economists can "turn the tables" back to the persons or entity making the decision and present the range of outcomes as related to costs.[31] This is done using a cost-consequence matrix, shown in **Table 3**.

The primary goal of studying the SBAR communication format rigorously is to show that it improves outcomes. Such an understanding also informs the economic evaluation, allowing one to anticipate where both costs and consequences (positive or negative) will arise. An economic evaluation of SBAR needs to include the following considerations.

Timing

The timing of the economic evaluation is important because the costs incurred at the beginning of the planned clinical portion of the evaluation may be a one-time startup cost, considered a "sunk" cost, and become less applicable by the end of the trial if it is prolonged because of inflationary factors and the time value of money. Optimally, the economic evaluation begins with the clinical trial and incorporates up-to-date

Table 3
Cost consequence matrix

Costs	Consequences: Beneficial Consequences	Little Difference	Negative Consequences	Insufficient Evidence
Cost savings	+	+	±	?
Little difference in cost	+	±	−	?
Greater costs	±	−	−	?
Insufficient evidence	?	?	?	?

Abbreviations: +, Intervention is worthwhile; −, Intervention is not worthwhile; ±, Intervention has both increased costs and increased benefits; ?, There is insufficient evidence to determine.
From McIntosh E, Cairns J. A framework for the economic evaluation of telemedicine. J Telemed Telecare 1997;3(3):132–9, with permission.

cost and sensitivity analyses as it progresses. McIntosh and Cairns,[51] Robinson,[52] and other prominent health economists recommend this approach.[31]

Perspective

Societal segments possibly affected need to be considered: patients, health care workers, health system financial entities, states, the federal government, and so forth.

Effectiveness

Although measuring effectiveness proves challenging, it should be feasible to collect meaningful outcome data, including the cost reduction from elimination of redundant services. Additionally, unwanted patient outcomes, such as adverse drug events or reintubations in the PACU, need to be captured before and after the intervention to determine cause-and-effect relationships.

Nonhealth Outcomes

Nonhealth outcomes need to be valued appropriately. "Soft" dollar reductions may occur from improved physician and staff morale, increased performance efficiency, and better community relations. Specifically, it is probable that those personnel involved in clinical communication, such as PACU nurses, anesthesiology providers, and ICU care personnel, will report improved job satisfaction because they concretely improve patient care.

SUMMARY

During the past two decades, anesthesiology has led many patient safety improvement initiatives, and morbidity and mortality rates have decreased greatly as a result. As evidenced by the latest JCAHO sentinel events report, however, the specialty continues to grapple with suboptimal outcomes, many related to poor communication. Anesthesia providers' work hours and practice settings are more variable than in the past, and attendant breakdowns in clinical information transfer can lead to systemic medical errors, many of which result in adverse events. Current evidence indicates that formal handoff tools, such as SBAR, can improve clinical communication and may reduce medical errors. At the time of this writing, however, no communication improvement modalities of this type have been subjected to formal clinical or economic analysis, in part because the potential benefits remain nebulous. The authors propose to study SBAR prospectively along with a formal economic evaluation. Solutions are needed that effectively address what the journalist Edward R. Murrow described as "the oldest problem in the relations between human beings: what to say and how to say it." By doing so clinicians can better the specialty of anesthesiology and improve the quality of care patients receive.

APPENDIX 1
Vanderbilt University SBAR Handoff Report

NOT AN OFFICIAL MEDICAL RECORD

Vanderbilt University Medical Center
THE VANDERBILT CLINIC / VANDERBILT HOSPITAL
Department of Anesthesiology
INTRAOPERATIVE PACU REPORT

MR Number:
Patient Name:
Acct #:
DOB: 10/19/1970 **Age:** 36 yrs - Male
WT: 67 kg **ASA:** 2 **OR:** VUH3 RM 05

DOS: **6/5/2007**

S

ID Band Location: ______ PACU Time In: ______ Time Out: ______
Allergies: ______

Anesthesia Attending: Anesthesia Provider:
Type of Anesthesia: General Anesthesia
Surgical Procedure: Right Inguinal Herniorrhaphy w/Mesh
Presenting Diagnosis: Right Inguinal Hernia, Recurrent
Attending Surgeon: Surgical Resident/First Assist:

Surgical Information & Issues: ______

Pre-op Vital Signs: BP ___/___ HR ___ RR ___ SpO2 ___% Temp ___°C / °F
Problem List/Medical History: ______

Airway Management: Mask with an oral airway; easy mask; LMA (5)
ANES. AGENTS: ______ Paralyzed: YES NO ______ Reversed: YES NO ______
Intra-op Vital Signs: BP ___ - ___/___ - ___ HR ___ - ___
(ranges) SpO2 ___ - ___% on FiO2 ___ Temp ___ - ___°C PACU Temp ___°C / °F

B

Medications Administered (Doses, Units, Time of last dose)

dolasetron 12.5 mg IV, 9:35 am
fentanyl 250 mcg IV, 8:10 am
glycopyrrolate 0.5 mg IV, 9:40 am
hydromorphone 1 mg IV, 9:05 am
lidocaine 100 mg IV, 7:40 am
midazolam 2 mg IV, 7:20 am
neostigmine 3 mg IV, 9:40 am
propofol 200 mg IV, 7:40 am
vecuronium 10 mg IV, 8:10 am
• ______

Prophylactic Antibiotics (Drug, Dose, Units, Time of Last Dose)
cefazolin IV 1 gm 7:30 am
• ______

Fluids - Inputs:
NS: ___ ml LR: ___ ml Other (___): ___ ml Total Fluids: ___ ml
PRBC: ___ ml /U Cell Saver: ___ ml Platelets: ___ ml/U FFP: ___ ml/U

Outputs:
EBL: 100 ml Urine: 250 ml NG: ___ ml Other (___): ___ ml

Intraop Labs
Last PCV: ___% Other Labs: ______ Glucose/Insulin: ______

A

Events/Complications:
Issues/Special Precautions (isolation/spine/radiation/etc): ______

R

Plans: ______

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