Regular Article

The next phase in patient safety education: Towards a standardized, tools-based pathology patient safety curriculum
A call to action from the Association of Pathology Chairs' Residency Program Directors Section Training Residents in Patient Safety Workgroup

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A B S T R A C T

Patient safety education is a mandated Common Program Requirement of the Accreditation Council for Graduate Medical Education and for the Royal College of Physicians and Surgeons of Canada in all medical residency and fellowship programs. Although many hospitals and healthcare environments have general patient safety education tools for trainees, few to none focus on the unique training milieu of pathologists, including a mix of highly automated and manual error-prone processes, frequent multiplicity of events, and lack of direct patient relationships for error disclosure. We established a national Association of Pathology Chairs-Program Directors Section Workgroup focused on patient safety education for pathology trainees entitled Training Residents in Patient Safety (TRIPS). TRIPS included diverse representatives from across the United States, as well as representatives from pathology organizations including the American Board of Pathology, the American Society for Clinical Pathology, the United States and Canadian Academy of Pathology, the College of American Pathologists, and the Society to Improve Diagnosis in Medicine. Objectives of the workgroup included developing a standardized patient safety curriculum, designing teaching and assessment tools, and refining them with pilot sites. Here we report the establishment of TRIPS as well as data from national needs assessment of Program Directors across the country, who confirmed the need for a standardized patient safety curriculum.

Keywords: Curriculum, Medical education, Pathology education, Patient safety, Quality assurance, Root cause analysis

Introduction

In 1999, the Institute of Medicine (now the National Academy of Medicine/NAM) published the landmark report *To Err is Human: Building a Safer Health System*, which identified medical errors as a major source of patient morbidity and mortality and called for sweeping reforms to the healthcare system to ensure patients' safety.[1]

In 2015, sixteen years after the publication of *To Err is Human*, the NAM issued a follow-up report, *Improving Diagnosis in Healthcare*,[2] which prioritized diagnostic errors as an urgent national concern. In 2018 and for several years thereafter, the non-profit Emergency Care Research Institute designated diagnostic errors as the United States' primary patient safety concern,[3] echoing the conclusion from the NAM report that "It is likely that most of us will experience at least one diagnostic error in our lifetime, sometimes with devastating consequences."[2] The 2015 NAM report and leaders within the laboratory community specifically called on pathologists to join the patient safety movement.[4] Laboratory testing is at the heart of clinical decision making and modern healthcare delivery. Over 70% of medical decisions are the direct result of one or more laboratory test results.[5] An error in pathology can result in a multiplicity of subsequent inappropriate medical decisions in the treatment of a patient, or, due to the batched nature of many laboratory tests, multiple patients. Breakdowns in communicating abnormal test results are commonplace and can result in catastrophic harm.[6] And an uncomfortable number, ranging from 2 to 9%, of cytology and pathology specimens are incorrectly diagnosed.[7] Improving patient safety is a critical issue for the field of pathology and for medicine overall.

The first step in identifying and addressing safety concerns is developing reliable error reporting practices. Both NAM reports urged that healthcare organizations adopt safety event reporting systems similar to those pioneered in the aviation industry and educate front-line workers on the importance of their participation in documenting safety events.[8] Large-scale analyses of safety event reporting in healthcare found, however, that physicians across all specialties rarely submit safety reports.[9] One study found that out of almost 100,000 safety events reported across 26 hospitals, physicians only submitted 1.4% of those reports.[10] Resident physicians have been found to report less frequently than their attending counterparts.[11,12,13] Pathology residents specifically have been found to report even less frequently than that, with one study finding that pathology residents report safety events at one tenth the rate of trainees overall.[14] Although only one component of patient safety, physicians' lack of engagement in safety reporting is viewed as emblematic of the broader challenge of engaging physicians in patient safety.

Not only is a robust understanding of patient safety essential to moving the field of medicine forward but also multiple regulatory bodies mandate that programs instruct their trainees in these areas. The Accreditation Council for Graduate Medical Education (ACGME) has integrated new requirements for patient safety education,[15] as have numerous international educational regulatory bodies, such as the Royal College of Physicians and Surgeons of Canada's CanMEDS program.[16] The ACGME has long tried to increase resident physician engagement in patient safety, recognizing that high-quality patient safety education during residency will pay dividends for the rest of that physician's time in practice. In 1999, the same year that NAM published *To Err is Human*, the ACGME introduced "The ACGME Outcome Project,"[17] which defined six core competencies of medical training: patient care, medical knowledge, interpersonal and communication skills, professionalism, practice-based learning and improvement, and systems-based practice.[18,19] Systems-based practice in particular aims to address NAM's call for understanding errors within a broader, systems-wide context.[20] More recently, an interprofessional consensus report identified twelve key competencies to promote diagnostic quality and safety, applicable to both undergraduate and postgraduate students in the health professions.[21] These competencies are highly relevant to pathology trainees in their role as members of diagnostic teams, and in seeking to improve their diagnostic skill in pathology by promoting critical thinking and recognizing and reducing cognitive bias.

In 2019, new ACGME/Clinical Learning Environment Review patient safety requirements went into effect, affecting every residency training program in the country.[22] Current ACGME Common Program Requirements address patient safety across all training programs (Table 1), and Milestones are used as a developmental framework to assess resident performance in a specific specialty. Published pathology-specific ACGME Milestones for patient safety fall under the "Systems-Based Practice" rubric (Table 2).[23]

Despite the importance of and the regulatory pressure for training in patient safety, no comprehensive studies exist on the state of patient safety education in the specialty of pathology. Thus, the adequacy of patient safety education in pathology residency programs is not known. National organizations like the United States and Canadian Academy of Pathology (USCAP) struggle to teach patient safety.[24] Do pathology training programs struggle to teach these critical concepts or are they satisfied with their existing curricula? To answer this question, and with the support of the Association of Pathology Chairs Residency Program Directors Section (APC-PRODS) and the American Society for Clinical Pathology, two of the authors (RLH and YKH) established the

Table 1
ACGME common program requirements for patient safety and quality improvement.

Common Program Requirement	Heading	Number	Description
Patient Safety	Culture of Safety	VI.A.1.a). (1).(a)	The program, its faculty, residents, and fellows must actively participate in patient safety systems and contribute to a culture of safety.
		VI.A.1.a). (1).(b)	The program must have a structure that promotes safe, interpersonal, team-based care.
	Education on Patient Safety	VI.A.1.a). (2)	Programs must provide formal educational activities that promote patient safety-related goals, tools, and techniques.
	Patient Safety Events	VI.A.1.a). (3).(a).i-iii	Residents, fellows, faculty members, and other clinical staff members must: -know their responsibilities in reporting patient safety events at the clinical site; -know how to report patient safety events, including near misses, at the clinical site; and, -be provided with summary information of their institution's patient safety reports.
		VI.A.1.a). (3).(b)	Residents must participate as team members in real and/or simulated interprofessional clinical patient safety activities, such as root cause analyses or other activities that include analysis, as well as formulation and implementation of actions.
Quality Improvement	Education in Quality Improvement	VI.A.1.b). (1).(a)	Residents must receive training and experience in quality improvement processes, including an understanding of health care disparities.
		VI.A.1.b). (2).(a)	Residents and faculty members must receive data on quality metrics and benchmarks related to their patient populations.
		VI.A.1.b). (3).(a)	Residents must have the opportunity to participate in interprofessional quality improvement activities.

APC-PRODS Training Residents in Patient Safety (TRIPS) workgroup to perform a needs assessment to determine the current state of patient safety education in pathology. APC-PRODS has a successful track record of creating, via workgroup formation, national pathology-specific curricula in informatics (Pathology Informatics Essentials for Residents)[25] and genomics (Training Residents in Genomics).[26] The ultimate goal of the TRIPS workgroup is to design a generalizable pathology resident patient safety education curriculum with resources to allow for implementation at any institution and without the explicit need for a faculty subject matter expert in patient safety.

Materials and methods

Formation of the APC-PRODS workgroup

Two of the authors (RLH, YKH) with previous experience in medical education and patient safety, respectively, received APC leadership and PRODS Council approval for the formation of a multi-organizational workgroup, which would provide national leadership on increasing the role of pathology in patient safety education through transforming patient safety training in pathology residency programs. As founding co-chairs, they recruited APC-PRODS members interested in patient safety and patient safety subject matter experts to establish the TRIPS workgroup.

The overall goals of this workgroup were

1. Define the role of pathology and laboratory medicine in improving patient safety in medical education.
2. Perform a needs assessment and gap analysis on patient safety training in pathology residency programs in the United States including review of related existing pathology Entrustable Professional Activities (EPAs), competencies, and milestones.[23,27,28]
3. Using the information and curricula obtained through step 2, develop a resident patient safety curriculum and tools for implementation and assessment.
4. Utilizing sessions at the annual meetings of organizations represented on the workgroup as well as at individual residency programs, conduct a national pilot study on teaching patient safety in pathology using the standardized curriculum.
5. Develop a rigorous assessment to evaluate the effectiveness of the curriculum.
6. Disseminate and monitor implementation of the curriculum as a core of fulfilling new ACGME program requirements in anatomic pathology and clinical pathology.

Table 2
Pathology-specific milestones: Systems-based practice 1, 2, and 5.

Systems-Based Practice	Level 1	Level 2	Level 3	Level 4	Level 5
Patient Safety and Quality Improvement (QI) (AP/CP)	**Demonstrates knowledge of common patient safety events Demonstrates knowledge of how to report patient safety events Demonstrates knowledge of basic QI methodologies and metrics**	**Identifies system factors that lead to patient safety events Reports patient safety events through institutional reporting systems (simulated or actual) Describes departmental and institutional QI initiatives**	**Participates in analysis of patient safety events (simulated or actual) Participates in disclosure of patient safety events to clinicians and/or patients and families, as appropriate (simulated or actual) Participates in departmental and institutional QI initiatives**	**Conducts analysis of patient safety events and offers error prevention strategies (simulated or actual) Discloses patient safety events to clinicians and/or patients and families, as appropriate (simulated or actual) Demonstrates the skills required to identify, develop, implement, and analyze a QI project**	**Actively engages teams and processes to modify systems to prevent patient safety events Role models or mentors others in the disclosure of patient safety events Creates, implements, and assesses QI initiatives at the institutional or community level**
Systems Navigation for Patient-Centered Care (AP/CP)	**Demonstrates knowledge of case coordination Identifies key elements for safe and effective transitions of care and hand-offs Demonstrates knowledge of population and community health needs and disparities**	**Coordinates care of patients in routine cases effectively using interprofessional teams Performs safe and effective transitions of care/hand-offs in routine situations Identifies pathology's role in population and community health needs and inequities for their local population**	**Coordinates care of patients in complex cases effectively using interprofessional teams Performs safe and effective transitions of care/hand-offs in complex situations Identifies opportunities for pathology to participate in community and population health**	**Models effective coordination of patient-centered care among different disciplines and specialties Models and advocates for safe and effective transitions of care/handoffs within and across health care delivery systems Recommends and/or participates in changing and adapting practice to provide for the needs of communities and populations**	**Analyses the process of care coordination and leads in the design and implementation of improvements Improves quality of transitions of care within and across health care delivery systems to optimize patient outcomes Leads innovations and advocates for populations and communities with health care inequities**
Accreditation, Compliance, and Quality (AP/CP)	**Demonstrates knowledge that laboratories must be accredited Discusses the need for quality control and proficiency testing**	**Demonstrates knowledge of the components of laboratory accreditation and regulatory compliance (Clinical Laboratory Improvement Amendments and others), either through training or experience Interprets quality data and charts and trends, including proficiency testing results, with assistance**	**Identifies the differences between accreditation and regulatory compliance; discusses the process for achieving accreditation and maintaining regulatory compliance Demonstrates knowledge of the components of a laboratory quality management plan Discusses implications of proficiency testing failures**	**Participates in an internal or external laboratory inspection Reviews the quality management plan to identify areas for improvement Performs analysis and review of proficiency testing failures and recommends a course of action, with oversight**	**Serves as a resource for accreditation at the regional or national level Creates and follows a comprehensive quality management plan Formulates a response for proficiency testing failures**

The short-term objectives of the workgroup were to

1. Establish a multi-organizational workgroup with diverse members representing programs of varied size and geographic distribution.
2. Recruit organizational members with representation from: USCAP, the American Society for Clinical Pathology (ASCP), the College of American Pathologists, the American Board of Pathology, the Academy of Clinical Laboratory Physicians and Scientists, and the Society to Improve Diagnosis in Medicine.
3. Recruit patient safety expert advisors to include leadership from medical school graduate programs, such as Master of Quality and Safety and/or Master of Public Health.

The intermediate objectives of the workgroup were to

1. Conduct a survey-based gap analysis.
2. Develop a tools-based teaching session curriculum to pilot at national meetings.
3. Develop assessment tools to use with the pilot curriculum.

The long-term objectives of the workgroup were to

1. Pilot the curriculum:
   a. Develop a standardized curriculum based on the "best practices" and the results of the survey-based gap analysis.
   b. Design assessment tools (e.g. evaluation with detailed rubrics).
   c. Obtain Institutional Review Board approval for education research, select pilot sites from interested residency programs and organizations.
   d. Conduct national pilot and evaluate post-intervention data on patient safety knowledge and culture.
   e. Evaluate data and develop manuscripts and present findings nationally/internationally.
2. Expand the curriculum:
   a. Revise and finalize patient safety training curriculum based on pilot results and feedback
   b. Publish and/or post sample curriculum with resource packages online
   c. Present and promote work nationally/internationally
   d. Assess degree of implementation

This manuscript describes the progress and findings of Overall Goals (1) and (2), all of the short-term Goals, and introduces the intermediate and long-term Goals.

Designing the survey

After this APC-PRODS workgroup was established, the first goal was to perform a US nationwide needs assessment to learn the current state of American pathology residents' training in patient safety and to collect information on "best practices." The TRIPS workgroup created a multiple-choice survey to be distributed electronically via Survey Monkey (https://www.surveymonkey.com/) to all members of APC-PRODS. APC-PRODS members were first asked if their residents were taught patient safety using a hospital-wide patient safety curriculum or a pathology-specific patient safety curriculum. If the respondent answered that the training program used a pathology-specific patient safety curriculum, the survey would then ask a series of questions regarding how that curriculum had been implemented along with open-ended questions with free text responses about the structure of the curriculum and its perceived success. If, however, the respondent answered that there was not a pathology-specific patient safety curriculum in use, the survey would ask if the respondent would like to implement a pathology-specific patient safety curriculum. If the respondent said yes, then the survey would ask a series of questions similar to those asked of respondents with pre-existing pathology-specific curricula, except that the questions asked about the respondent's plans for implementing such a curriculum.

Finally, if the respondent expressed a preference for the hospital-wide, general patient safety curriculum over a pathology-specific one, the survey asked why that was the preference through a single open-ended, free response question. Regardless of their responses, all respondents were surveyed on the number of residents in their training program and whether there was a medical director for quality and safety in the department (Fig. 1).

The survey was distributed to the 143 pathology training program directors in the United States using the APC-PRODS email distribution list. As multiple individuals from a single program can be on the distribution list, it was requested that only one person per program respond. Responses were collected over a two-month period (June to August 2019) with several reminders.

Data processing and analysis

Survey response data were exported from SurveyMonkey to Excel (https://www.microsoft.com/en-us/microsoft-365/excel). Geographical distribution of the responses was generated based on the participants' IP addresses and grouped into West, Midwest, Northeast, and South regions according to the United States' Census Bureau Regions and Divisions.[29] Data were expressed using bar charts and violin graphs with boxplots to display data distribution.

Results

Of the 143 APC-PRODS program directors surveyed, 48 program directors responded (response rate of 33.5%). The plurality of respondents were from the South (39.6%) and from medium-sized residency programs with 16–20 residents (39.5%) (Fig. 2, Table 3).

The majority of respondents did not have access to a hospital-wide patient safety curriculum (60.4%), or a pathology-specific patient safety curriculum (66.7%), or a medical director for quality and patient safety (55.8%) (Fig. 3). Respondents who did not have a pathology-specific patient safety curriculum were asked if they would want to implement a pathology-specific patient safety curriculum. All respondents said yes.

The following series of survey questions asked respondents about either their current practice (if they had a pathology-specific patient safety curriculum) or their ideal practice (if they did not have a pathology-specific patient safety curriculum). The questions were multiple choice where respondents could select all applicable answers. All questions included the option of "other" with a free text space for respondents to fill in alternative answers to the questions.

Both those with and those without an existing pathology-specific patient safety curriculum viewed the first year of residency as the ideal time to teach residents about patient safety (75.0% and 71.9%, respectively) (Fig. 4). In programs with a pre-existing pathology-specific patient safety curriculum, 33.3% responded "other" to the question of the ideal time to teach patient safety to residents; free text responses accompanying the answers of "other" stated that patient safety was taught throughout residency, rather than at a discrete time point of a resident's training. In contrast, only two respondents (6.3%) from programs without a pathology-specific patient safety program said that they thought patient safety would be best taught throughout residency ("other").

Both groups indicated that pathology faculty were the ideal educators for patient safety (83.3% and 74.2%). The free text responses from respondents who answered "other" to the question of who is best to teach patient safety included laboratory managers and local supervisors, Institute for Healthcare Improvement online modules,[30] and a mixture of faculty members drawn from pathology, faculty from clinical departments, and/or faculty from non-clinical departments such as an affiliated School of Public Health (Fig. 5).

When asked about the ideal assessment tool to measure the effectiveness of the patient safety program, both groups (programs with and without existing curricula) indicated a strong preference for resident
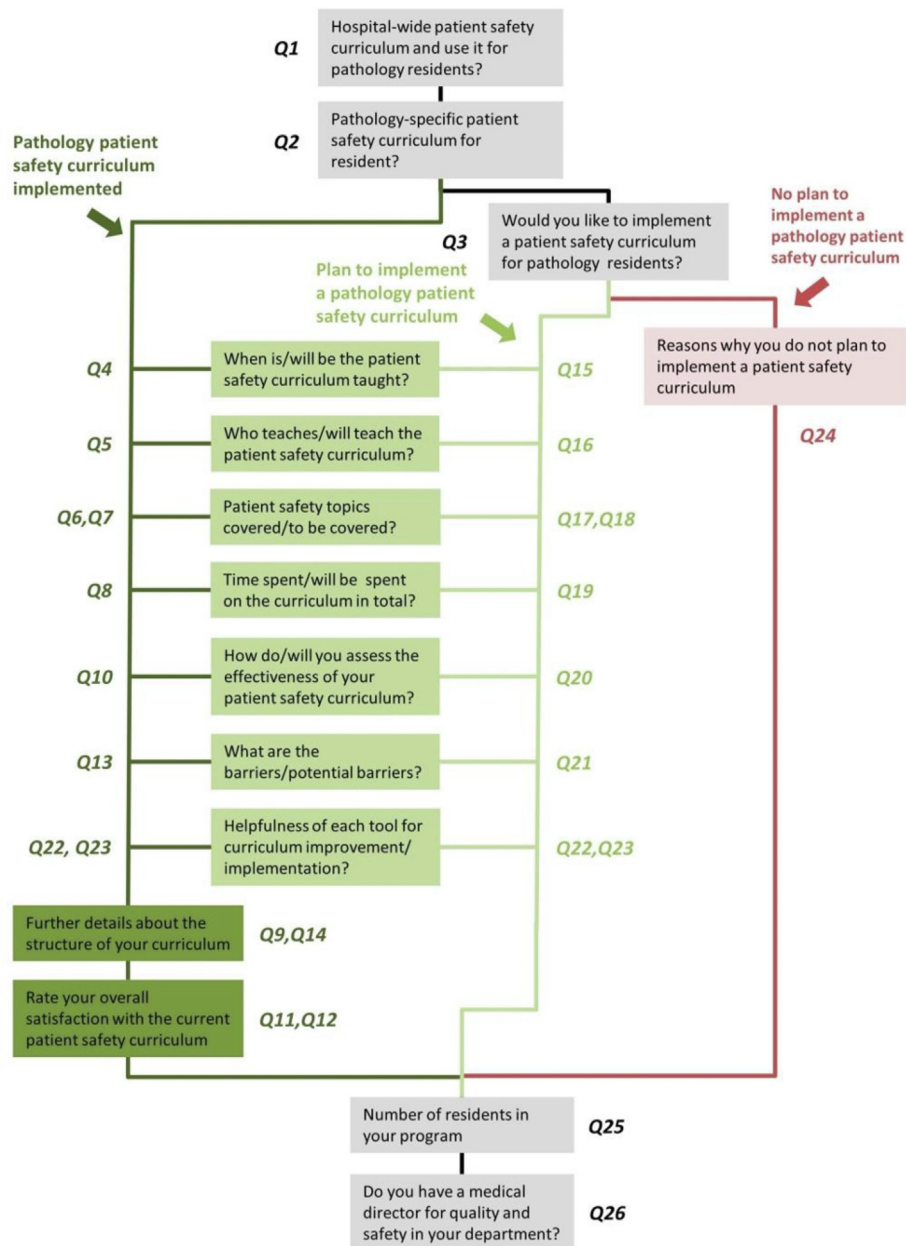
Fig. 1. Survey design flowchart.

feedback to evaluate a program's effectiveness (75.0% vs 71.0%, respectively). One quarter (25%) of respondents with a pathology-specific patient safety curriculum in place said that they were not assessing the effectiveness of the program while only one respondent (3.2%) indicated that in the event a patient safety curriculum was implemented, its effectiveness would not be assessed. Those without an existing curriculum showed a greater preference for conducting a knowledge assessment of the residents than those with an existing curriculum (64.5% vs 16.7%, respectively). Among those who responded "other" to the question, responses included looking at the quality and the number of adverse events reported by residents, resident attendance at departmental and hospital-wide safety huddles, residents' ability to lead a safety huddle, and resident self-evaluations (Fig. 6).

Respondents were surveyed on the existing or potential barriers to educating residents in patient safety. Those without an existing curriculum showed a greater concern for the lack of faculty time (80.7%) and the lack of resident time (45.1%) as barriers to a patient safety curriculum than those with an existing curriculum (50.0% and 16.7%,

respectively). The vast majority (87.1%) of respondents without a curriculum indicated that the lack of teaching resources was a barrier to implementing a patient safety curriculum. Among those with an existing patient safety program, 16.7% responded that the lack of teaching resources either had been a barrier to implementation or was still a barrier to effective patient safety education. Both groups identified the lack of faculty expertise as another barrier (50.0% and 64.5%). The minority in both groups identified a lack of funding or a lack of patient safety activities as a barrier. Among those who responded "other," the free text answers included that it was difficult to make patient safety content specific to pathology, a lack of central structure within the pathology department, a lack of coordination at the hospital level, difficulty in involving the residents in patient safety events for training purposes, and dissatisfaction with the currently used patient-safety curriculum (Fig. 7).

Both groups were asked about the amount of time currently spent on a patient safety curriculum/how much time would be available to be spent on a patient safety curriculum. The results are depicted as violin plots (Fig. 8). While both groups' responses shared a mean of 19 h and had
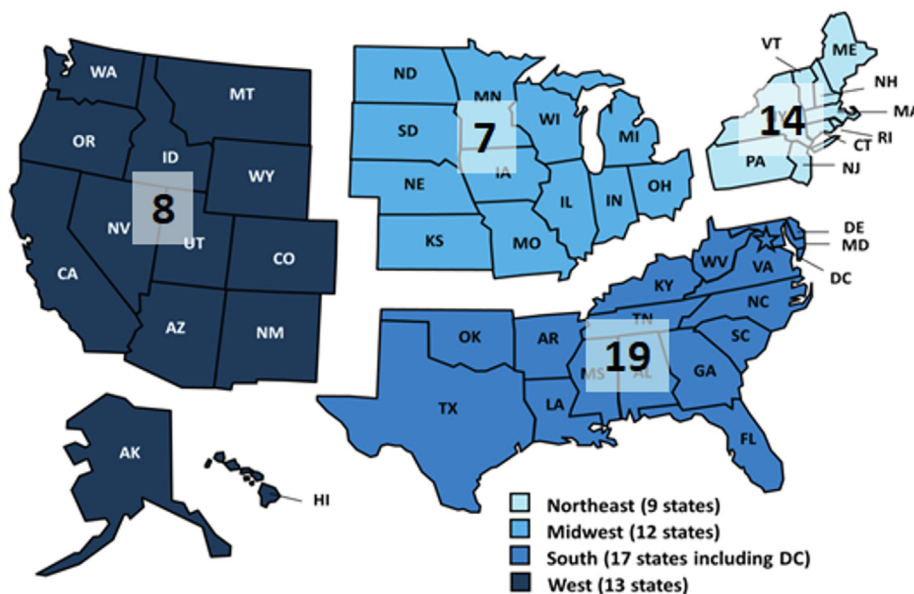
Fig. 2. Geographic distribution of respondents.

Table 3
Summary/Demographic information.

Geographical distribution	**48**	
West (13 states)	8	16.7%
Midwest (12 states)	7	14.6%
Northeast (9 states)	14	29.2%
South (17 states including DC)	19	39.6%
Program size (number of residents in your program)	**43**	
1~5	0	0.0%
6~10	5	11.6%
11~15	8	18.6%
16~20	17	39.5%
21~25	6	14.0%
26~30	5	11.6%
>30	2	4.7%
Availability of hospital-wide patient safety curriculum	**48**	
Yes	19	39.6%
No	29	60.4%
Availability of pathology-specific patient safety curriculum	**48**	
Yes	16	33.3%
No	32	66.7%
Availability of a medical director for quality and safety in your department	43	
Yes	19	44.2%
No	24	55.8%

similar medians of 15 h and 10 h, two respondents without an existing curriculum indicated that a much greater amount of time could be spent on patient safety education (up to 100 h).

Respondents were surveyed either on what patient safety topics were included in their curriculum and how they were taught or what topics they would like to include in a patient safety curriculum. In both groups, 100% of respondents included or wanted to include incident reporting/safety event reporting. Most respondents with an existing curriculum instructed residents in safety event reporting through didactic lecture (66.67%) with web-based training as the second most common method (41.67%). The topics not currently covered in an existing patient safety curriculum that respondents did not want included were failure modes and effects analysis (9.09%) and systems-based thinking and human factors (8.33%). The topics that respondents without a current curriculum would not include in their ideal patient safety curriculum were safety

and just culture (3.23%) and systems-based thinking and human factors (3.23%). All respondents without a current curriculum would want to include patient safety incident reporting and root cause analysis (Fig. 9).

In the final set of survey questions, all respondents were asked to rate, on a 1–5 scale with 5 being most helpful, the perceived utility of various tools to either improve an existing patient safety curriculum or to assist in implementing a new curriculum. All tools received high responses with means above 4: expert-created patient safety curricula received a mean of 4.6; tool kits for teaching, 4.6; online teaching modules, 4.3; tools to assess resident knowledge, 4.5; a guide to finding patient safety resources online, 4.1 (Fig. 10).

Discussion

Prior to conducting this needs assessment survey of the members of the APC-PRODS, the current state of patient safety education in pathology was not known. The TRIPS' needs assessment survey found that the majority of pathology residency programs lack a patient safety curriculum but are interested in implementing one and would welcome structured tools to do so. A major barrier to implementation, however, is the lack of patient safety teaching resources, indicating a clear need for an accessible patient safety curriculum.

While those with and those without an existing pathology-specific patient safety program agreed that the curriculum should target first year residents (75.0% vs 71.9%, respectively), 33.3% of those with an existing curriculum thought that patient safety was best taught throughout residency, while only 6.3% of those without an existing curriculum favored this longitudinal approach. This difference may reflect experiences learned on the part of those programs with patient safety curriculum, indicating that there may be value in teaching to all levels longitudinally.

Another suggestive finding was the difference between the expectation and the execution of a patient-safety education program. This is best seen when comparing the responses to the question of how the efficacy of a patient safety curriculum is/would be measured: while only 3.2% of those without an existing curriculum indicated that efficacy would not be measured, 25.0% of those with an existing curriculum indicated that efficacy is not measured. Few begin a new educational program with the expectation that outcomes will not be measured, and yet it is easy to understand how a quarter of programs with a patient safety curriculum in place do not follow through on measuring the efficacy of the program
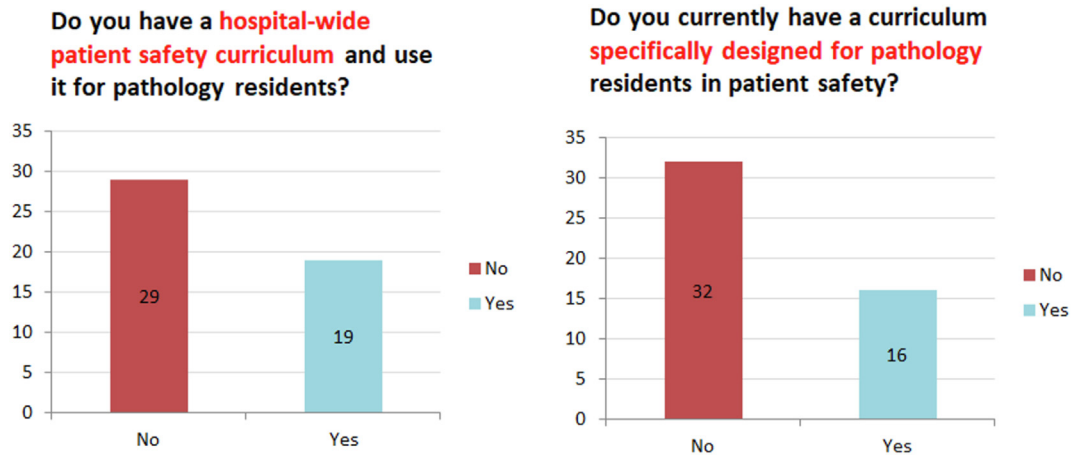
Do you have a hospital-wide patient safety curriculum and use it for pathology residents?

Do you currently have a curriculum specifically designed for pathology residents in patient safety?

Fig. 3. The availability of patient safety curricula.

When is the patient safety curriculum taught? (N=12)

During what year of training would you like to implement a patient safety curriculum? (N=32)

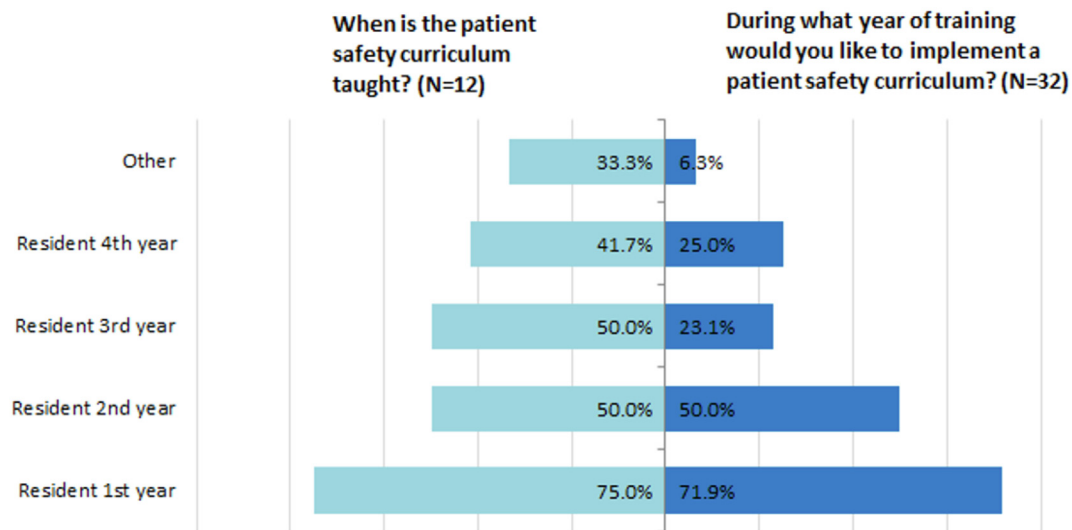|	Light blue	Dark blue
Other	33.3%	6.3%
Resident 4th year	41.7%	25.0%
Resident 3rd year	50.0%	23.1%
Resident 2nd year	50.0%	50.0%
Resident 1st year	75.0%	71.9%

Fig. 4. When are/should residents be taught about patient safety according to programs with an existing pathology-specific patient safety program (light blue) and programs that would like to implement a pathology-specific patient safety program (dark blue).
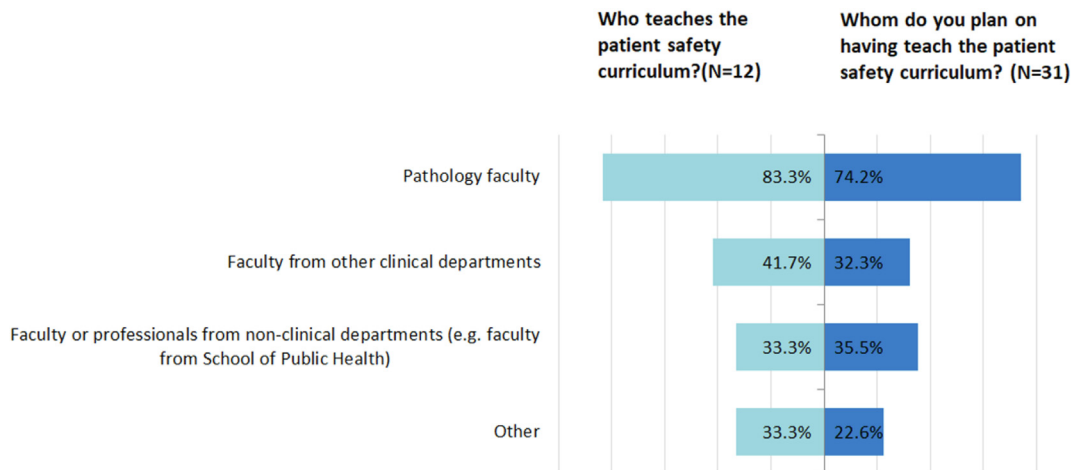
Who teaches the patient safety curriculum?(N=12)

Whom do you plan on having teach the patient safety curriculum? (N=31)

	Light blue	Dark blue
Pathology faculty	83.3%	74.2%
Faculty from other clinical departments	41.7%	32.3%
Faculty or professionals from non-clinical departments (e.g. faculty from School of Public Health)	33.3%	35.5%
Other	33.3%	22.6%

Fig. 5. Preferences for instructors according to programs with an existing pathology-specific patient safety program (light blue) and programs that would like to implement a pathology-specific patient safety program (dark blue).
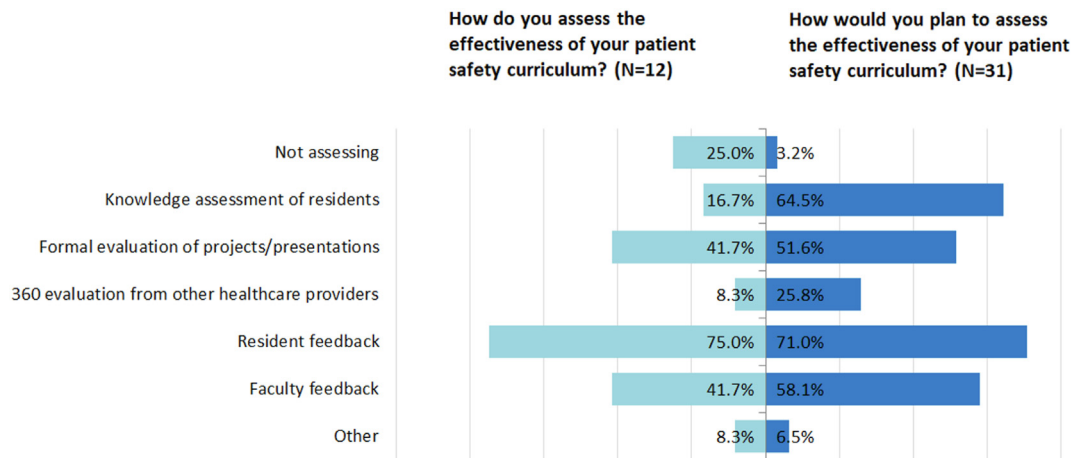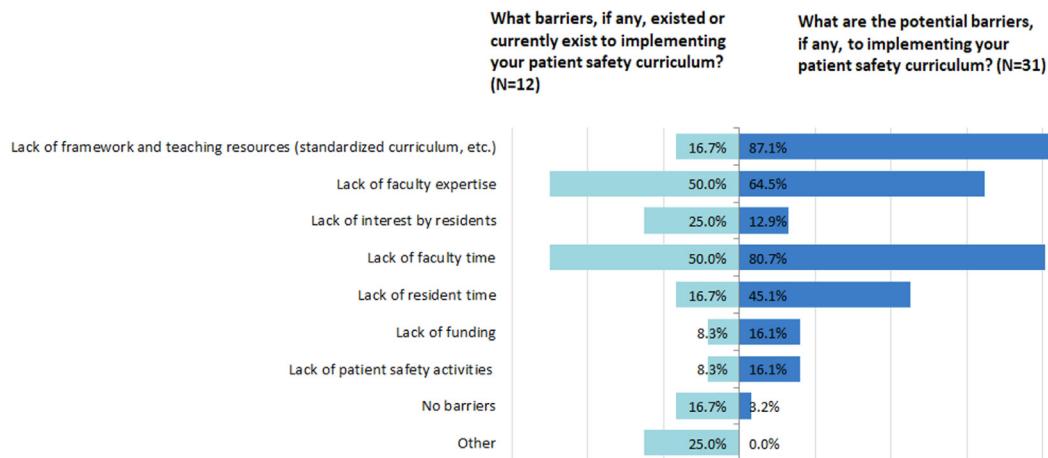
How do you assess the effectiveness of your patient safety curriculum? (N=12)

How would you plan to assess the effectiveness of your patient safety curriculum? (N=31)

Fig. 6. Assessment methods, according to programs with an existing pathology-specific patient safety program (light blue) and programs that would like to implement a pathology-specific patient safety program (dark blue).

What barriers, if any, existed or currently exist to implementing your patient safety curriculum? (N=12)

What are the potential barriers, if any, to implementing your patient safety curriculum? (N=31)

Fig. 7. Perceived barriers in patient safety education, according to programs with an existing pathology-specific patient safety program (light blue) and programs that would like to implement a pathology-specific patient safety program (dark blue).

given restraints on faculty time and limited resources toward the development of assessment tools. Similarly, those who hoped to implement a patient safety curriculum expressed a much greater preference for conducting a knowledge assessment of the residents than those with an existing curriculum (64.5% vs 16.7%). This difference likely reflects the difficulty in actually evaluating a resident's knowledge and competence. While residency programs are increasingly considering EPAs as a mechanism to evaluate resident competency,[31] assessment of tools for EPAs for the field of patient safety is lacking. The difficulty in evaluating resident competency likely explains the high rate of respondents who indicated that they would find tools to assess resident knowledge very helpful (mean, 4.5).

When asked about barriers to implementation (either currently or in the past), those without a current patient safety curriculum were more likely to report barriers, identifying lack of teaching resources, lack of faculty expertise, lack of faculty time and resident time, lack of funding, and lack of patient safety activities as barriers in greater proportions than those with an existing patient safety curriculum. Interestingly, while those without an existing patient safety curriculum expressed concern regarding the lack of resident time (45.1%), only 16.7% of programs with an implemented curriculum identified resident time as a barrier, suggesting that it is possible to create time for teaching patient safety, even in a busy resident schedule. The only two barriers that those with an existing curriculum cited in greater proportion were "other"—indicating

that barriers exist beyond those anticipated by those currently without curricula—and lack of interest by residents. This latter barrier is possibly another example of the difference between the expectation and the execution of a patient-safety education program, as only 12.9% of those who hope to implement a patient safety program worried that resident engagement would be a barrier while 25% of those with an existing program identified resident disinterest as a barrier. To combat resident disinterest in patient safety, a key pedagogical tactic is to actively engage learners through the use of hands-on, case-based learning rather than passive teaching methods like lecture series. Guiding residents through their own root case analysis of a real-life safety event—a teaching method all respondents either wanted to employ or did employ—would certainly engage learners more than the online patient safety modules popular in many hospital systems.

Regardless of whether there was a pre-existing patient safety curriculum or not, all respondents rated the perceived utility of expert-created patient safety curricula, tool kits for teaching, online teaching modules, tools to assess resident knowledge, and a guide to finding patient safety resources online between helpful and very helpful.

A limitation of this study is that it was a survey study that relied on participants responding. Organizational research surveys have an average response rate of 35.7% and the response rate in this study was 33.5%, comparable to an expected response rate.[32] However, there remains the possibility—and the concern—that there may have been a

How much time is spent on different patient safety curriculum components for pathology residents in total?

How much time would be available to spend on patient safety curriculum for pathology residents in total?
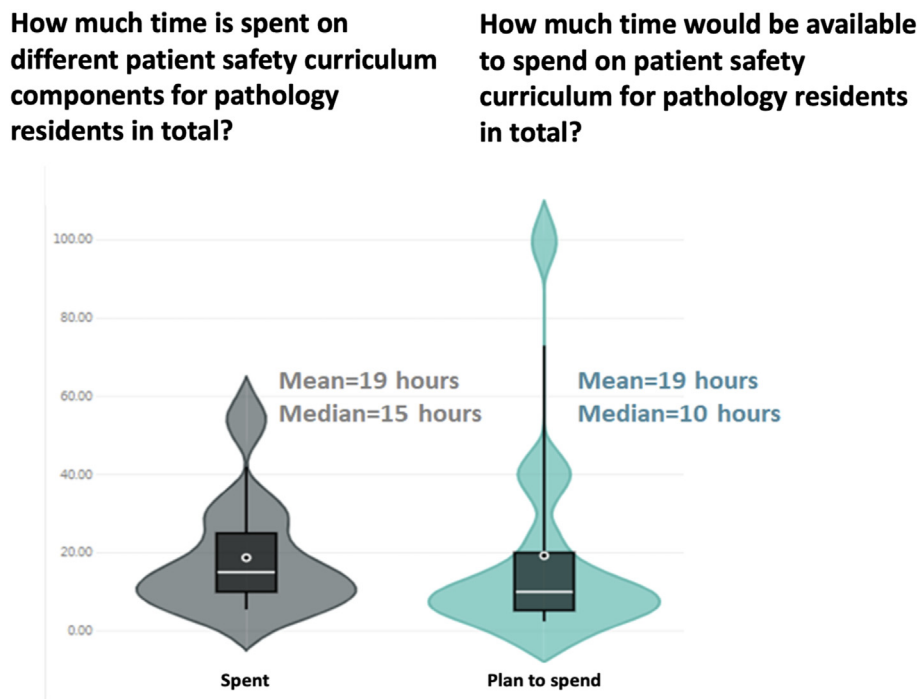

Fig. 8. Violin charts depicting how much time is either currently spent on patient safety education (gray) or how much would be available to spend on patient safety education (blue). Violin charts allow for a more detailed depiction of probability density using length and width (shape area). They are useful for showing multi-modality in a dataset; the more answers that fall in a specific range, the larger the violin shape for that range. The dot represents the mean and the line represents the median.

What are the patient safety topics covered in your curriculum and mode of teaching?

What patient safety topics would you like to like to be covered in your curriculum?

	Didactic lecture	Web-based training	Journal club	Case-based learning	Morbidity and mortality conference	Not included, but would like to include	Not included, but would NOT like to include	N	Would like to include	Would NOT like to include	Don't know	N
Patient Safety Incident Reports	66.67%	41.67%	16.67%	25.00%	16.67%	0.00%	0.00%	12	100.00%	0.00%	0.00%	31
Root Cause Analysis (RCA)	66.67%	25.00%	0.00%	66.67%	8.33%	8.33%	0.00%	12	100.00%	0.00%	0.00%	31
Failure Modes and Effects Analysis (FMEA)	27.27%	36.36%	9.09%	18.18%	9.09%	36.36%	9.09%	11	80.65%	0.00%	19.35%	31
Error Disclosure and Communication	66.67%	41.67%	8.33%	41.67%	8.33%	0.00%	0.00%	12	96.77%	0.00%	3.23%	31
Safety and Just Culture	54.55%	36.36%	0.00%	9.09%	0.00%	27.27%	0.00%	11	90.32%	3.23%	6.45%	31
System-Based Thinking and Human Factors	50.00%	41.67%	8.33%	16.67%	0.00%	8.33%	8.33%	12	87.10%	3.23%	9.68%	31
Diagnostic Error	66.67%	33.33%	8.33%	41.67%	16.67%	16.67%	0.00%	12	93.55%	0.00%	6.45%	31

Fig. 9. Respondents with an existing patient safety curriculum on which patient safety concepts are currently included in their curriculum and the mode of teaching used, which concepts are not included that they would like to include, and which concepts are not included that they would not wish to include. Respondents without an existing patient safety curriculum on which patient safety concepts they would like to include and which they would not like to include.

selection bias in who did and who did not respond to the survey. For example, were programs with a robust patient safety curriculum more or less likely to respond to a needs assessment survey about patient safety education? Additionally, survey data are inherently subjective and relies on the perception of the respondent, which may not reflect the "actual" state of patient safety at the training program. While the entire TRIPS workgroup gave feedback on and approved the survey questions, how a question is interpreted and the resultant response data are inseparable, meaning that a poorly worded question can inadvertently skew the conclusions.[33,34] Another limitation of the survey is that by asking about

if an institution had a "medical director" for quality and patient safety, institutions with "director" (i.e. a trained professional who is not an MD, DO, or PhD) were excluded from the analysis. Because of the national heterogeneity of quality, safety, and risk management structures in pathology and laboratory medicine (some are made up of laboratory technical staff, nurses, and even engineers) and because of TRIPS' sponsorship by APC-PRODS (the Program Director arm of the Association of Pathology Chairs), the TRIPS workgroup was specifically interested in connecting with Pathology faculty and understanding their role in Quality and Safety oversight and education; however, understanding the
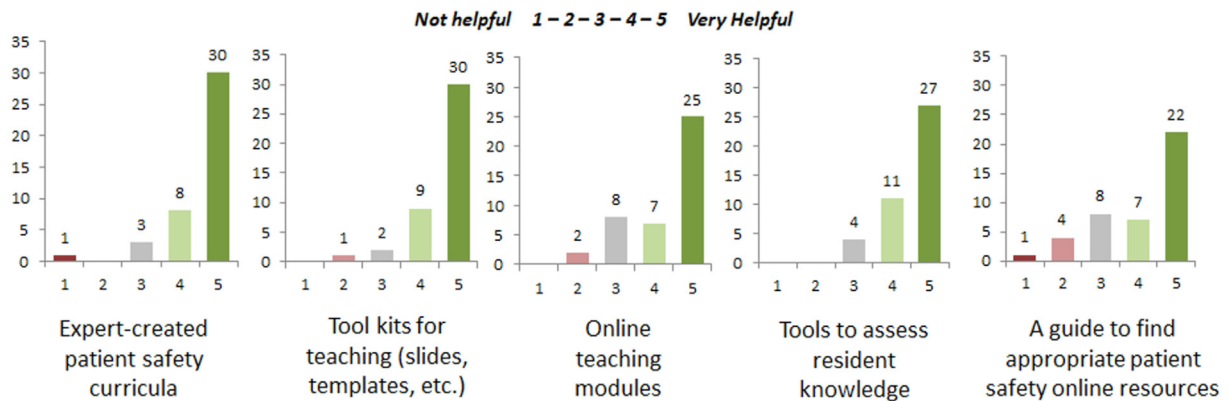
Fig. 10. Distribution of responses on the perceived usefulness of various tools for improving an existing patient safety curriculum or implementing a patient safety curriculum. The rating is on the x-axis and number of respondents on the y-axis.

nuances between these leaders and structures is fertile ground for future study.

Residency is a formative time in a doctor's career, with the lessons taught and the behaviors modeled having long-lasting implications for a physician's practice of medicine. High-quality patient safety education during residency, therefore, is a key intervention in improving patient safety in the field of pathology as a whole. By conducting a needs assessment on the state of patient safety education in pathology residency programs, the TRIPS workgroup identified a clear and compelling need on the part of training programs for pathology-specific, patient safety educational tools and confirmed the established objectives. The next phase of the TRIPS workgroup is to design a generalizable patient safety education curriculum that can be used by training programs to instruct pathology residents, to pilot that curriculum at select teaching sites, and then to make that curriculum available for interested educators and patient safety leaders. A guiding principle in the curriculum design is hands-on, group-driven, and case-based learning. By using near-miss events or patient safety events resulting in harm as opportunities for case study, the TRIPS curriculum would move patient safety education beyond a passive didactic lecture and into an opportunity for genuine trainee engagement.

Declaration of competing interest

The authors have no conflicts of interest to disclose.

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