19 It Takes Teamwork: Consideration of Difficult Hospital-Acquired Conditions

J. Wesley Diddle, Christine M. Riley, and Darren Klugman

Chapter Objectives

- To explain the high risk ICU environment and the associated impact on patient safety
- To define hospital-acquired conditions, using unintended extubations as an exemplar
- To highlight the importance of interprofessional collaboration and system redundancy in quality improvement processes
- To understand the impact proactive process maintenance has on assuring sustainable gains

Vignette 19.1

In a tertiary care free-standing children's hospital, an unintended extubation occurs in an infant in the cardiac intensive care unit (CICU). The patient experienced a brief cardiac arrest during the efforts to re-secure the airway, and she received cardiopulmonary resuscitation (CPR) for 3 minutes before return of spontaneous circulation (ROSC). Because of the serious nature of this safety event, a root-cause analysis (RCA) was convened to explore factors contributing to the inadvertent airway loss. That process identified several factors that potentially increased the likelihood of an unintended extubation: the event occurred during nursing sign out; the endotracheal tube (ETT) was noted to be high by radiology on the morning X-ray; the patient has been in the CICU, intubated, for more than 3 weeks, and she was described as "difficult to sedate" by several bedside providers; the respiratory therapist (RT) involved in the case typically works in another unit in the hospital but was "cross"-covering the CICU during this shift. Unit leadership, with the support of hospital leadership and the assistance of the Quality and Safety Team, has been charged with reducing the chance of similar future events.

J. W. Diddle
Pediatric Cardiac Intensivist, Children's National Hospital, Cardiac Critical Care Medicine, Washington, DC, USA
e-mail: jdiddle@childrensnational.org

C. M. Riley (✉)
Cardiac Intensive Care Unit, Children's National Hospital, Washington, DC, USA
e-mail: criley@childrensnational.org

D. Klugman
Cardiac Intensive Care Unit, Children's National Heart Institute, Children's National Hospital, Cardiac Critical Care Medicine, Washington, DC, USA
e-mail: dklugman@childrensnational.org

R. K. Shah, S. A. Godambe (eds.), *Patient Safety and Quality Improvement in Healthcare*,
https://doi.org/10.1007/978-3-030-55829-1_19

Opening Problem

Hospital-acquired conditions (HACs) can result in additional, preventable harm to patients in any milieu, but patients in an ICU are particularly vulnerable because of their disease complexity, level of invasive monitoring and support devices, and frequent procedures and blood draws, multiplying the opportunities for lapses in safety and subsequent harm. This chapter uses one type of preventable event – unintended extubations in a pediatric CICU – to explore the unique challenges to patient safety and quality improvement inherent in the ICU environment. This chapter is not about unplanned extubations per se; rather it uses this hospital-acquired condition as an exemplar to demonstrate the generalizable principles necessary for achieving and sustaining improvement in this setting.

Introduction

While an intensive care unit typically accounts for only a fraction of the total bed spaces in a hospital, it accounts for a disproportionate share of hospital activity, whether viewed in terms of hospital charges, acuity, or utilization of hospital resources (laboratory, pharmacy, nursing, engineering, etc.) [1–3]. In addition, hospitals are characterized by more than just numbers of beds, or revenue; they are the backdrop for stories about patients' lives. The stories that unfold in the ICU are among the most dramatic, whether they detail a miraculous recovery or a tragic loss, and they impact patients, families, the hospital community, and the local community, to a degree out of proportion to the number of beds they represent.

The pediatric cardiac intensive care unit has emerged as a separate ICU in many children's hospitals over the course of the last two decades. Improvements in surgical and cardiopulmonary bypass technique have led to the performance of palliative and corrective surgeries in progressively younger and more complex patients, such that even the most complex lesions are now routinely operated on in the neonatal period. Patients who were previously considered to have nonsurvivable congenital cardiac anomalies or to carry a prohibitively high risk for operative mortality now routinely undergo complex operations in spite of gestational age or weight and often while still in the midst of the physiologic transition from fetal life. Such patients can be quite fragile due to their cardiovascular pathophysiology prior to operative intervention, but they are often even more so in the immediate postoperative period, when the vulnerabilities secondary to an inefficient circulation are magnified by the systemic effects of cardiopulmonary bypass. This combination of underlying circulatory pathophysiology and transient bypass-related instability leads to a low level of resiliency in this patient population. This has helped drive the creation of dedicated cardiac intensive care units and a concomitant sub-specialization of training for medical, nursing, and ancillary staff.

The expansion of pediatric cardiac intensive care units has led to new challenges and considerations for care delivery. The benefits of subspecialization in the CICU are widely accepted, but this a level of expertise requires extensive education, additional training, and significant practical experience. The opening of CICUs at pediatric centers around the country over recent years, coupled with a high-intensity work environment which is associated with elevated levels of burnout [4–7], means that there simply are not enough experienced nurses to fill the available positions. As a result, in any given CICU, during any given shift, there is a growing number of novice providers at the bedside. Additionally, trends such as the prolongation of medical training, in-house 24/7 attending coverage, and assignment of higher-risk patients and procedures to specialized staff mean that residents and fellows show up to the CICU with less experience and comfort with complex physiology and procedural expertise than in the past. Consequently, hospitals and training programs have had to devise educational models that aim to rapidly get junior staff the knowledge and skills they need to perform their jobs optimally. One means of addressing the wide variability in experience levels is protocolization of care. Formal protocols enhance safety and decrease practice variability among providers, optimizing patient safety even when provider experience level is varied [8].

Vignette 19.2

Following the RCA, local nursing, physician, and respiratory care leadership identified several strategies to better understand and address the problem of unintended extubations (UEs). The first was the decision to identify UEs as a modifiable problem; although UE had been tracked for years, it had not previously been given the rigor of other quality metrics such as central line-associated blood stream infections (CLABSIs) or catheter-associated urinary tract infections (CAUTIs). After making the cognitive leap to characterize the issue as a modifiable metric rather than an accepted risk, a prospective registry for UEs was created, with a plan for data collection to better understand the scope of the problem. Concurrently, the following immediate interventions were put in place, based on suggestions generated during multidisciplinary brainstorming sessions:

- The RN and RT would measure the ETT position each morning before the chest X-ray was taken and document that position in the patient record and on the ventilator at the patient bedside.
- As an additional safety check, the RN would explicitly verbalize the ETT position at morning rounds with the medical team.
- ETT manipulation would always be performed with two providers. If ETT malposition was recognized and needed to be addressed during sign out, a minimum of two people would complete the task, and sign-out would be paused until the security and proper positioning of the airway was assured.
- Repositioning of the ETT first requires a discussion regarding the need for additional sedation or neuromuscular blockade, empowering nursing and respiratory staff to advocate for these to be ordered if needed.

Framing the Problem

Local, multicenter, and nationwide efforts to identify best practices and reduce unwanted practice variation have led to increased use of protocols or guidelines to help standardize care [9, 10]. Initially, guidelines may be based on expert consensus; however, over time, the data should be accrued to inform and refine best practices. The unit leadership in the vignette is following the business management adage "if you can't measure it, you can't improve it," in establishing a registry to characterize the problem of UEs. The model for improvement provides a simple framework to guide improvement efforts, and the necessity of good data in those efforts is evidenced by the model's questions. After first identifying what we are trying to accomplish (i.e., reduce unintended extubations in the CICU), the second question in the model is "How will we know a change is an improvement?" A dramatic event such as the airway loss leading to cardiac arrest described above may well motivate changes in unit practice that will result in improvement, but cognitive biases towards dramatic or recent events can result in an incomplete or inaccurate picture of the scope of a problem. Objectively recorded data over time can inform more logical, thoughtful responses to problems, and it enables a unit to measure the impact of their interventions. Sometimes what "feels" like the right way to address a problem is an appropriate and effective solution, but just as often it may not have the intended effect in practice; data allow for the distinction to be made and corrective actions to be taken.

Data Collection

Both multicenter data and local data have value. Multicenter registries leverage the statistical power of the greater number of events to identify predictors and patterns which might not be evident in the data from a single center and may identify patterns which persist across a variety of practice patterns and patient populations. Such registries may also enable comparison of local practice and outcomes to other centers, identifi-

cation of best practices, and the establishment of benchmarks that individual centers can strive for.

Frontline Investment and Stakeholders

It is critical to seek input from frontline staff when planning and implementing performance improvement initiatives, as showcased in this vignette. Frontline staff interact with the system in a very different way than those in leadership. Charging the staff to address the problem rather than dictating interventions to them grants staff buy-in and ownership in the improvement process. This sense of ownership promotes engagement and increases the likelihood of the long-term investment necessary to produce sustainable gains. Involvement of frontline staff also leverages their detailed knowledge of day-to-day unit operations, making it more likely that new interventions will fit seamlessly into established practice patterns. When planning interventions, the "hassle factor" should be considered. Even well-intentioned providers may be unlikely to participate in interventions that dramatically increase the time or cognitive burden required to complete a task. Streamlined interventions that are built into current practice patterns and workflow are more successful over the long term.

Background of Hospital-Acquired Conditions

Introduced as a concept by the Center for Medicare & Medicaid Services (CMS) as part of Medicare reform in 2008, HACs were defined as an undesirable situation, condition, or complication that a patient develops during a hospital stay that was not present at admission [11]. Traditionally, many HACs have been characterized as infections secondary to devices or procedures, but the list is updated by the CMS on an ongoing basis (see Table 19.1 for a complete list of 2008 and 2018 HACs). Great strides have been made in decreasing HAC rates through the utilization of care bundles [11, 12]. Expanding this definition and classifying UE as a HAC was novel and allowed new interventions to be rolled out utilizing a vocabulary and paradigm of improvement that staff was familiar with.

Table 19.1 2008 and 2018 hospital-acquired conditions per Center of Medicaid Studies [13]

Hospital-acquired conditions per CMS	
2008	2018
Foreign object retained after surgery	Foreign object retained after surgery
Air embolism	Air embolism
Blood incompatibility	Blood incompatibility
Stage III and IV pressure ulcers	Stage III and IV pressure ulcers
Falls	Falls
Manifestations of poor glycemic control	Manifestations of poor glycemic control
Catheter-associated urinary tract infection	Catheter associated urinary tract infection
Vascular catheter-associated infection	Vascular catheter-associated infection
	Deep vein thrombosis/ pulmonary emboli following hip replacement
	Surgical site infection
	Iatrogenic pneumothorax with venous catheterization

Vignette 19.3

It is 1 year later, and the rate of UEs is being reevaluated at an annual review of unit data. After a dip in the frequency of UEs following the sentinel event the previous year, the incidence has increased over the last 2 months. A detailed review of cases reveals that several of the UEs occurred when the ETT was in a higher position than ordered by the physician – i.e., it was measured and documented by the RT and RN as being higher than ordered, but no intervention was taken to remedy the situation. It is also noted that the use of PRN sedation prior to re-taping of ETT's has decreased, in part because of a national shortage of the most frequently used medications for sedation. The unit reviews the current care bundle in light of these recent changes in local practice and

decides to implement the following interventions aimed at hardwiring best practices and creating visual reminders for staff:

- Incorporate a mandatory field for ETT position into the ventilator order set, forcing the medical team to be explicit about the desired ETT position.
- ETT position will be included as a quality/safety metric on the unit quality dashboard, which will auto-populate the ETT position once entered by the RT and automatically highlight if it differs from the ordered position.
- When weekly medication shortage updates are sent out to the unit, alternative sedation medications with suggested dosing regimens will be included in the emails, and the unit-based pharmacist will highlight the readily available options appropriate for a patient during rounds, in order to anticipate potential sedation needs.

Sustaining Initial Gains

Interval review of processes and data with practice audit and feedback to local teams is essential in order for quality improvement efforts to sustain a positive impact over the long term. Continued surveillance and audit may identify unintended effects and/or cross talk of various QI efforts in the complex environment of the CICU. In the case described, well-intentioned efforts to address drug shortage issues had the unanticipated downstream effect of frontline staff reducing their use of sedatives in some cases where their use would have been appropriate, perhaps contributing to an environment where an unintended extubation was more likely. Purposeful solicitation of input from frontline staff, as part of the continual assessment and refinement of the QI efforts, allowed for the identification of this unintended consequence. In addition, it helped elucidate the reasons that a bundle element was difficult to implement during this time period. While bedside staff was measuring the ETT position daily, as specified in the bundle, this was not effectively triggering appropriate action by the medical team. To effect changes in provider behavior, additional interventions were required. Involving the unit-based pharmacist to not only provide information regarding drug shortages but also provide anticipatory guidance on alternatives helped ensure that sedation was being given when appropriate. Introducing an automatic trigger for medical providers to verify ETT position when placing respiratory care orders ensured that when this information was provided by bedside staff at rounds, it would prompt an action by the medical team to reconcile any differences between the ordered and actual endotracheal tube positions. This set up a "call and response" or "push and pull" dynamic, wherein different provider roles reinforce one another towards a shared goal. This example reinforces the need for the presence and active participation of multiple stakeholders in the planning process (see Fig. 19.1 for a cause-and-effect diagram), prospective data collection with planned periodic data review (see Fig. 19.2 for run chart), and ongoing involvement of stakeholders representing the entire spectrum of providers who would be implementing or affected by the efforts.

Sharing data within organizations also provides opportunities to learn and discover new ways to tackle problems that may not be unique to a single unit or environment. As part of the broader organizational approach to HACs and specifically UE, the CICU UE team began meeting regularly with other ICU team members who were also working on reducing UE in their respective areas. Meetings included data sharing from each unit with sharing of successes and challenges. These meetings, which include data and process sharing across ICUs, are powerful venues to translate successes from one area to another and also to learn from experiences of others who faced similar challenges. Critical in sustaining success is the ability to share data with frontline staff and more broadly across an organization. Knowledge of the data should be universal and is an important tool to maintain momentum and ensure long-term success.

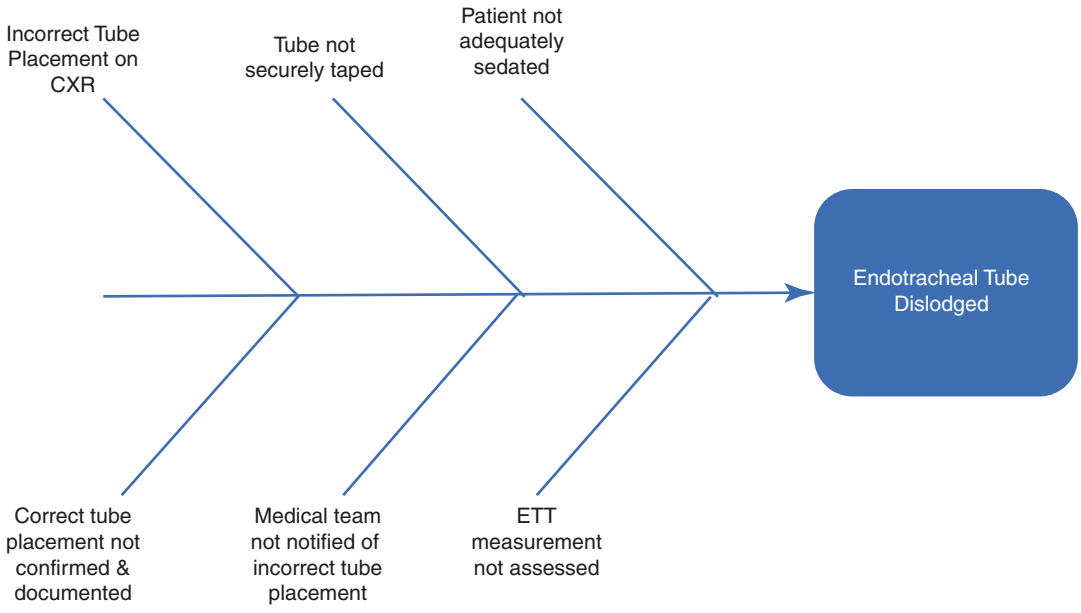

Fig. 19.1 Cause-and-effect diagram

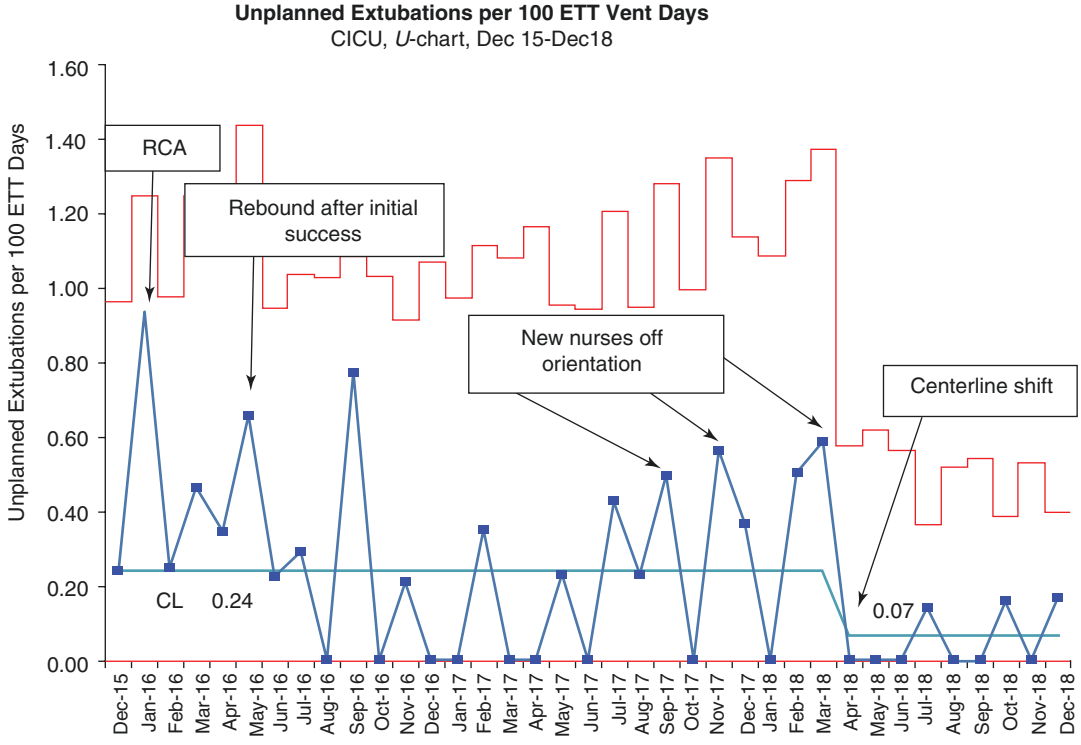

Fig. 19.2 Sample run chart

Redundancy

Redundancy is necessary to embed a practice change, and it will be most effective if actions are reinforced at multiple levels across professional roles. In this case, order set modification to create a field that triggers a mandatory prompt for medical staff supplements and supports the efforts by the bedside nurse and respiratory therapist to ensure appropriate ETT position. It ensures that their efforts of measurement, documentation, and announcement are acknowledged by the medical team. Based on review of the X-ray and the patient's trajectory, the most appropriate action may be to adjust the order to reflect the reality of the current ETT position, or it may be to provide additional sedation, adjust tube position, and repeat an X-ray. The redundancy built into the architecture encourages the necessary data acquisition to facilitate decision-making and creates a trigger for the dialogue to come to a decision. Ideally, such redundancy supports the overall goals of the QI efforts without significantly increasing the cognitive burden of the staff involved. Optimizing technology to support the staff efforts is one way of creating redundancy without assigning more "tasks" to the bedside staff. In this ICU, a quality dashboard pulled data automatically from the electronic medical record to a flat screen monitor mounted on the wall, prominently displaying a number of important quality and safety metrics for each patient. This dashboard was an accepted fixture of the unit's culture, and the care team begins rounds at the quality board during morning and evening rounds. Working with the information technology (IT) department, ETT position data was added to the dashboard, with color-coding of the data when a discrepancy existed between documented and ordered positions. This intervention built upon a familiar landmark and workflow in the unit, and it created a visual reminder that could be quickly appreciated by the team before rounds even began. As the available technology in our hospitals continues to be updated, revamped, or overhauled, we must seek out opportunities for the technology to support our work, rather than add to the burden. IT services can be a crucial ally in creating and supporting successful QI efforts.

Small Tests of Change

QI in complex care environments may be more accepted by staff, and ultimately more successful, when done as small tests of change rather than attempting a dramatic process overhaul. Small tests of change are mini-interventions that allow teams to quickly and effectively test new ideas. These changes, undertaken as Plan-Do-Study-Act cycles, allow for change to be grafted onto existing practice, where they can be viewed as modifications of the familiar rather than seen as a new burden to be added to the existing task load. Incorporation of provider feedback early and often can help inculcate a culture that is accepting of change and expecting to have a say in the details of that change. This culture can lead to a unit which is more engaged in the QI efforts and which understands QI as a continuous process rather than a project with discrete endpoints. Internal data review assures that interventions remain pertinent and effective accounting for unexpected variations in local practice patterns. Feedback from frontline staff should be frequently solicited, resulting in modification or even elimination of interventions that don't enhance team performance or have a high "hassle factor."

Vignette 19.4

It is 2 years later, and the overall rate of unintended extubations has remained low, but a pattern has been noted in the occurrence of UEs – they tend to increase when there is an influx of new bedside nursing staff. The unit is a high-intensity environment, with high turnover among staff. In addition, significant variability has been noted among the medical staff in terms of use of the safety dashboard as a resource on

rounds. Several tests of change are implemented:

- Best ETT re-taping practice is incorporated into the onboarding of new nurses and RTs when joining the unit, and an electronic copy of the practice is made available on the unit website.
- A joint review of the unit dashboard by the medical teams, charge RN, and RTs is to be performed each morning prior to the initiation of bedside rounds to ensure that ETT malposition is recognized and a plan is put in place to address them.
- Unintended extubation data will now be incorporated into a periodic summary of key unit quality metrics that will be shared with all members of the unit on a quarterly basis, in order to help staff move from personal anecdotal experience to a more global understanding of the state of safety in the unit from a data-driven perspective. When UEs remain low, this success will be highlighted and the importance of the coordinated efforts of the members of the team reinforced; when there are spikes in the frequency of UEs, these data will be broadcast along with reminders to adhere to best practices and solicitation for input regarding creative solutions.

As this case study has highlighted, quality improvement is a dynamic process, not a project with a discrete beginning and end. Evaluation and modification must be ongoing to create sustainable gains in a complex care matrix like the CICU. QI is also a team effort. Stakeholder representative of the broad spectrum of providers in the unit should not only be involved in process planning but also in process maintenance, and their dual roles as effectors of change and providers affected by change should be explicitly recognized. Good data is essential to inform ongoing efforts, and it should be anticipated, reported transparently, and the results should be reported at routine intervals for iterative data analysis and feedback. Interventions must be streamlined and easily incorporated into current practice, avoiding undue complexity which might lead them to be abandoned, challenged, or ignored. Whenever feasible, interventions should be hardwired and redundancy created, so that the various silos in the care hierarchy support one another in common purpose. Education needs to be on a continuous cycle to re-educate existing staff, ensure ongoing competency, and maintain awareness of guidelines and practice expectations. Ultimately, culture change cannot be achieved unless staff are engaged, educated, and motivated, which requires active participation by empowered stakeholders and positive meaningful leadership investment.

Editors' Comments

Hospital-acquired conditions (HACs) originally described as a term in 2008 by CMS, but implied in the 1999 Institute of Medicine report [14], are a major focus for healthcare organizations globally. No healthcare worker comes to work planning to cause harm – but few healthcare systems are well designed to help their team members completely prevent HACs from occurring. As discussed in the preceding chapters, their inherent complexity makes the pursuit of zero harm challenging, but these challenges are no more insurmountable than those faced by high reliability organizations (HROs). The authors of this chapter have successfully embedded HRO principles in their HAC reduction efforts in their cardiac intensive care unit, especially pre-occupation with failure, sensitivity to operations, and reluctance to simplify. Their use of automated boards, or andons, that point out patients at risk of unplanned extubation are consistent with the Toyota Production System principle of *jidoka* or building quality into their processes discussed in earlier chapters. The authors and

their organization have made HAC reduction and their prevention into a team sport, a success that many organizations will want to emulate. Team building and engagement are key points emphasized in this chapter to build a learning system that will help all health systems drive to "zero harm." Their admirable focus on sustaining their gains, building redundancy, and small tests of change only further encourage their teams' engagement. The authors have demonstrated the practical application and alignment of many of the key improvement and safety science principles mentioned in the earlier chapters. Steven Spears [15] in *The High Edge Velocity* described four capabilities of successful complex organizations: (a) visualizing problems as they occur; (b) timely problem solving; (c) spreading new knowledge learned; and (d) leading by developing capabilities a, b, and c. Our authors' cardiac intensive care unit is an excellent example of a system designed for success which captures all of the aforementioned capabilities. In the spirit of continuous process improvement, their work continues to even further improve their outcomes for their critically ill, mechanically ventilated patients.

Chapter Review Questions

1. What is a hospital-acquired condition?

   Answer: Introduced as a concept by the Center for Medicare & Medicaid Services (CMS) as part of Medicare reform in 2008, HACs were defined as an undesirable situation, condition, or complication that a patient develops during a hospital stay that was not present at admission [11].
2. Define "small test of change"

   Answer: Small tests of change are mini-interventions that allow teams to quickly and effectively test new ideas. These changes, undertaken as Plan-Do-Study-Act cycles, allow for change to be grafted onto existing practice, where they can be viewed as modifications of the familiar rather than seen as a new burden to be added to the existing task load.
3. True or false. Frontline buy-in isn't necessary to sustain culture change as long as strong leadership is present.

   Answer: False
4. Why is redundancy important when planning and maintaining QI initiatives?

   Answer: Redundancy is necessary to embed a practice change, and it will be most effective if actions are reinforced at multiple levels across professional roles. In this case, order set modification to create a field that triggers a mandatory prompt for medical staff supplements and supports the efforts by the bedside nurse and respiratory therapist to ensure appropriate ETT position.
5. True or false. QI is a discrete process with defined start and endpoints.

   Answer: False. QI embraces the principles of continuous process improvement, wherein each small test of change, whether defined as successful or not, provides a new opportunity to evaluate the system for opportunities for improvement.

References

1. Halpern NA, Pastores SM. Critical care medicine in the United States 2000–2005: an analysis of bed numbers, occupancy rates, payer mix, and costs. Crit Care Med. 2010;38(1):65–71.
2. Chalfin DB, Cohen IL, Lambrinos J. The economics and cost-effectiveness of critical care medicine. Intensive Care Med. 1995;21(11):952–61.
3. Barrett ML, Smith MW, Elixhauser A, et al. Utilization of intensive care services. Available at: http://www.hcup-us.ahrq.gov/reports/statbriefs/sb185-Hospital-Intensive-Care-Units-2011. Accessed 5 May 2019.
4. Opgenorth D, Stelfox HT, Gilfoyle E, Gibney RTN, Meier M, Boucher P, et al. Perspectives on strained intensive care unit capacity: a survey of critical care professionals. PLoS One. 2018;13(8):e0201524.
5. Shenoi AN, Kalyanaraman M, Pillai A, Raghava PS, Day S. Burnout and psychological distress among pediatric critical care physicians in the United States. Crit Care Med. 2018;46(1):116–22.

6. Larson CP, Dryden-Palmer KD, Gibbons C, Parshuram CS. Moral distress in PICU and neonatal ICU practitioners: a cross-sectional evaluation. Pediatr Crit Care Med. 2017;18(8):e318–26.
7. Sano R, Schiffman RF, Shoji K, Sawin KJ. Negative consequences of providing nursing care in the neonatal intensive care unit. Nurs Outlook. 2018;66(6):576–85.
8. McKee C, Berkowitz I, Cosgrove SE, Bradley K, Beers C, Perl TM, et al. Reduction of catheter-associated bloodstream infections in pediatric patients: experimentation and reality. Pediatr Crit Care Med. 2008;9(1):40–6.
9. Resar R, Griffin FA, Haraden C, et al. Using care bundles to improve health care quality. IHI innovation series white paper. Cambridge, MA: Institute for Healthcare Improvement; 2012.
10. Payne V, Hall M, Prieto J, Johnson M. Care bundles to reduce central line-associated bloodstream infections in the neonatal unit: a systematic review and meta-analysis. Arch Dis Child Fetal Neonatal Ed. 2018;103(5):F422–9.
11. Bae SH. CMS nonpayment policy, quality improvement, and hospital-acquired conditions: an integrative review. J Nurs Care Qual. 2017;32(1):55–61.
12. Borgert M, Binnekade J, Paulus F, Goossens A, Dongelmans D. A flowchart for building evidence-based care bundles in intensive care: based on a systematic review. Int J Qual Health Care. 2017;29(2):163–75.
13. "Hospital-Acquired Conditions", Centers for Medicare & Medicaid Services. https://www.cms.gov/medicare/medicare-fee-for-service-payment/hospitalacqcond/hospital-acquired_conditions.html. Accessed 27 June 2019.
14. Kohn LT, Corrigan JM, Donaldson MS. To err is human: building a safer health system, vol. 1. Washington, D.C: National Academies Press; 2000. p. 1–287.
15. Spear SJ. The high-velocity edge. 1st ed. New York: McGraw Hill; 2009. p. 87–108.