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Are You Ready to Respond? Reports of High Harm Complications after Surgery and Invasive Procedures

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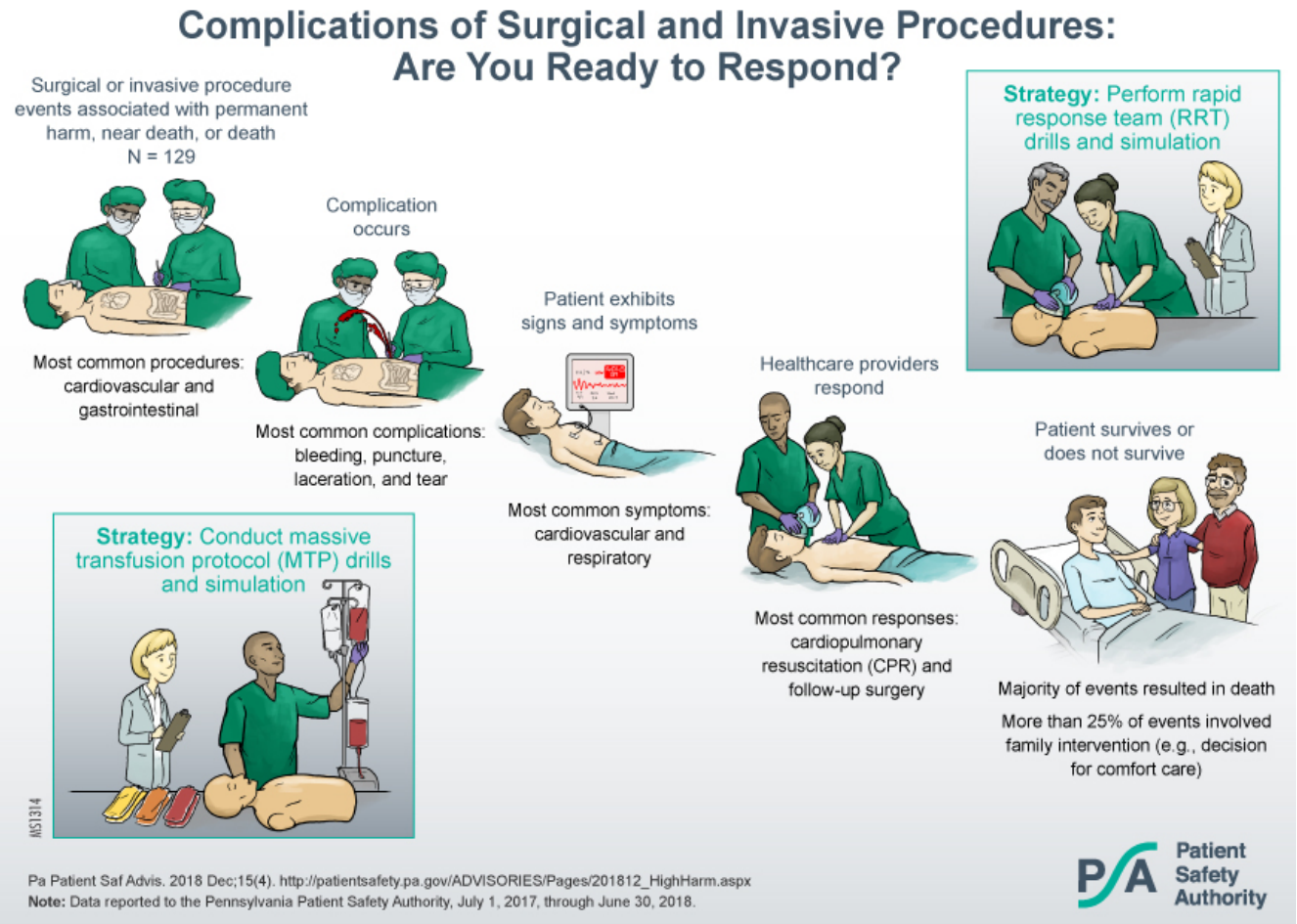
Abstract



Surgery and other invasive procedures carry risk of complication and mortality. Recognizing and responding rapidly to such complications can improve patient outcomes. The Pennsylvania Patient Safety Authority sought to explore surgical complications and healthcare providers' responses by analyzing events reported as complications after surgery that resulted in permanent harm, near death, or death outcomes (high harm events). Analysts queried the Pennsylvania Patient Safety Reporting System for these high harm events submitted under the "complication following surgery or invasive procedure" event subtype for the 2017 academic year (i.e., 12 months ended June 2018). The query yielded 129 events of which cardiovascular and gastrointestinal procedures predominated (59.7%, n = 77 of 129). In these categories, bleeding and puncture, laceration, or tear were the most common complications (73.6%, n = 95 of 129). The majority of these high harm events (85.3%, n = 110 of 129) described some type of patient symptomatology to which healthcare providers responded 90.7% (n = 117 of 129) of the time. The majority of events resulted in death (65.1%, n = 84 of 129). Healthcare facilities can act now by using a similar analysis on their own cases and evaluate complication-response mechanisms to identify priorities for surgical-care learning and improvement.

Introduction

Events that contribute to or result in permanent harm, a near-death event, or death[1]—called high harm events—can be devastating for patients, families, and healthcare providers. High harm events represent about 5% of all Serious Events and 0.17% of all events reported through the Pennsylvania Patient Safety Reporting System (PA-PSRS).[2]

Definitions of Serious Event and Incident as defined in the Medical Care Availability and Reduction of Error (MCARE) Act can be seen at http://www.legis.state.pa.us/cfdocs/legis/li/uconsCheck.cfm?yr=2002&sessInd=0&act=13 (http://www.legis.state.pa.us/cfdocs/legis/li/uconsCheck.cfm?yr=2002&sessInd=0&act=13).

Analysis of high harm events helps facility leaders prioritize investigations into the causes and circumstances leading up to an event and evaluate and improve responses. A primary objective for facility leadership, physicians, and other caregivers is to prevent recurrence of complications, but early recognition and effective response are also important.

Complications of surgery and invasive procedures and management of those complications have been extensively studied.[3-6] Not all events are preventable and recognition and response, sometimes referred to as rescue, are equally important. Some would argue that rescue is a better indicator of surgical quality because it is sensitive to an organization's ability to recognize and respond to signals indicating a patient's deteriorating condition.[3,4,6]

The objectives of this study were to quantify procedure and complication types from the high harm subset of events reported to the Pennsylvania Patient Safety Authority under the "complication following surgery or invasive procedure" event subtype, and to provide analysis in terms of patient symptomatology, healthcare provider response, and patient outcomes.

Methods

Analysts queried the PA-PSRS database for high harm events reported as "complication of procedure, treatment, or test" event type, under the event subtype "complication following surgery or invasive procedure" for the 2017 academic year (July 1, 2017, through June 30, 2018).

The analysis was based on this presumed process:

1. Complication of surgical or invasive procedure occurs
2. Patient exhibits signs and symptoms
3. Heathcare providers respond
4. Patient survives or does not survive

Analysts reviewed event reports for evidence that each step of the process occurred. The outcome of the review yielded three possible results per step: it occurred, did not occur, or was not evident.

Analysts manually reviewed the events to determine the following components:

- Type of procedure
    - Anatomic categorization of the procedure
- Type of complication
- Signs and symptoms that led to the recognition of the complication
- Healthcare providers' response to the complication
    - Response timing: whether it was during or after the operation or procedure and whether the postoperative responses occurred in the postanesthesia care unit (PACU) or beyond
- Response outcome
    - Patient survived or did not survive
    - Family involved in the decision to prevent or stop resuscitation

Based on prior experience reviewing events, analysts anticipated that not all of the above information would be discernable from every event and multiple components could be described per step (e.g., more than one sign or symptom). These variations are reflected in the differing sample sizes noted in the results.

Additionally, a single event could contain information about multiple procedures and complications. If more than one procedure was described, analysts identified the primary or precursor procedure from which subsequent occurrences—such as complication development, signs and symptoms, and healthcare provider response—were deemed to stem. Patient signs and symptoms described in the event narratives were categorized by symptomatology and ascribed to an anatomic location when specified.

Healthcare providers' responses to complications were analyzed by type and timing of response. Responses that occurred during surgery and/or while the patient was still in the operating or procedure room were considered intraoperative (intraprocedural). Responses that occurred in the PACU and beyond were considered postoperative (postprocedural).

Results

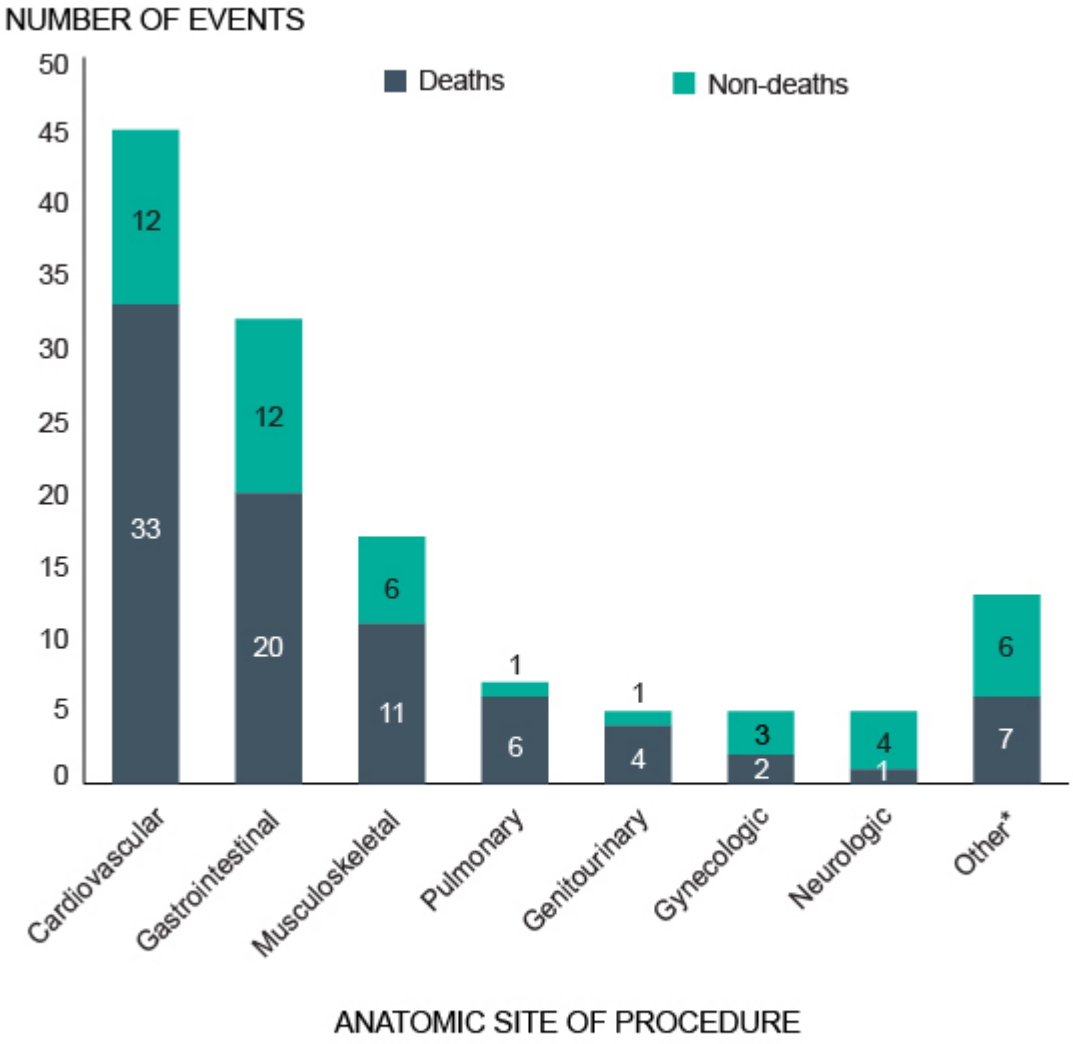
The PA-PSRS query yielded 129 high harm events reported under the event subtype "complication following surgery or invasive procedure."

Procedures and Complications

Analysts identified 13 anatomic sites for 127 of the 129 events. The remaining two events lacked sufficient information for analysts to assign a site.

Figure 1 shows the anatomic sites of the surgery or invasive procedure described in the event narratives. The seven specific anatomic categories in the figure accounted for 89.9% of events (n = 116 of 129) and 91.7% of deaths (n = 77 of 84).

Figure 1. High Harm Events and Deaths by Anatomic Site of Procedure (N = 129)



Note: As reported to the Pennsylvania Patient Safety Authority, July 1, 2017, through June 30, 2018, in the "complication following surgery or invasive procedure" event subtype.

* The "Other" procedure site contains endocrine, dental, dermatologic, endocrine, eyes/ears, nose/throat, renal, and unable to determine.

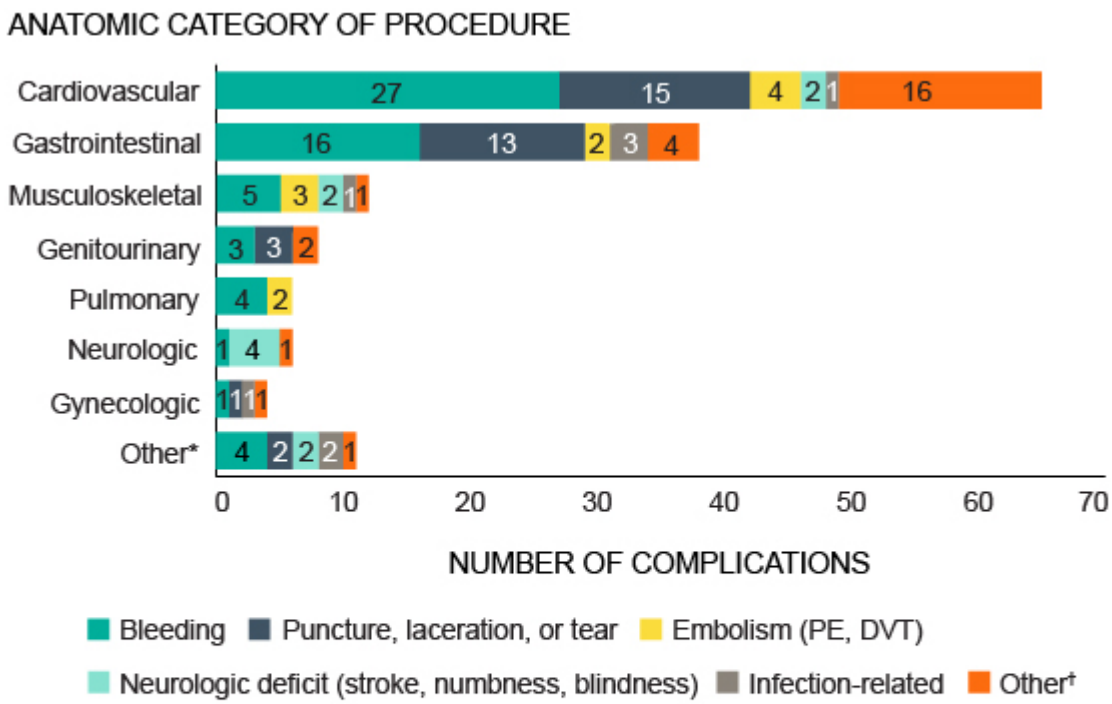
MSI366

Cardiovascular (CV) procedures accounted for the highest number of both events (34.9%, n = 45 of 129) and deaths (39.3%, n = 33 of 84). Gastrointestinal (GI) procedures accounted for the second highest number of both events (24.8%, n = 32 of 129) and deaths (23.8%, n = 20 of 84).

In the subset of events that resulted in death, more than 60% involved CV or GI procedures (63.1%, n = 53 of 84).

Figure 2 shows the top complications by anatomic category of initial procedure. More than three-quarters (78.3%; n = 101 of 129) of events provided sufficient detail for analysts to categorize the type of complication after the surgery or invasive procedure.

Figure 2. Complication Type by Anatomic Category of Procedure (N = 101)



Note: As reported to the Pennsylvania Patient Safety Authority, July 1, 2017, through June 30, 2018, in the "complication following surgery or invasive procedure" event subtype. Complication types were identified in 101 of 129 reports. Total number of complications equals more than 101 because some reports describe multiple complications.

DVT: Deep vein thrombosis; PE: pulmonary embolism.

* The "Other" anatomic category of procedure contains dental, dermatologic, endocrine, eyes/ears, nose/throat, renal, and unable to determine.

† Examples of "Other" complications include arrhythmia, cardiac tamponade, compartment syndrome, and wound dehiscence.

MSI 367

More than half (60.4%, n = 61 of 101) of the events in which complication details were provided in the "complication of surgery or invasive procedure" subtype involved bleeding,* and more than a third (33.7%, n = 34 of 101) involved punctures, lacerations, or tears.

More than three-quarters (76.2%, n = 77 of 101) of the bleeding or breaches (e.g., punctures) complications involved CV and GI procedures.

The following are examples of CV and GI events involving bleeding or punctures, lacerations, or tears reported through PA-PSRS:†

Patient had an aortic valve implant procedure. Approximately 24 hours later developed hypotension and labored respirations. The patient went into cardiac arrest and was taken emergently to the [cardiac] catheterization lab where a femoral arterial bleed was repaired. Despite the control of bleeding, the patient remained unstable and could not be resuscitated.

Patient had a colonoscopy after which developed [severe] abdominal pain. Abdominal CT [computed tomography] scan revealed a splenic laceration which required an emergent splenectomy.

Signs and Symptoms

Analysts identified seven sign and symptom categories encompassing 110 of the 129 events. The remaining 19 events lacked sufficient information for analysts to assign a category.

Table 1 depicts the number and percentage of signs and symptoms identified per event.

Table 1. Signs and Symptoms per High Harm Event (N = 129)

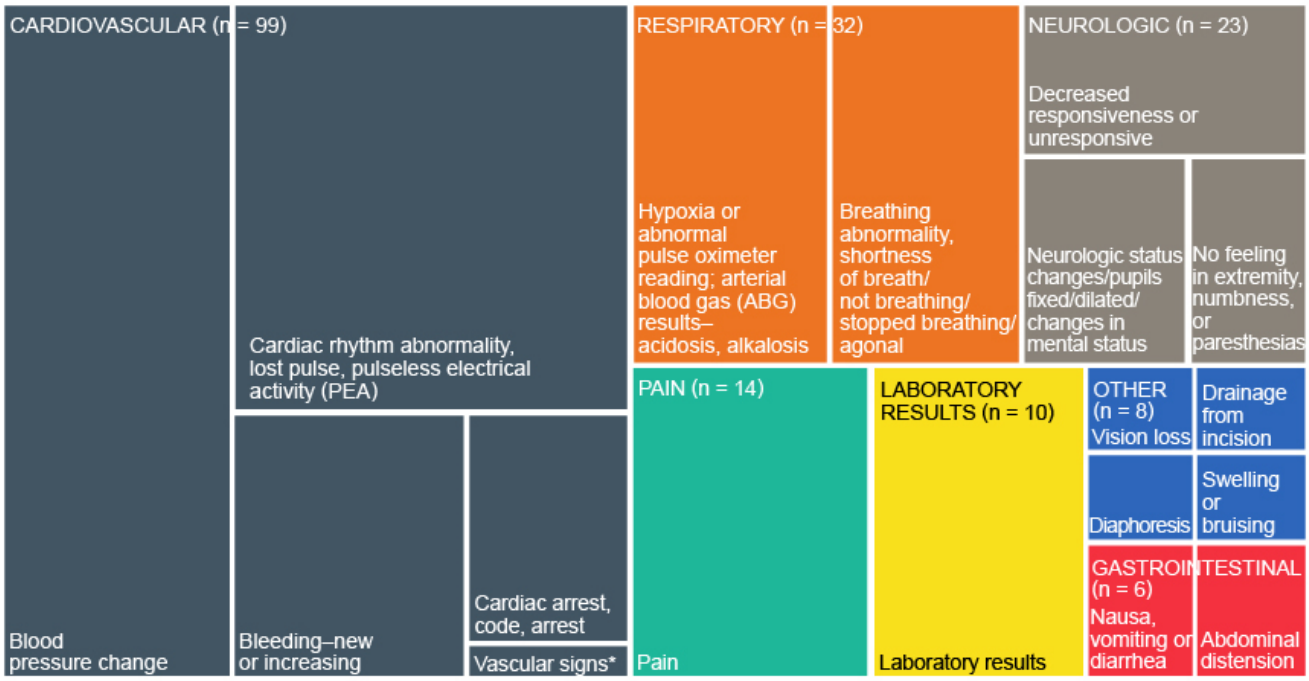
NUMBER OF SIGNS AND SYMPTOMS PER EVENT	HIGH HARM EVENTS, NO. (% OF ALL EVENTS)
0*	19 (14.7)
1	56 (43.4)
2 to 3	50 (38.8)
4 to 6	4 (3.1)

Note: As reported to the Pennsylvania Patient Safety Authority, July 1, 2017, through June 30, 2018.

* Signs and symptoms were not described in the Pennsylvania Patient Safety Reporting System event and therefore not evident to the analysts.

Figure 3 shows the physiologic systems of the signs and symptoms as described in the event narratives.

Figure 3. Type of Symptoms by Physiologic System (N = 129)



Note: As reported to the Pennsylvania Patient Safety Authority, July 1, 2017 through June 30, 2018, in the "complication following surgery or invasive procedure" event subtype. Total number of signs and symptoms totals more than 129 due to some reports describing multiple signs and symptoms.

* Vascular signs include: mottling, cyanosis, and decreased pulses.

MSI368

The six specific categories in the figure included 192 descriptions of symptomatology among events analyzed.

Most events (90%, n = 99 of 110) involved CV symptoms. Blood pressure changes were the symptom mentioned the most among events analyzed (36.4%, n = 40), followed by cardiac rhythm abnormalities (33.6%, n = 37).

Respiratory symptoms were described in 29.1% (n = 32 of 110) of the events. Arterial blood gas or pulse oximetry results were mentioned in 16.4% (n = 18) of the events.

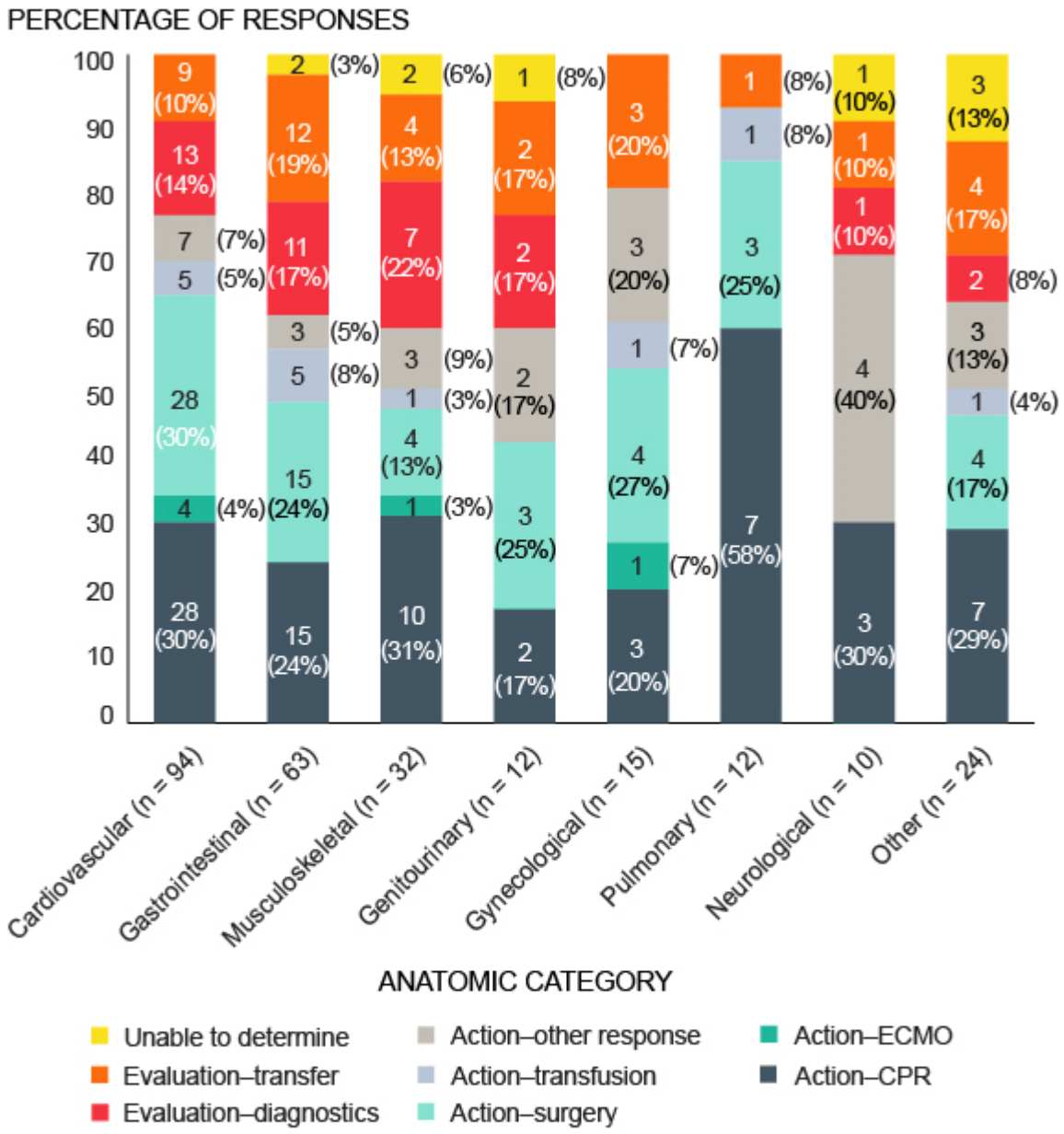
Healthcare Provider Response and Outcomes

Response Type

Analysts identified seven response types encompassing 114 of the 129 (88.4%) events. The remaining 15 events lacked sufficient information for analysts to assign a category.

Figure 4 shows the most common healthcare provider responses to changes in the patient condition by anatomic category of the procedure. Analysts identified 262 healthcare provider responses.

Figure 4. Provider Response Types by Anatomic Category of Procedure (N = 114)



Note: As reported to the Pennsylvania Patient Safety Authority, July 1, 2017, through June 30, 2018, in the "complication following surgery or invasive procedure" event subtype. Healthcare provider response types were identified in 114 of 129 reports. Total number of responses equals more than 114 because some reports describe multiple responses. Analysts identified 262 healthcare provider responses. CPR, Cardiopulmonary resuscitation; ECMO, extracorporeal membrane oxygenation.

* The "Other" procedure category contains dental, dermatologic, endocrine, eye/ears, nose/throat, renal, unable to determine.

MSI369

The seven specific anatomic categories in the figure account for 90.8% (n = 238 of 262) of identified healthcare

responses described in event narratives.

Identified responses were broadly characterized as either action or evaluation responses. Action responses accounted for 68.7% (n = 180 of 262) and evaluation responses 27.9% (n = 73).

Among the 73 evaluation responses, diagnostic testing (50.7%, n = 37 of 73) and transfers (49.3%, n = 36) were described in event narratives.

More than a quarter of high harm events in the "complication following surgery or invasive procedure" event subtype involved providing cardiopulmonary resuscitation (CPR; 27.5%, 72 of 262), mostly among CV events. Follow-up surgery or procedure was performed in 24.4% (n = 64) of events, also chiefly among CV events.

Response Timing

Details of providers' responses were identified in 90.7% (n = 117 of 129) of events. The remaining 12 events lacked sufficient information for analysts to assign a category.

Table 2 shows the timing of healthcare providers' responses to changes in patient condition by anatomic site of the procedure.

Table 2. Response Timing by Anatomic Site of Procedure

ANATOMIC SITE	INTRAOPERATIVE, NO. (% of events per category)	POSTOPERATIVE, NO. (% of events per category)		NOT EVIDENT,* NO. (% of events per category)	TOTAL
		PACU	Post-PACU		
Cardiovascular	23 (51.1)	4 (8.9)	18 (40.0)	0 (0)	45
Gastrointestinal	9 (28.1)	6 (18.8)	14 (43.8)	3 (9.4)	32
Musculoskeletal	4 (23.5)	3 (17.6)	6 (35.3)	4 (23.5)	17
Pulmonary	4 (57.1)	0 (0.0)	3 (42.9)	0 (0)	7
Genitourinary	1 (20.0)	0 (0.0)	3 (60.0)	1 (20.0)	5
Neurologic	0 (0.0)	2 (40.0)	2 (40.0)	1 (20.0)	5
Gynecologic	1 (20.0)	0 (0.0)	4 (80.0)	0 (0)	5
Other†	4 (30.8)	1 (7.7)	5 (38.5)	3 (23.1)	13
Total	46 (35.7)	16 (12.4)	55 (42.6)	12 (9.3)	129

Note: Data reported through the Pennsylvania Patient Safety Reporting System (PA-PSRS), July 1, 2017, through June 30, 2018.

PACU, Postanesthesia care unit.

* Analysts could not discern that a response occurred from the information provided in the PA-PSRS report.

† The "Other" procedure site contains dental, dermatologic, endocrine, eyes/ears, nose/throat, renal, and unable to determine.

Intraoperative responses accounted for more than one-third (35.7%, n = 46 of 129) of all events and postoperative response timing accounted for more than half (55.0%, n = 71). Among the postoperative responses, more than one-third (77.5%, n = 55 of 71) occurred beyond the PACU setting.

Outcomes

Overall, 65.1% of events submitted under "complications following surgery or other invasive procedure" resulted in death (n = 84 of 129; see Figure 1). Of the 84 deaths, family was involved 27.4% of the time (n = 23 of 84) in the decision to discontinue resuscitation (n = 8); withdraw care or life support (n = 9); or initiate comfort measures or do-not-resuscitate orders (n = 6).

Of the events submitted under "complications following surgery or other invasive procedure" in which an intraoperative or postoperative response was evident, two-thirds (66.7%, n = 78 of 117) resulted in death, and 92.9% (n = 78 of 84) of the overall number of deaths showed evidence of a healthcare provider response.

Of the 45 patients who survived, 62.2% (n = 28) experienced a near-death event. These events include loss of pulse and respirations or hemorrhage for which advanced cardiac life support, extracorporeal membrane oxygenation, massive transfusion protocol, or emergency surgery was employed to successfully resuscitate the patient. The remaining 37.8% (n = 17 of 45) experienced permanent harm, including stroke or neurologic deficit; blindness; infection resulting in enucleation; orchiectomy; or amputation.

Following are examples of specific responses and outcomes to surgical or procedural complications reported through PA-PSRS:

[An] elderly patient had a PCI [percutaneous coronary intervention] with stenting and pacemaker insertion. The patient sustained a retroperitoneal bleed requiring MTP [massive transfusion protocol] and surgery to repair an arterial [puncture].

Patient had cataract removal with lens implant. At post-op visit patient complained that [he] could not see. Culture was taken and eye injected with antibiotic. Approximately [six] days later patient still could not see and the surgeon determined that the eye could not be saved and an enucleation was performed.

Following a testicular biopsy and resection of a nodule in the [right] testis, the patient complained of scrotal pain. Surgeon found that patient was hemorrhaging from incision and took patient back to surgery. Upon exploration surgeon found [large] hematoma and active bleeding. Unfortunately after repair of the bleeding [artery], circulation to the testis could not be restored and an orchiectomy was performed.

Following a CABG [coronary artery bypass graft] and AVR [aortic valve replacement] the patient developed right ventricular failure coming off bypass. ECMO [extracorporeal membrane oxygenation] was initiated. Days later, patient returned to surgery to address sternal wound dehiscence and had a tracheostomy placed due to respiratory failure. [Currently] the patient is extubated and recovering on step down unit.

Following discectomy surgery, patient was unable to move [left] side, could not speak, and had deviation of the eyes and tongue. A stroke alert was initiated, a head CT [computed tomography] scan performed, and neurology consulted. Stroke was confirmed and cranial decompression needed due to worsening [enlarging] infarct including new swelling and midline shift.

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* Bleeding includes hemorrhage and hematoma.

† The details of the PA-PSRS event narratives in this article have been contextually deidentified to preserve confidentiality.

Discussion

More than 10 high harm events per month were reported under the event subtype "complication following surgery or invasive procedure" in Pennsylvania this past academic year (12 months ended June 30, 2018). The majority of reported events in this analysis involved CV or GI procedures, and bleeding and punctures, lacerations, and tears were the most common complications. Facilities may find this information useful in order to prioritize what types of response or rescue resources and capabilities might have the greatest impact.

Provider Responses and Failure to Rescue

The concept of failure to rescue is defined in the medical and nursing literature as death after an adverse occurrence (complication),[3] (i.e., the "clinicians' inability to save a hospitalized patient's life when he experiences a complication")[7].

Silber and colleagues examined abstracted medical records of 5,972 Medicare patients undergoing elective surgery (cholecystectomy or transurethral prostatectomy) to determine whether factors associated with overall mortality rate were different from those that predicted surgical complications. They found that failure to rescue was associated more with hospital characteristics than patient characteristics.[3] They determined that the failure-to-rescue rate was a "better indicator of a hospital's quality of care than its rate of complications alone." The latter rate was associated more with patient characteristics.[3,7]

Hospital characteristics included bed size, number of surgeons on staff, number of board-certified surgeons, number of board-certified anesthesiologists, nurse-to-patient ratio, and nurse-to-operation ratio. Patient characteristics included age, sex, severity of illness on admission, type of procedure, and history of congestive heart failure, myocardial infarction, stroke, diabetes, and high blood pressure.[3]

See Table 3 for measures associated with surgical quality.

Table 3. Quality Measures

MEASURE NAME	CALCULATION
Death (mortality) rate	Number of deaths / number of patients
Adverse occurrence (complication) rate	Number of patients who developed an adverse occurrence / number of patients
Failure-to-rescue rate	Number of deaths in patients who developed an adverse occurrence / number of patients with an adverse occurrence

Source: Silber JH, Williams SV, Krakauer H, Schwartz S. Hospital and patient characteristics associated with death after surgery. A study of adverse occurrence and failure to rescue. Med Care. 1992 Jul;30(7):615-29.

Events reported through PA-PSRS under the event type "complication of procedure, treatment, or test" were found to include occurrences in which no error was reported or apparent in the event analysis. The Patient Safety Authority finds this fact encouraging because a primary intent of the MCARE Act of 2002 was to identify events involving harm, regardless of whether error occurred.[8]

Facility leaders can bear in mind that the complication rate as calculated by administrative data is not equivalent to that component of the Serious Event definition referring to an "unanticipated injury requiring the delivery of additional health care services" (i.e., that MCARE reporting is based on harm, regardless of whether error contributed).[8]

The concept of looking beyond a single numerator and denominator is essential to appreciate the entire picture of surgical quality. Healthcare facility staff have access to data and information on both types of characteristics—mortality and complication rates. Besides working with these rates, healthcare facilities are encouraged to calculate and understand their own failure-to-rescue rate as a means for improving surgical patient safety and quality.

Rescue after Hemorrhage

It is imperative that healthcare providers recognize signs and symptoms of a complication and act rapidly. For example, in this analysis, the majority of complications involved bleeding and hemorrhage, and healthcare facility staff responded with blood and blood product administration including activation of a massive transfusion protocol (MTP).* Addressing intraoperative bleeding may require assistance from a surgeon in another specialty. An easily accessible on-call schedule of surgical subspecialists available for intraoperative emergency consultations could be beneficial.

Prompt blood replacement in the presence of hemorrhage or exsanguination is a well-established clinical practice.[9-11] Administering large amounts of *whole* blood is a historical military practice and has evolved into a bleeding management strategy for hemorrhagic shock known as "damage control resuscitation in the civilian setting."[9,10]

Current practice of massive transfusion is to rapidly administer plasma, platelets, and packed red blood cells.[11] The goals of an MTP are to administer blood products quickly and standardize the most effective hemorrhage treatments while reducing waste of blood product.[12]

Current Guidelines for Massive Transfusion Protocol

In their review of international research, Hsu and colleagues[9] summarize U.S. and European current best practice regarding MTP guidelines and recommendations, including the following:

- Protocol triggers for MTP activation and deactivation
- Algorithm for preparation and delivery of blood products (including plasma)[11-13] in all settings
- Transfusion targets
- Use of pharmacologic hemostatic agents
- Ongoing evaluation of cumulative MTP performance[9,11,12]

For a complete list of MTP prediction algorithms and guidance on developing an "optimal" MTP, see the work of Hsu et al.[9]

Concerns of over-use of MTP exist. Gadi and colleagues determined there is a higher rate of MTP activation in nontrauma cases versus trauma cases, and a higher mortality rate found in *all* nontrauma patients that suggests that over-activation of MTP does not significantly affect patient outcomes. However the authors suggest development of refined diagnostic criteria to predict when to initiate MTP.[14] Baumann Kreuziger and colleagues concluded that MTP may be successfully used in trauma and nontrauma settings without significantly impacting overall blood product use.[11]

MTP resuscitation is often infrequent. It is stressful and can be chaotic. While simulation may not completely prepare workers for all events that occur during a massive transfusion resuscitation, MTP performance can be evaluated and improved through simulation. Francis Hildwine, American Heart Association training center coordinator at

Nemours/Alfred I DuPont Hospital for Children, developed a massive transfusion simulation for the MTP staff at Lancaster General Hospital in Lancaster, Pennsylvania. This specific simulation is beneficial for staff learning new equipment such as the rapid fluid infuser, commonly used in massive transfusions.

Hildwine advocates conducting simulations in-situ (in actual patient care locations), with embedded participants (e.g., surgeon prepared in advance to role-play appropriate interactions), unannounced, and as close to real-time as possible.[15] "A benefit of simulating the massive transfusion response is that you're more likely to find gaps in the system when you don't have a patient's life on the line," says Hildwine. Additionally he mentions creating imitation blood products that approximate real blood products as much as possible, which lends credibility to the exercise.[15] See Figure 5 for a photo of a massive transfusion simulation display of imitation blood products. Imitation blood product recipes are provided in the Supplemental Material section.[16]

Figure 5. Imitation Blood Products for Massive Transfusion Protocol Simulation

Photo credit: Francis Hildwine, BS, NRP, 2018

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Perioperative Responses

Rapid response teams (RRTs) have existed since about 2004 as an effort to "reduce cardiac arrests and other life-threatening events" and thus reduce mortality.[17,18] These teams are comprised of healthcare providers with critical care expertise who respond to patients demonstrating signs of deterioration; they rapidly assess and intervene with the goal of preventing cardiac arrest or death.[19,20] Over the years, specialty alerts such as stroke and sepsis have evolved from the unit-based RRT concept.

More recently other location- and condition-specific rapid response techniques have emerged, such as surgical crisis checklists;[21] intraoperative emergency manual use, including cognitive aids;[22] pulmonary embolism response protocols;[23,24] and shock and vascular RRTs.[24] However, other than for cardiac arrest or fire, a typical OR may have no formal, coordinated response protocol.[25]

Intraoperative

In a simulation study involving 106 simulated surgical-crisis scenarios (e.g., massive hemorrhage, cardiac arrest), "failure to adhere to lifesaving processes of care was less common during simulations when checklists were available. Checklist use was associated with significant improvement in the management of intraoperative crisis" (e.g., reducing delay in transcutaneous pacing).[21]

In a case study, an emergency manual was successfully used by anesthesia and nursing personnel during a pulseless electrical activity (PEA) cardiac arrest in a patient undergoing a urologic procedure.[22] Use of the PEA manual reduced stress, fostered calm, and improved teamwork and communication. Overall the use of an emergency manual intraoperatively improved the delivery of patient care through effective team functioning, thus "closing the gap between evidenced-based optimal care and care delivered during a crisis."[22]

In these studies a read-do crisis checklist, designed differently from the checklist for common procedures such as central line insertion, guides the operators through complex but critical, multistep procedures.[26]

An in-situ simulation was used to formally assess responses to unplanned intraoperative emergencies.[25] After the simulation and debriefing, participants identified areas of improvement and potential solutions. The outcome was the development of a technical RRT named C-STAT (Circulate, Scrub, and Technical Assistance Team).[25] Roles and responsibilities are predetermined yet flexible. This multidisciplinary group helps the primary surgical team with tasks such as obtaining additional supplies and communicating with other surgeons, thus allowing the primary team to focus attention on the patient and operative field.[25]

In contrast to clinical rapid responses, perioperative staff at Geisinger Medical Center in Danville, Pennsylvania, developed a rapid response for operational needs called SORT—Surgical Operations Resource Team. Composed of operating room (OR), postanesthesia care unit, and business managers this team functions to help personnel in the OR suite with operational needs, such as staff or scheduling delays, incorrect counts, patient transport assistance, personnel relations, and ancillary support. According to Pamela Wallace, Geisinger's associate vice president of surgical services, "The SORT process empowers our team to reach out for support of our leadership team when they are faced with operational or patient care issues that require immediate assistance."[27]

Benefits of in-situ simulation for uncommon events go beyond identifying gaps and staff training. It serves as a reminder to staff that these type of events do actually occur and patients are well served when facility leadership and staff employ strategies to prepare for such events.[26,28]

Postoperative

In this analysis of Pennsylvania event reports, the majority of healthcare providers' responses occurred in the postoperative setting. Weingarten and colleagues studied activations of RRTs in postsurgical patients transferred to regular units after surgery and found that 62% of the postoperative RRTs occurred within 12 hours of discharge from

the PACU.[18] Their study further identified factors associated with postoperative deterioration requiring RRT activation, which include "preoperative opioid use, history of central neurologic disease, and intraoperative hemodynamic instability."[18]

Vascular (aorta), pulmonary embolism, and shock rapid response multidisciplinary teams are examples of RRTs that can be immediately deployed to triage and manage all patients suffering from those conditions.[23,24]

Facility staff are encouraged to evaluate patient care locations and other factors contributing to the use of RRTs in their own patient care settings.

Limitations

This analysis is based on facility-reported events in the event subtype of "complication following surgery or invasive procedure." Despite mandatory reporting laws,[8] the data are subject to the limitations of self-reporting and the complexities of the reporting system.

As with all reporting systems, the type and number of events collected depend on the degree to which facility reporting is accurate and complete. The reporting cultures and patterns in each facility, and their interpretations of what occurrences are reportable, can lead to reporting variations. Although the free-text fields of the events help analysts discern what happened during the event, they often do not contain details describing how the event deviated from the standard operation or which factors contributed to the event.

The analysis may not be generalizable to all surgical and procedural events because this analysis reflects only those reported complications that were associated with patient harm. Also, events with complications or potential harm events, in which rescue was successful in preventing harm or death, were not included in the selection criteria.

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* Defined when either total blood volume is replaced within 24 hours (more than 10 units of red blood cells), 50% of total blood volume is replaced within 3 hours, or rapid bleeding rate is documented or observed.[9,12]

Conclusion

Recognizing changes in patient symptomatology, identifying when to act (respond), and responding in a timely manner are vital to reduce surgical morbidity and mortality.

Findings in this analysis suggest that a robust surgical quality improvement program includes analysis of facility-specific surgical procedures and complications, recognition of those complications, and response to changes in patient condition. Although this data set yielded a higher percentage of CV and GI procedures, bleeding complications, cardiovascular symptoms, and postoperative responses, facility staff are encouraged to evaluate their own data to see where it leads and to help prioritize patient safety work.

RRTs have been shown to improve outcomes, and there is a need to have systems and processes in place to respond rapidly to a surgical or procedural complication. Facilities can respond to this challenge by evaluating the current state of their own response mechanisms, including rapid response and code teams, and by considering additional mechanisms for the intraoperative setting and for specific conditions. Simulation can help refine RRT protocols.

Understanding, in the aggregate, high harm surgical complication events and predominant associations (e.g., procedure type, nature of complication, provider response), can enhance prevention and quality improvement efforts and provide context beyond facility-specific events.

Notes

1. Pennsylvania Patient Safety Authority harm score taxonomy. Harrisburg (PA): Pennsylvania Patient Safety Authority; 2015. 1 p. Also available: http://patientsafety.pa.gov/ADVISORIES/Documents/Tool%20PDFs/201503_taxonomy.pdf (/ADVISORIES/Documents/Tool%20PDFs/201503_taxonomy.pdf).
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Supplemental Material

Imitation Blood Product Recipes for Simulation

Whole blood: 0.6 mL red food coloring and 0.05 mL blue food coloring added to a 500 mL bag of normal saline solution

Plasma: 0.5 mL yellow food coloring and 0.2 mL milky white solution from a simulation lipid parenteral nutrition bag added to a 500 mL bag of normal saline solution

Platelets: 1 mL yellow food coloring added to a 250 mL bag of normal saline solution

Note: Simulated blood products should be clearly labeled.

Recipes courtesy of Francis Hildwine, BS, NRP

Patient Safety Authority

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