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## Regular Article

# Supporting a culture of patient safety: Resident-led patient safety event reviews in a pathology residency training program



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## ABSTRACT

Patient safety is a critical component of quality patient care at any healthcare institution. In order to support a culture of patient safety, and in the context of a hospital-wide patient safety initiative at our institution, we have created and implemented a new patient safety curriculum within our training program. The curriculum is embedded in an introductory course for first-year residents, in which residents gain an understanding of the multifaceted role of the pathologist in patient care. The patient safety curriculum is a resident-centered event review process and includes 1) identification and reporting of a patient safety event, 2) event investigation and review, and 3) presentation of findings to the residency program including core faculty and safety champions for the consideration of implementation of the identified systems solution. Here we discuss the development of our patient safety curriculum, which was trialed over a series of seven event reviews conducted between January 2021 and June 2022. Resident involvement in patient safety event reporting and patient safety event review outcomes were measured. All event reviews conducted thus far have resulted in the implementation of the solutions discussed during event review presentations based on cause analysis and identification of strong action items. Ultimately this pilot will serve as the basis by which we implement a sustainable curriculum in our pathology residency training program centered on supporting a culture of patient safety, and in line with ACGME requirements.

**Keywords:** Curriculum development, Event review, Pathology education, Patient safety

## Introduction

Patient safety is a critical component of high-quality care. The 2000 Institute of Medicine publication *To Err is Human: Building a Safer Health System*, was pivotal in creating a platform to improve patient safety, and in focusing the attention of the field on faulty systems, not the personal actions of those who work within these systems.<sup>1</sup> This publication has served as a foundation for Quality Improvement/Patient Safety (QIPS) systems leadership, including development of QIPS resident curriculums in recent years.<sup>2-4</sup> Although additional evidence of impact on patient outcomes is needed, studies have shown that patient safety curricula affect meaningful quality metrics such as length of stay, clinical documentation, and surgical morbidity.<sup>5-7</sup> Guidelines put forth by the Accreditation Council for Graduate Medical Education (ACGME) require continuous assessment of QIPS learning, which is a Systems-Based Practice Pathology Milestone.

QIPS education leaders in a number of fields including emergency medicine, internal medicine, family medicine, pediatrics, surgery, radiology, and radiation oncology have worked to evaluate current patient safety practices, oftentimes resulting in the development of dedicated

curricula.<sup>4,8-14</sup> Published studies provide a framework for the development of patient safety curricula, but often they do not adequately reflect patient safety processes in the laboratory diagnostics setting, as these studies are primarily patient-facing. Compared to more than a decade of published curricula in other fields of practice, we have identified just two published safety curricula in pathology.<sup>3,15</sup> We hope to further contribute to the current fund of knowledge, providing an additional resource supporting the development of a culture of patient safety in pathology and in collaboration with departments throughout our institution.

As Aaron et al. described, residents play a critical role in the reporting of patient safety events given they are often at the frontlines of patient care. Based on a review of the literature, the authors determined that the most successful patient safety interventions combined strategies that minimized the time required of those involved, incorporated accessible event reporting systems, and became part of a normal workflow in patient care.<sup>16</sup> Previous studies have indicated that comprehensive intra-departmental safety programs have a positive effect on safety culture, especially when leadership emphasizes safety as a system responsibility.<sup>2,13</sup> The ACGME's Clinical Learning Environment Review process emphasizes alignment between training programs and their

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sponsoring institutions.<sup>17</sup> To our knowledge, previous pathology-specific curricula have not been integrated with institutional safety processes to this degree. With this in mind, we organized an intradepartmental event review process in the context of hospital-wide initiatives to enhance identification and review of patient safety events, involving first-year pathology residents as key players, and senior residents and faculty mentors as safety champions.

## Material and methods

### Study setting

Sidney Kimmel Medical College (SKMC) is the Sponsoring Institution for Thomas Jefferson University Hospital (TJUH) Graduate Medical Education (GME) programs. SKMC sponsors over 80 training programs at the urban academic medical center, with over 800 total learners including both residents and fellows. The pathology program has 4–5 learners per year, with faculty resources including a Program Director, 3 APDs, and Core Faculty supported by 2 PGY3 or PGY4 chief residents.

In preparation for curriculum implementation, patient safety mentors (AG, CT) participated in a hospital-wide intensive faculty development course for patient safety educators, consisting of a 7-session workshop series over 12 weeks with a content expert in patient safety and medical education (RJ) as well as representatives from departments including family medicine, neurosurgery, surgery, and obstetrics and gynecology. The goals of the workshop were to develop faculty skills in event review, introduce program leads to shared curriculum tools, and adopt a standard curriculum to the needs and structures of individual programs. A pilot event review was conducted at the conclusion of the workshop series in January 2021.

### Intervention

Target learners were identified as the entire first-year class, consisting of 3–5 first-year residents per year, split into two groups to perform event reviews conducted during their Introduction to Pathology course. The Introduction to Pathology course is a 4-week rotation completed in the PGY-1 year, to provide new residents with an understanding of the role of a pathologist in patient care through competency-based goals and objectives. The rotation was designed to allow new trainees to consider the scope of practice in pathology, rather than focusing on medical knowledge in each of the individual laboratories. This includes observing senior residents assigned to each rotation, as well as attending departmental or hospital meetings in which pathology faculty participate. Residents adhere to a previously determined schedule and complete a case log as they rotate through each laboratory and are additionally introduced to research opportunities and practice presenting journal club articles. Finally, residents participate in a formal event review process in accordance with ACGME requirements, to which they are introduced at the start of the course. This will end with a departmental presentation of their findings. Finally, residents will be oriented to academic opportunities available in the department and will present a journal club during the last week of the rotation.

Members of the department including trainees and faculty identified the near miss or low-harm events to be reviewed, and reviews were performed by the first-year residents with the involvement of ancillary staff including pathology assistants, histotechnologists, and laboratory technicians. Event reviews were planned to occur annually with built-in protected time throughout the four-week introductory course for preparation, presentation, and review at department-wide conferences, with mentorship provided by the program lead (AG).

During their investigation, learners met weekly with their mentor, for 60–90 min per session, with inter-session work assigned each week using a standardized workbook as a guide. The workbook consisted of a series of fillable PowerPoint slides used to structure the process by which reviews were performed, aligning with the RCA2 model.<sup>18</sup> The

standardized workbook includes slides which take reviewers through detailing an overview of the event, questions assessing possible contributing factors (e.g. regarding communication, training/scheduling, work environment, and/or rules/policies), a flow diagram of the event, a brainstorming and formal contributing causes slide, final causal statements, and a solutions slide including measurement strategy and improvement aim.

The first session introduced the concept of event review, explained the goals of the project, introduced the standardized workbook, and gave the learners basic information on their assigned event. At the second session, residents shared their created story map (Fig. 1), brainstormed possible causes, and started to work through at least one causal thread (Fig. 2). At the third session, residents shared their causal threads, and began to work on causal statements (Table 1) and possible action items (Table 2). At the fourth session, residents reviewed their presentation for final feedback. Final presentations included four specific slides from the standardized workbook: event storyboard, causal threads, causal statements, and action plan with the selected best solution (Figs. 1 and 2, and Tables 1–3). A final meeting was held after the residents' presentation to allow for bidirectional feedback on the event review process. At all meetings, the two groups of residents actively listened to each other's work and provided suggestions and feedback.

Residents were given numerous digital documents during their first meeting with their mentor to assist in their event review. Documents included a blank workbook, an example of completed workbook, an example of a superlative presentation, and a schedule for their assignments and meetings. Residents were also given a sample email of introduction (see Supplemental Material) to use when trying to schedule meetings to solicit information from staff members regarding their event. It was made clear to residents to involve their mentors early if they had challenges in setting up meetings and gleaned information.

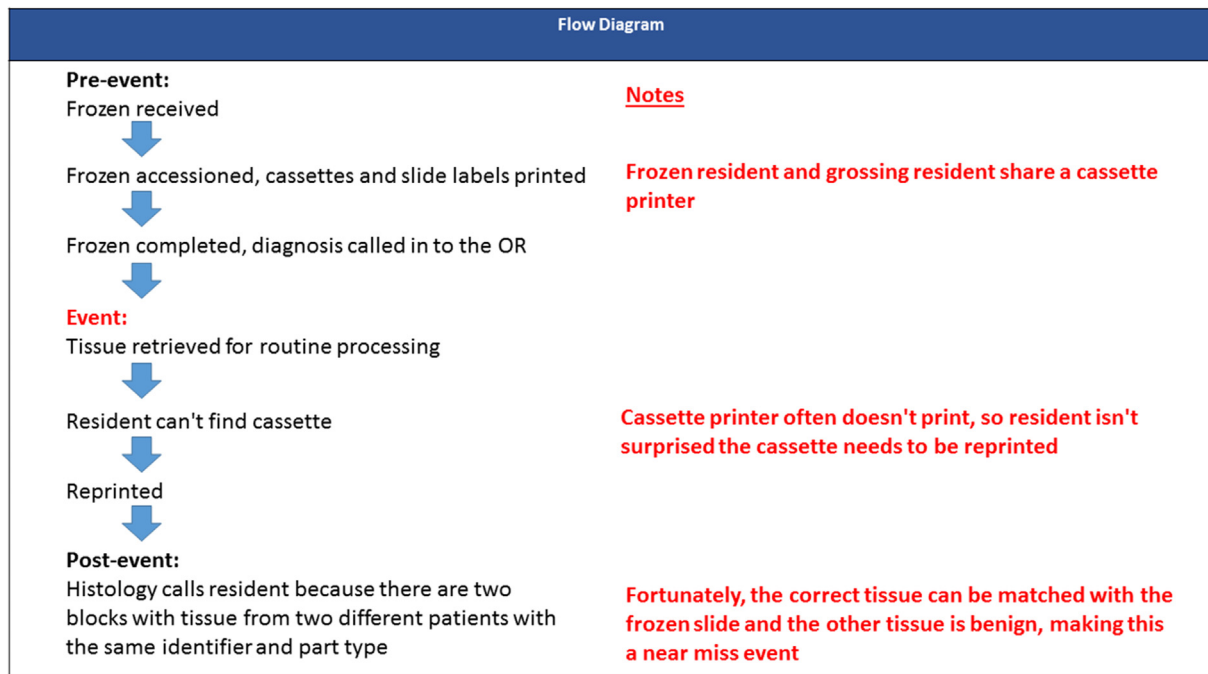
The study proposal was evaluated by our Institutional Review Board (IRB) and deemed exempt from IRB review.

### Evaluation and analysis

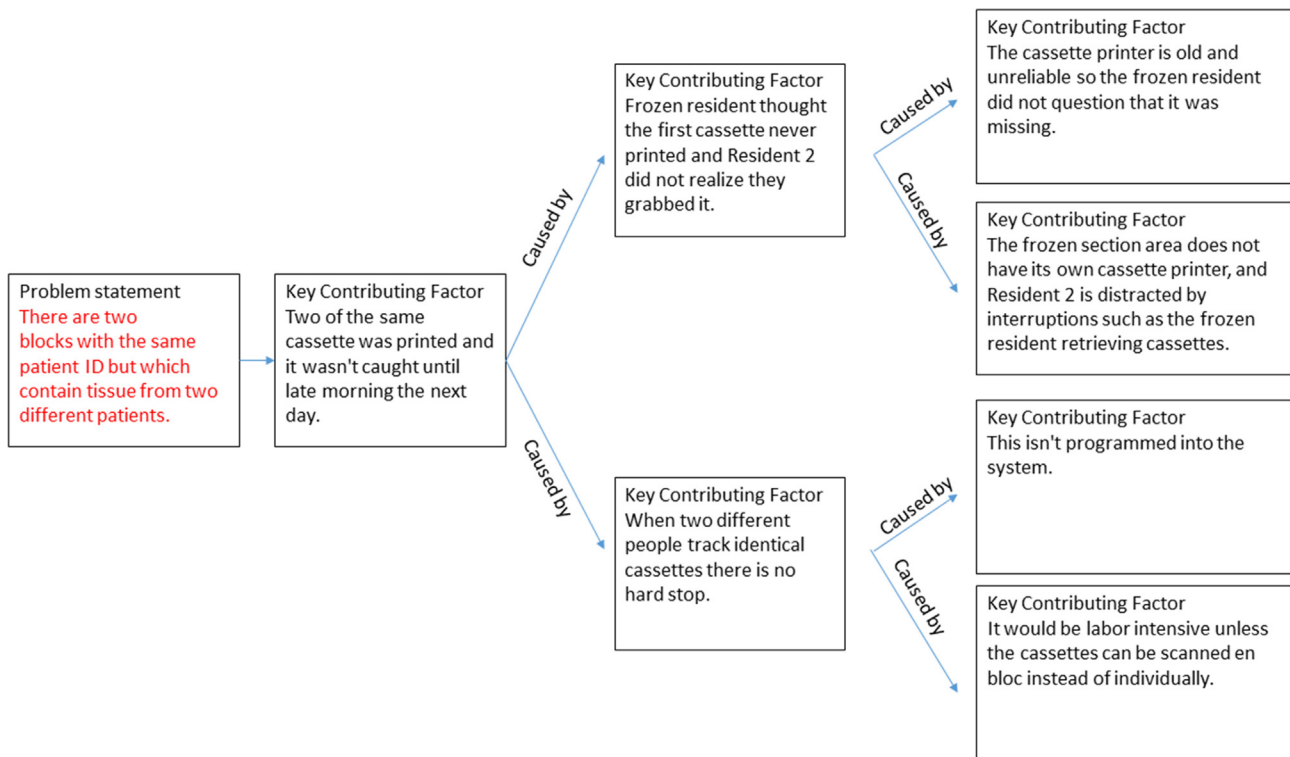
Evaluation of this educational intervention was undertaken at multiple levels, including participation, learning, and behavioral change. Program-level participation goals included involving the entire first-year class in an event review before the end of the academic year. Learning was assessed by measuring the quality of the event reviews performed, and outcomes of each event review. Event review quality was assessed using the Strong String Assessment, a validated measure assessing nine dimensions of an event review with a total potential maximum score of 10 points.<sup>17</sup> Behavior change was measured using self-reported involvement in patient safety event reporting as a measure of integration with institutional safety culture. Resident patient safety event reporting knowledge was quantitatively assessed before the first patient safety event review, and after the most recent event review. Chi-squared test was used to compare populations and p-value was set at 0.05. The two surveys were conducted anonymously over Zoom and consisted of three questions with yes or no answers: (1) have you ever witnessed a patient safety event? (2) do you know how to report a patient safety event? and (3) have you ever reported a patient safety event?

## Results

Prior to the implementation of the patient safety event reviews as part of the Introduction to Pathology course, two pilot event reviews were performed by the current patient safety mentors. An additional event review was conducted by the three PGY-1 residents in the class of 2024 at the end of their PGY1 year. In the first full year of the curriculum, 5 of the 5 PGY-1 residents in the class of 2025 participated in an event review, fulfilling ACGME requirements. However, secondary to visa challenges, two residents started residency late and missed the Introduction to Pathology course. These two residents successfully completed an event



**Figure 1.** Example flow diagram of pilot event chosen by pathology patient safety mentors for Patient Safety Incubator course. The diagram details the event itself and pre- and post-event factors.



**Figure 2.** Example causal threads associated with pilot event, in which learners can visualize the problem statement and contributing causes, from which they create causal statements.

review together while on other rotations, separate from the introductory course.

A total of 7 formal reviews were performed. 12 total learners were involved in the 7 reviews, including learners in their first, second, and third training years. Table 4 describes the pathology resident learners, interprofessional staff, and divisions for each event review. Patient safety event reviews included events in both clinical pathology (clinical

chemistry, transfusion medicine) and anatomic pathology (surgical pathology, autopsy, and cytopathology).

Reviews were objectively high quality, scoring on average 8.5 out of 10 total possible points 10 (range: 7–9) based on the Strong String Assessment. Strengths of the event reviews include assessment of real events, involvement of multiple team members in interprofessional roles, creation of cause-and-effect diagrams with strong resulting causal

**Table 1**  
Causal statements from pilot event.

Causal Statements
1- Something (a gap or system breakdown), 2- led to/caused/increased the likelihood of something else, which 3- ultimately resulted in the end result.
The frozen section area and grossing station #1 are shared, which leads to increased interruptions while Resident 2 at grossing station #1 is working, which ultimately resulted in Resident 2 grabbing the frozen cassette without realizing it as they were trying to concentrate on efficiently clearing the specimen counter for the day, which ultimately led to two blocks with the same patient ID but which contain tissue from two different patients.
The cassette printers in the gross room are not reliable, which caused the frozen resident to not question the missing cassette and approach Resident #2 about it, so the frozen resident reprinted the cassettes, which ultimately led to two blocks with the same patient ID but which contain tissue from two different patients.
There is no hard stop when two different people scan cassettes with the same identifying information, which decreased the likelihood of the frozen section resident and Resident #2 catching the mistake the same day, which ultimately led to two blocks with the same patient ID but which contain tissue from two different patients.

statements, and development of intermediate to strong action items with a handoff to the organization involved for implementation of solutions. Weaknesses included some difficulty in completing the event review within a 45-day time frame and including a time frame with which to measure the effectiveness of the chosen action item after the event review process.

Findings of the 7 event reviews were presented at a department-wide conference with attendance by members of the pathology residency program including involved faculty and residents, with the additional participation of interprofessional partners when possible. The strongest solution(s) identified by the resident team were then discussed at the conference and either adjusted, implemented, or archived for future consideration. Table 5 describes the topics of the reviews and the resulting implemented action items. The residents were variably involved in the implementation of solutions, depending predominantly on ease of access to resources and time constraints given service responsibilities.

We observed a non-significant trend towards improved self-reported recognition of safety events, improved knowledge of how to report safety events, and increased reporting behaviors following the full implementation of the curriculum (Table 6).

**Discussion**

We were able to meet ACGME SBP learning goals through the implementation of a reproducible and sustainable safety event review curriculum for pathology residents. Event reviews were very high quality, as measured using a validated scale. Reviews presented by residents at departmental conferences resulted in implementation of corrective actions focused on systems solutions. While not significant, there is a trend

**Table 2**  
Action items from pilot event.

Solution	Strength of Action	Internal or External	Resources Required
Replace old cassette printers that don't function reliably	Strong		Need departmental approval, funds, surg path department buy in
Get a cassette printer for the frozen section area so one printer isn't shared between stations	Strong		Need departmental approval, funds, more space ideally, surg path department buy in
Program a hard stop when two different people scan cassettes with identical patient and case information	Intermediate	External	Need IT/Epic buy in
Remind residents and staff to double check identifiers on cassette and current case	Weak	Internal	Educational time
Update protocol so that frozen resident does not print frozen cassette until after the frozen is completed, which decreases time between the resident retrieving the cassette and decreases likelihood grossing resident will grab it	Weak	Internal	Educational time, surg path department buy in

**Table 3**  
Best solution from pilot event.

Best Solution	Measurement Strategy	Improvement Aim
Get a cassette printer for the frozen section area so one printer isn't shared between stations	Number of times per month that a near miss occurs Number of times Resident 2 is interrupted How often the new frozen cassette printer malfunctions	Reduce the number of near miss events to zero per month.

**Table 4**  
Summary of event reviews.

Event review number	Pathology learners	Interprofessional staff	Divisions involved
1	PGY3 and faculty member	Histotechnologist	Surgical Pathology
2	PGY3*	Laboratory technicians	Clinical Chemistry
3	PGY1, PGY1, PGY1	Pathology Assistant	Autopsy
4	PGY1, PGY1, PGY1	Microbiology technician Histotechnologist Pathology Assistant Operating Room Nurse	Surgical Pathology Microbiology
5	PGY1, PGY1, PGY2	Histotechnologist Cytotechnologist Administrative Assistant	Surgical Pathology Cytopathology
6	PGY2*, PGY3	Pathology Assistant	Surgical Pathology
7	PGY2*, PGY3	Laboratory Technician	Transfusion Medicine

Event reviews performed from January 2021 and June 2022. An asterisk (\*) indicates this was the pathology learners' second event review.

towards increased engagement in institutional safety culture practices by our residents following implementation of the curriculum. We aim to accumulate additional data in subsequent years to confirm this trend, as the survey results were likely underpowered given the small number of residents in our program. This also provides us with opportunities for improvement as we continue to establish this new curriculum.

While not directly measured, there have been several other observed benefits to implementing this curriculum. First, educating our first-year residents in the process of patient safety event review has allowed them to subsequently teach event review to their more senior colleagues, acting as content experts and spreading the skill of event review throughout our residency program, as with the formalin spill event. Next, this curriculum has created a systemic process for managing low- and no-harm events that occur in our department without fear of reprisal and with the entire team, including ancillary staff, involved in process improvement. Further, interprofessional involvement, including but not limited to pathology assistants, histology technicians, microbiology

**Table 5**  
Event descriptions and implemented solutions.

Event review number	Event description	Implemented solution
1	Two pieces of tissue from different patients in cassettes with same patient information	Obtained additional cassette printer for frozen section station so no printers are shared
2	Critical glucose level reporting to an outpatient who is diabetic and deaf	Clarified critical value phone call escalation strategy and call schedule visibility
3	Delay in grossing of brain on autopsy service	Created easily accessible, password-protected case log on shared drive
4	Tissue meant for intraoperative frozen section delivered to microbiology	Distributed signs with frozen section insignia throughout laboratories and enlarged "STAT" on frozen section labels
5	Rapid lung biopsy was not signed out in a timely matter and no pathologist was aware	Epic checking of outstanding biopsy cases and check sign-out status of biopsies associated with cytology cases prior to filing
6	Mastectomy specimen left without formalin in "hot" closet over the weekend	Updated tracking procedure, closed loop communication, 2 "hot" closet checks per day
7	Non-irradiated blood product issued to a patient who required irradiated blood	New BMT pool in Epic, which is updated when new patients are added, distribution of re-education material

**Table 6**  
Event review survey results.

Question	Pre-event review affirmative responses (n = 16)	After fifth event review affirmative responses (n = 17)	P-value
Have you ever witnessed a patient safety event?	5	9	0.09
Do you know how to report a patient safety event?	4	8	0.08
Have you ever reported a patient safety event?	2	5	0.17

technicians, chemistry staff, and environmental services, allows new residents to develop problem-solving skills and learn more about laboratory processes in the context of the event review process as future attending pathologists and patient safety advocates. An example of this includes an additional event review performed by a PGY1 and a PGY3 resident regarding exposure to formalin after a spill in the morgue. The PGY1 had already completed a formal event review and served as the "expert", teaching the process to the PGY3. Event review training allowed the investigative team to implement appropriate solutions including the purchase of storage containers with screw-top lids, addition of a spill kit, and formalin exposure checks and training.

Our original hope had been to include patient safety event reviews exclusively in the Introduction to Pathology course, as this allowed us to guarantee protected time to perform the reviews and gave us a deliverable for the course. Challenges with arrival dates for our new residents required us to be nimble and adjust our expectations of the schedule. Regardless, we were able to mentor all PGY1 residents through an event review in their first year of residency. This experience, and that of the organic event reviews performed when events arose, reinforces the flexibility of our patient safety event review process to fit into the greater pathology curriculum wherever necessary, rather than exclusively as a part of the introductory block.

Possible limitations include generalizability and sustainability of the curriculum. We implemented our event review curriculum in the context of broad institution-based faculty development. This process acted as an accelerator and availed the pathology patient safety mentors with tools that would have otherwise been difficult to access. The tools provided and skills developed throughout the development workshops resulted in the establishment of a patient safety curriculum in our pathology department, where one had not existed previously. Key facilitators for change were the collaborative efforts of a lead educator and interdepartmental patient safety champions, all of whom were striving towards a common goal of improving patient safety and resident education at our institution. The importance of this infrastructure to our success may limit generalizability to other

institutions, but also highlights a possible approach that GME leadership may wish to replicate.

The curriculum remains early in development. Adjustments to the curriculum will be made based on constructive feedback and survey responses, with the goal of continuing to support a culture of patient safety by addressing systems issues using standardized processes. As such, we cannot yet assess the final state of the curriculum, comment on its long-term sustainability, or delineate concrete clinical outcomes based on solutions implemented. However, adopting a continuous improvement approach to a safety curriculum is internally consistent. Early facilitators of sustainability include strong departmental leadership, incorporating the curriculum in an already mature PGY-1 rotation, limiting the total number of reviews by having new residents perform them as a team, and committing to faculty development so that multiple people in the department can mentor reviews.

Finally, the majority of event reviews were related to anatomic pathology, specifically surgical pathology. We hope to expand additional event reviews to clinical pathology as we continue forward with the curriculum. We believe this will be achievable with further integration of the project into our department's standard work. Ultimately our goal is to solicit events with increased frequency, maintaining anonymity where necessary to decrease fear of reprisal, and include more senior residents as mentors. This will help guide junior residents and prepare seniors for practice in the context of their Laboratory Management rotation and a possible future as laboratory directors. As we move forward with our curriculum, we hope to continue contributing to current perspectives as to what type of events constitute patient safety events in our field, which may not have previously been considered amongst more patient-facing specialties or even potentially among those of us practicing pathology.

## Conclusions

Our results thus far indicate that a structured interprofessional event review curriculum aligned with institutional safety event review practices can achieve educational and clinical goals in pathology. Since the initiation of the project, our entire PGY-1 class fulfilled a challenging ACGME requirement. The output of our curriculum was very high quality, and there is a suggestion that clinically meaningful outcomes will continue to follow, including trends to improved reporting, and the fact that we implemented solutions for each review. Future study includes evaluating long-term sustainability, and learner attitudes after a year of patient safety event reviews, as well as assessing the efficacy of solutions implemented as a result of event reviews as we work towards incorporating event reporting and reviews as standard practice within our department.

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### Declaration of competing interests

The Authors declare that there are no competing interests.

### Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.acpath.2023.100069>.

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