

Trauma Hand-Offs: Moving Patients Through Multiple Phases and Locations of Care

George W. Williams II¹ · Christopher T. Stephens¹ · Carin Hagberg¹

Published online: 19 February 2016
© Springer Science + Business Media New York 2016

Abstract Hand-off reports in hospitals have recently gained attention as a potential safety issue regarding overall patient care. This has been a particular concern in the acutely injured patient. There is a paucity of research regarding patient care hand-offs in a trauma center environment and as a result, little has been done to change this global problem. Hand-offs of trauma patients begin in the emergency department between pre-hospital providers and trauma center staff, and continue to the operating room, ICU, as well as other locations. As a result, patient assessment and critical information get lost along the way. After reviewing the literature, we have identified some important references and recommendations to improve trauma patient hand-offs.

Keywords Emergency department hand-offs · Operating room hand-offs · Trauma care communication · Intraoperative hand-off · Intensive care unit hand-off · SBAR

Introduction

Hand-offs affect nearly every medical specialty to some degree. The term ‘hand-off’ has multiple synonyms commonly applied in medical texts and literature. Some of the

terms include transitions of/in care, handover, and signout [1]. In either case, a patient hand-off is the transfer of information and professional responsibility from one provider to another while a patient is admitted to a hospital or a facility.

Pre-hospital (EMS) to Emergency Department (ED)/Trauma Center Hand-Off

Handing off (“sign out”) of patients has been a cornerstone of healthcare services since the inception of clinics and hospitals. Unfortunately, as our healthcare system has become more advanced and burdened with increased numbers of patient admissions, there has been little progress made with respect to improved “hand-off” communication between pre-hospital providers and emergency department (ED) staff. The “hand-off” (transfer of patient care) from one healthcare provider to another is arguably the most important skill during the care of the seriously ill or injured patient [2, 3].

Anyone who has worked in a busy ED or trauma center has witnessed the communication breakdown between EMS and hospital receiving staff. The following scenario is what typically occurs during this critical phase of patient care:

Emergency medical services (EMS) roll into the trauma bay with a critically injured patient where chaos ensues as the medics attempt to move the patient from their stretcher to the trauma room bed: Intravenous catheters get accidentally pulled out during transfer, monitor cables get tangled around the patient and beds, EMS providers attempt to move their stretcher out of the way as nurses, medical students, interns, residents, fellows, and physicians bump into each other all trying to simultaneously “assist”

This article is part of the Topical Collection on *Anesthesia for Trauma*.

✉ George W. Williams II
george.w.williams@uth.tmc.edu

¹ University of Texas Medical School at Houston, 6431 Fannin Street, MSB Suite 5.020, Houston, TX 77030, USA

in evaluating and treating the patient...throughout this “organized chaos,” the EMS providers are attempting to communicate a patient “field report” on what has been witnessed and the care that was performed prior to patient arrival at the ED/Trauma Center. One of the nurses or residents may hear part of what the medic is saying but in reality, much of the EMS “hand-off” is lost in translation and goes in one ear and out the other of the ED/Trauma Center staff. The disgruntled medics then leave to prepare for another call and a short time later, the attending physician makes inquiry as to what drugs were administered in the field, how much fluid patient received, and if the vitals were unstable. No one really knows the answers to these questions, as the medics have already departed and the nurses have been too busy to chart anything that EMS stated in their report. With any luck, a carbon copy of the EMS “run report” may be left behind for someone to try and interpret the scribbled notes, usually with minimal success. After all, most EMS field patient care reports are now electronic and a copy is unable to be accessed until long after the patient has been treated and moved off to other locations in the hospital, with multiple hand-offs occurring throughout the process.

We can learn from these all too common experiences, as we have tackled this problem in the operating room (OR) through a very specific “time-out” checklist. This checklist has essentially solved the problem of “hand-off” communication breakdown, as the patient is rolled to the OR to be placed under anesthesia for a surgical procedure. A big difference between the field/ED/trauma bay is that this checklist is performed under a controlled setting in the OR, with plenty of time to communicate any issues that need to be addressed, such as antibiotic administration, correct surgical procedure, appropriate consents. Often times, there is a moribund patient in the trauma bay where a controlled “hand-off” is very difficult for EMS providers to complete in a timely fashion. In fact, studies have demonstrated that ED staff recall less than half of the information that EMS providers report during verbal hand-offs [4–6].

Unfortunately, hand-offs between EMS providers and the ED/Trauma Center staff is a largely unstudied area of health care. There are few reports in the literature with respect to “medic hand-offs” to hospital staff. A review of EMS safety by Bigham et al. showed that only 4 of 88 studies included in the review addressed EMS hand-offs [7•]. The primary reason for this is that there are very few pre-hospital studies compared to hospital-based research. Thus, studies involving hand-offs from the EMS providers’ viewpoint are lacking, leading to slow advancement in this important area of research.

A recent report by Meisel et al. attempted to address this issue of EMS providers’ perspective during hospital hand-offs. The goal of their study was to identify factors and

issues involving the EMS hand-off process that occurs on a regular basis, and attempt to address these issues in order to streamline the process into a safer, more efficient, and higher-quality patient-centered practice [8•]. This study demonstrated that EMS providers recommend the following changes to the current hand-off process: communicating directly with the physician who will be responsible for patient care, ED staff familiarity of EMS protocols and field environment, as well as a standardized approach to the hand-off report to include all critical aspects of field assessment and care that occurred prior to arrival. Furthermore, it was suggested that current technology be utilized to bridge the gap between information exchanges [9]. The results of this study bolster previous research, which demonstrated that EMS hand-off reports are variable in content and organization, and that the majority of patient information is delivered to clinicians not ultimately responsible for the care of the patient [9–11].

Another well-organized study by Carter et al. attempted to identify and utilize a “trauma hand-off checklist” of 16 key data elements in an urban academic trauma system. The focus of the study was to identify these “key data elements” that were actually “transmitted” (verbal delivery) to the trauma team staff by EMS providers yet not “received” (documented by trauma team). The results of this elegant study demonstrated that only 72.9 % of data elements “transmitted” by EMS were “received” by the trauma team. The most common transmitted data elements were mechanism of injury, anatomic location of injury, and age. One significant limitation of this study was that the 16-data-element list is not applicable to every trauma patient (blunt vs penetrating) [12]. Further work on this important topic included an observational study by Sarcevic and Burd on EMS patient report hand-off to trauma team members [13•]. This group examined the characteristics of information handover between EMS and trauma team members during trauma resuscitations. The results of this observational study suggested that a significant number of pre-hospital hand-off reports are incomplete, thus triggering a barrage of questions from the trauma team, some of what may or may not be important at the time and likely will not be recalled by team members. This study group further suggests that problems occur when EMS reports are disorganized, lack key information, such as procedures/treatments performed at the scene and en route, as well as response to those treatments. In addition, electronic complete field reports take time to complete after the fact and are usually not easily accessible to the ED/Trauma Center staff [13•].

It is evident from the few well-designed studies involving EMS hand-offs to ED/Trauma Center staff that there are several potential pitfalls that occur with each patient hand-off encounter. In general, the EMS providers

do not give the “key” data information points within a certain time frame to the receiving trauma team in an organized concise fashion that is understandable and to the point. Secondly, the responsible clinician is not paying attention to the verbal hand-off and is left with many unanswered questions during the initial care of the patient, as the EMS providers leave the trauma bay. Furthermore, the recording representative (typically the trauma nurse) fails to receive, inquire, and chart the key EMS data points that need to be included in the patient’s medical record.

Emergency Department (ED) to Anesthesiology (Operating Room) Hand-Off

Once the EMS hand-off has occurred, the trauma team quickly assesses and performs any indicated life-saving interventions, such as intubation, vascular access, chest tube placement, and ultrasound FAST exam in the trauma bay. If a surgical procedure is indicated, the attending trauma surgeon typically says to post the case with “Anesthesia” and call the OR charge nurse. A short time later, the patient arrives to the OR and a very brief “hand-off” occurs between the trauma nurse who transported the patient and/or the intern, surgical resident or fellow, and least likely the attending trauma surgeon to the anesthesiology resident, advanced care practitioner, or least likely the Anesthesiology attending. This “hand-off” typically describes the mechanism of injury and blood product administration in the ED/trauma bay. There may be a brief discussion of vascular access and whether the patient was intubated in the ED or field. The nurse then departs quickly back to the busy ED, while the attending Anesthesiologist attempts to decipher the tangle of monitors, vascular lines, and a quick survey of the airway or oxygenation/ventilation, if the patient is already intubated. Much of this “hand-off” may have been “watered down” from the anesthesia resident or advanced care practitioner caring for the patient under the medical oversight of the Anesthesiology attending.

As peri-operative specialists, Anesthesiologists are expected to quickly gather a patient history, perform a brief focused physical exam, and prepare to anesthetize a critically injured trauma patient in a matter of minutes on arrival to the OR. The end result is a potentially critically ill patient with little, if anything, known regarding key elements relevant to care (patient history, vascular access and its functionality, blood product administration, medication administration, physiological responses, airway difficulties and details of airway management, results of chest X-rays, CT scans and FAST exams if performed, and pre-hospital EMS reports). In reality, most of this critical information is never filtered down to the attending

Anesthesiologist, who is responsible for the care of this critically injured patient. It is up to that physician to seek out this information from their surgical colleagues and hope that they recall much of what has been performed in the care of the patient up to this point. One can now see how the major gaps in patient hand-off can and do take place and that this is ultimately detrimental to definitive patient care.

At The University of Maryland R Adams Cowley Shock Trauma Center, attending trauma Anesthesiologists are present for every trauma admission in the Trauma Resuscitation Unit (TRU), which is located adjacent to the trauma operating rooms. Thus, the attending trauma Anesthesiologist is present for the EMS provider hand-off report from the field care given by the EMTs/paramedics. Furthermore, the Anesthesiologist is present to manage the airway/ventilation, initiate resuscitation with the attending surgeon, perform any indicated procedures, such as vascular access or chest decompression, and is ready to perform a direct seamless transition to the trauma OR, obviating the need for yet another hand-off from the trauma team. Thus, this institution is one of the few in the United States where an attending trauma Anesthesiologist is present from the delivery of the patient to the trauma bay through all peri-operative phases of care. This has minimized “hand-off errors” and allows the responsible physician to communicate directly with EMS providers, nursing staff, and other peri-operative colleagues.

There is a paucity of literature with respect to hand-offs occurring between the ED/Trauma Center staff and Anesthesiology personnel for patients requiring operative intervention. In a recent report by Evans et al., of the 500 articles reviewed in 2012 regarding the best practice peri-operative hand-offs, all of these reports focused on OR to intensive care unit (ICU) hand-offs [14, 15]. It appears that the hand-off process on delivering a critical patient to the operating room has essentially been overlooked in the literature. Evans et al. decided to perform an important recent literature search involving all peri-operative/peri-anesthesia hand-offs. Of the 80 articles identified, none addressed the hand-off of patients to the OR. This was an unexpected finding and is, indeed, concerning. The “reverse hand-off” as the authors call it from the ICU (or ED for trauma) to the OR is “potentially even more important than from OR to ICU because ICU to OR transfers often occur in unstable patients scheduled for emergent or urgent surgical procedures and magnify the potential risk to patient safety” [14]. The authors conclude that an “ICU to OR” checklist may have some merit in terms of decrease in the number of adverse events that occur in critical care patients being taken to the OR for an urgent procedure [14].

So what can we as trauma professionals learn from this hand-off “pitfall” in both the trauma bay and operating

room? Going back to our OR “time-out” policy that has become the standard of care for all hospital operating rooms, we as peri-operative specialists must take lessons learned from this time-out process and begin to utilize a similar approach to “handing off” a critically injured/ill patient. Much as a pilot of an aircraft does when he or she prepares to depart on a flight, a checklist is performed prior to take-off on every single flight so nothing crucial is missed. Should physicians be held to the same standards as FAA licensed pilots?

After reviewing the current literature, it is evident that we, as peri-operative physician professionals, need to perform a much better job at enforcing a hand-off process that is unique to the critically injured patient who is arriving to the trauma center and ultimately to the OR for definitive resuscitative care. One approach may be to have a standing “time-out style checklist” that will work for both EMS providers in the trauma bay and for ED staff delivering a critical patient to the OR. This checklist does not need to be exhaustive and time consuming but should have several bullet points that are crucial to hand-off information exchange. The following are examples of hand-off checklists that can be placed on the wall of the trauma bay and trauma operating room:

Trauma bay	Trauma OR
Mechanism of injury	Mechanism of injury
Pertinent medical history	Airway interventions
GCS in field	Vascular access
Last recorded vital signs	LSIs performed
Life-Saving Interventions (LSI's) en route	Blood products/massive transfusion protocol activation
Response to LSIs	Medications (paralytics, antibiotics, etc.)
Drugs and doses given	Recent vital signs
Field estimated blood loss	Results of radiological studies
Any concerns by EMS	Brief EMS report
	Lab results (rTEG, ABG, toxicology screen)
	Any concerns from ED staff

Intraoperative Hand-Offs

Transitions of care in the operating theater are unique among all other types of care transitions that will be discussed in this chapter for several reasons: (1) they are more frequent; (2) they may occur with various, and sometimes unpredictable, levels of complexity; and (3) the principal diagnosis/purpose of surgery may be extremely broad. The frequency of intraoperative hand-offs is very high secondary to the principal fact that the provider ratio for

anesthetic care is 1:1. Even in the ICU environment, a hand-off is not necessarily required to facilitate a nurse going to the bathroom, for example. As such, the OR is the highest level of care in the hospital from a provider standpoint, regardless of the type of case. This level of acuity is reflected in the fact that intraoperative hand-offs have a ‘dose-’ dependent effect on mortality [15]. As such, while various standardized systems, such as SBAR, may be generally effective, important information may be omitted. The potential complexity of anesthetic management needed to facilitate a surgical intervention is vast. As the reader likely knows, the medical challenges for a MAC upper gastrointestinal endoscopy are quite different from double lumen intubation, single lung ventilation, and video-assisted thoracoscopic surgery (VATS). The degree of content required and the systems affected are quite different for these two hypothetical cases.

Finally, the anesthesia team may be requested to care for patients with an unlimited variety of surgical interventions, diagnoses, and co-morbidities. As such, the standardization of hand-offs poses a unique challenge in that it may be more difficult to standardize a hand-off according to service line or specialty type. In tertiary centers, however, where anesthesiology teams are highly specialized, a structured hand-off that addresses subspecialty issues may not only be possible, but necessary for the implementation of protocols and quality improvement strategies.

The prevailing theme thus far with regard to intraoperative hand-offs is that in order for a hand-off tool to be universally applied in an institution, all systems would need to be included and such hand-offs would need to take place consistently. In order to achieve adoption of a hand-off tool, “buy-in” is required by all stakeholders and a cultural change must take place. Cultural change, while being the most obvious, may be the most difficult to implement in a group or a hospital. Nonetheless, it has been stated that ‘the difference between a good hospital and a great hospital is culture.’ When trainees are involved in the hand-off process, early educational intervention through simulation or coaching may be useful in maximizing success of such cultural modification. Multiple tools have been developed by multiple institutions to facilitate hand-offs, though many institutions create their own hand-off tool [16].

Out of necessity, secondary to the 80-h work-week or due to patient safety concerns, the ACGME requires that hand-off education be included in resident education [17••]. Furthermore, the Center for Medicare and Medicaid Services (CMS) may require hand-off documentation as an Anesthesiology quality metric in the near future. While paper is more common and potentially easier to implement in the OR, electronic hand-off tools have been demonstrated to facilitate increased retention of the information

Post-Operative CHATT

Please check the ICU Team given the Handoff:

<input type="checkbox"/> Burn ICU	<input type="checkbox"/> NTICU	Report Given to: _____ MD / APP
<input type="checkbox"/> CVICU	<input type="checkbox"/> STICU	
<input type="checkbox"/> MICU	<input type="checkbox"/> TSICU	

Anesthesiologist Attending: _____ Attending Surgeon: _____
 Anesthesiologist Attending Pager: _____ Face to Face Hand-off w/ICU Team: Yes No
 Procedure: _____ Procedure Date: _____

Airway Management: Easy Challenging Very Difficult (airway precautions for extubation)

Medication Infusions: No Infusions

Drug Name: _____	Drug Name: _____
Concentration: _____	Concentration: _____
Dose: _____ mcg/kg/min mcg/min	Dose: _____ mcg/kg/min mcg/min
mg/min mcg/kg/hr Units/hr mcg/hr	mg/min mcg/kg/hr Units/hr mcg/hr

Drug Name: _____	Drug Name: _____
Concentration: _____	Concentration: _____
Dose: _____ mcg/kg/min mcg/min	Dose: _____ mcg/kg/min mcg/min
mg/min mcg/kg/hr Units/hr mcg/hr	mg/min mcg/kg/hr Units/hr mcg/hr

Intra-operative Fluids

_____ ml LR / NS / PL	_____ ml 5% Alb / 25% Alb / Starch
_____ ml LR / NS / PL	_____ ml 5% Alb / 25% Alb / Starch
_____ unit (s) PRBC	_____ unit Cryoprecipitate / FFP
_____ unit (s) Platelets	_____ ml Cellsaver

Urine: _____ ml **EBL:** _____ ml **Resp:** Spont SIMV/AC PSV PEEP _____ cmH₂O
 FiO₂ _____ % PAP _____ cmH₂O

Feeding: None Parenteral @ _____ ml/hr Enteral @ _____ ml/hr

Expected Muscle Relaxation Duration Post-operatively:
 None present ~1-2 hours >3 hours

Significant Intraoperative Problems/Anticipated Postoperative Issues Over Next 24 hours:

Warnings/Other Concerns for ICU Team: Sleep Apnea

Report Given By: _____ / _____ MD / AA / CRNA
 Signature Printed Name

	Patient Name: _____ MRN: _____
-------------------------------------------------------------------------------------	-----------------------------------

Fig. 1 Sample consistent hand-off at transfer tool (CHATT) form currently used at the Memorial Hermann Hospital

contained within a hand-off in the intraoperative environment [18].

Hand-off policy adherence may be even more important on weekends and at night, as the 30-day mortality for

patients admitted during these time frames is increased [19]. Mechanisms proposed for this increased mortality include the tendency for a less well-staffed and more ‘junior’ team staffing patients during this time.

Operating Room to Post Anesthesia Care Unit (PACU)/Intensive Care Unit (ICU) Transfers

Improving hand-offs from the Anesthesiology team to the PACU/ICU team are an opportunity to improve patient safety in the hospital. While not the same level of care as the OR, the frequency of hand-offs required because of patients leaving the ICU for a procedure or surgery lends itself to complications arising. This risk is especially prominent when hand-offs occur between different teams instead of between members of the same team [19]. Additionally, 72 % of patients transported from an ICU to another location experience hypotension, arrhythmias, hypoxemia, or cardiac arrest [20]. Additionally, ICU personnel use information provided from the transporting team to direct their therapy, especially when it is their first time assessing the patient [21]. At the author's institution, the Anesthesiology team is encouraged to outline and report concerns for impending pathophysiology, if applicable. See Fig. 1 to review examples of the form, called consistent hand-off at transfer tool (CHATT), one for the pre-operative report from the ICU team to the anesthesiology team, and vice versa. This form is required whether the patient is brought to the PACU or ICU.

Ideally, any hand-off tool should be structured so that there is no information documented that is fully redundant to the chart, as this will likely serve to reduce compliance with tool completion by medical team stakeholders. Additionally, an effective hand-off tool serves as a mechanism to assist the person covering key recalling items to discuss with the receiving provider, similar to a checklist. In some instances, Anesthesiology-oriented checklists are compared to aviation checklists but this approach may be faulty. This is illustrated by the fact that a pilot is at equal risk as the passengers on any aircraft if the checklist is not followed (the pilot would go down with the passengers). In the OR or ICU, the Anesthesiologist is not at personal mortal risk if the checklist is not followed. Therefore, special care must be taken to ensure checklist compliance. By the time all transfers of care are completed during an inpatient hospitalization, dozens of medical providers need to know the same content of information to appropriately care for a given patient [21]. Utilizing a structured hand-off based on medical systems in lieu of a SOAP format not only ensures all information is covered but also fosters more accurate communication between caregivers [22]. As such, the importance of the OR to PACU/ICU hand-off should be treated with the same urgency as an intraoperative hand-off.

In future iterations of hand-off tools, integration and/or standardization based on information contained in the electronic health record (EHR) will likely take place. The

benefits of this may be reduced cost and time required for hand-offs overall across a service line, especially considering that 46 % of information in nursing and physician hand-offs overlaps in terms of the content discussed [23]. As trends in healthcare converge on the goal of zero complications, hand-off integrity is essential in achieving this goal.

Conclusion

Hand-off reports between multiple healthcare providers with differing backgrounds is a challenge in today's busy healthcare system. As a result, patient safety is a concern, particularly with respect to the critically injured patient arriving to a trauma center. As trauma professionals, we need to bridge this gap in communication by implementing novel strategies for patient information hand-off between multiple hospital locations. Checklists are one way that we can simplify and streamline this process so that critical information is not lost in translation. Further research is needed in this important aspect of patient care, particularly with pre-hospital to ED hand-offs, as well as ICU to OR hand-offs.

Compliance with Ethics Guidelines

Conflict of Interest Christopher T. Stephens, George W. Williams, II, and Carin Hagberg declare that they have no conflict of interest.

Human and Animal Rights and Informed Consent This article does not contain any studies with human or animal subjects performed by any of the authors.

References

Papers of particular interest, published recently, have been highlighted as:

- Of major importance
1. Abraham J, Kannampallil TG, Patel VL. Bridging gaps in handoffs: a continuity of care based approach. *J Biomed Inform.* 2012;45(2):240–54.
 2. Solet D, Norvell J, Rutan G, et al. Lost in translation: challenges and opportunities in physician-to-physician communication during patient hand-offs. *Acad Med.* 2005;80(12):1094–9.
 3. Koenig G, Galvagno S. Effective communication between providers & physicians improves patient hand-offs. <http://www.jems.com/articles/2012/04/effective-communication-between-provider.html> (2012). Accessed 16 Dec 2015.
 4. Talbot R, Bleetman A. Retention of information by emergency department staff at ambulance handover: do standardized approaches work? *Emerg Med J.* 2007;24(8):539–42.
 5. Bhabra G, Mackeith S, Monteiro P, et al. An experimental comparison of handover methods. *Ann R Coll Surg Engl.* 2007;89(3):298–300.

6. Pothier D, Monteiro P, Mooktiar M, et al. Pilot study to show the loss of important data in nursing handover. *Br J Nurs*. 2005;14(20):1090–3.
7. •• Bigham BL, Buick JE, Brooks SC, et al. Patient safety in emergency medical services: a systematic review of the literature. *Prehosp Emerg Care*. 2012;16:20–35. *Bigham et al. performed a 12 year literature review in order to identify EMS related threats to patient safety. Multiple factors negatively impacting patient safety included adverse events and medication errors, clinical judgment, communication, ground vehicle safety, aircraft safety, interfacility transport, and intubation. The authors suggest that interventions to modify behavior and provide closed-loop communication training reduced misunderstandings and encouraged staff to communicate concerns more readily.*
8. •• Meisel ZF, Shea JA, Peacock NJ, et al. Optimizing the patient handoff between emergency medical services and the emergency department. *Ann Emerg Med*. 2015;65(3):310–7. *Meisel et al. conducted 7 nationally oriented focus group (at 3 national and regional conferences) of EMS providers in order to determine their perspective on ways to improve handoffs. 4 potential ways to improve handoffs were determined, including 1) direct communication from EMS to the ED provider, 2) increased feedback and transparency, 3) handoff standardization and 4) use technology to close communication gaps.*
9. Carter AJ, Davis KA, Evans LV, et al. Information loss in emergency medical services handover of trauma patients. *Prehosp Emerg Care*. 2009;13:280–5.
10. Evans SM, Murray A, Patrick I, et al. Assessing clinical handover between paramedics and the trauma team. *Injury*. 2010;41:460–4.
11. Fairbanks RJ, Bisantz AM, Sunm M. Emergency department communication links and patterns. *Ann Emerg Med*. 2007;50:396–406.
12. Sarcevic A, Burd R. Information handover in time-critical work. In: Group'09 proceedings of the ACM 2009 international conference on supporting group work. New York: Association for Computing Machinery; 2009. p. 301–10.
13. •• Evans AS, Yee M, Hogue CW. Often overlooked problems with handoffs: from the intensive care unit to the operating room. *Anesth Analg*. 2014;118(3):687–9. *Evans et al. submits a letter to the editor discussing OR to ICU handoffs and the particular opportunities for improvement by presenting examples and discussing successful systems for this process. Additionally, barriers to optimizing such handoffs are reviewed in general.*
14. Segall N, Bonifacio AS, Schroeder RA, et al. Durham VA patient safety center of inquiry. Can we make postoperative patient handovers safer? A systematic review of the literature. *Anesth Analg*. 2012;115:102–15.
15. Lane-Fall M, Gutsche JT, Augoustides JG. Are intraoperative anesthesia handovers associated with harm? Getting to the heart of the matter in cardiac surgery: the search for the hat-trick of quality, safety, and continuous improvement. *J Cardiothorac Vasc Anesth*. 2015;29(1):8–10.
16. McCrory MC, Aboumatar H, Custer JW, Yang CP, Hunt EA. “ABC-SBAR” training improves simulated critical patient hand-off by pediatric interns. *Pediatr Emerg Care*. 2012;28(6):538–43.
17. •• Lane-Fall MB, Brooks AK, Wilkins SA, Davis JJ, Riesenberger LA. Addressing the mandate for hand-off education: a focused review and recommendations for anesthesia resident curriculum development and evaluation. *Anesthesiology*. 2014;120(1):218–29. *Lane-Fall et al. discussed handoffs role in health care quality and the Accreditation Council for Graduate Medical Education's (ACGME) interest in facilitating handoff education in order to prepare residents for practice in the emerging healthcare environment. Definitions of handoffs, elements of a successful handoff, a general history of handoff curricula and assessment techniques are reviewed.*
18. Agarwala AV, Firth PG, Albrecht MA, Warren L, Musch G. An electronic checklist improves transfer and retention of critical information at intraoperative handoff of care. *Anesth Analg*. 2015;120(1):96–104.
19. Filichia L, Halan S, Blackwelder E, Rossen B, Lok B, Korn-dorffer J, Cendan J. Description of web-enhanced virtual character simulation system to standardize patient hand-offs. *J Surg Res*. 2011;166(2):176–81.
20. Shields J, Overstreet M, Krau SD. Nurse knowledge of intra-hospital transport. *Nurs Clin N Am*. 2015;50(2):293–314.
21. Black-Schaffer RM. Communication among levels of care for stroke patients. *Top Stroke Rehabil*. 2002;9(3):26–38.
22. Abraham J, Kannampallil TG, Almoosa KF, Patel B, Patel VL. Comparative evaluation of the content and structure of communication using two handoff tools: implications for patient safety. *J Crit Care*. 2014;29(2):311.e1–7.
23. Collins SA, Stein DM, Vawdrey DK, Stetson PD, Bakken S. Content overlap in nurse and physician handoff artifacts and the potential role of electronic health records: a systematic review. *J Biomed Inform*. 2011;44(4):704–12.