APC-18-0001PC. Pathology’s Role in Biospecimen Science: A Study of Preanalytic Variables’ Impact on Thrombosis Biomarkers

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Objectives: Some cancers and cancer treatments significantly increase the risk of venous thromboembolism with associated increased mortality and morbidity. Biomarkers of thrombosis may be predictive, but few have been adopted in pathology and laboratory medicine due to lack of standardization. This pilot study was designed to identify steps during biospecimen procurement, handling, and processing for optimal specimen preservation and accurate marker detection. The objective is to provide guidance for measuring thrombosis biomarkers in patients with cancer.

Methods: Blood samples are collected from adult patients with cancer at diagnosis, pretreatment, and noncancer donors using rigorous standard operating procedures (SOPs). The impact of preanalytical variables (PAVs) in a clinical setting (delay to fractionation, delay to assay, and freeze–thaw cycles) is measured on markers of coagulation (factor VIII activity, F8; prothrombin fragment 1 + 2, F1 + 2), fibrinolysis (α-dimer, DDE; plasminogen activator inhibitor 1; plasmin–antiplasmin complex), cell injury (plasma DNA, DNA; nucleosomes, Nuc), and inflammation (soluble P-selectin, sPS; myeloperoxidase, MPO). Patients are followed for cancer and thrombotic outcomes and results compared.

Results: Demographics of patients with cancer are 60% male, and...
62% identify as non-Caucasian with an age range of 38 to 86 years. Noncancer controls are 52% male and 41% non-Caucasian with an age range of 23 to 64 years. Interim project data show increased thrombosis biomarker levels in patients with cancer, except for sPS and F1 + 2. Biomarker levels in patients with cancer (n = 9-52) were increased by approximately 300 ng/mL DNA, 100 ng/mL DDE, and 5 ng/mL MPO with a trending increase in FVIII (~30%) when compared to noncancer controls (n = 17-22). Freeze–thaw of plasma had no effect, while a 2-hour time to fractionation resulted in significantly increased MPO (~10 ng/mL), FVIII (~14%), and F1 + 2 (~310 pg/mL). Delay to testing for DNA and DDE showed no apparent effect on biomarker levels after 24 or 72 hours at 4°C. Current data show biomarker levels are impacted by presence of cancer rather than ethnicity of the patient. 

**Conclusions:** Donor recruitment is ongoing with recruitment goals of a diverse patient population. Rigorous use of hospital compatible SOPs contributes to identifying PAVs that matter for procedures that translate in the pathology setting for better diagnoses.

**APC-18-0002PC. Using Real-Time Laboratory INR Dashboard to Minimize Care Variation for Warfarin Anticoagulation in Hospitalized Patients**

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**Background:** Warfarin contributes up to 20% of adverse drug events (ADEs) in hospital settings. High variability in warfarin dosing contributes to increased hospital costs. Pharmacy-led inpatient anticoagulation has improved patient outcomes but needs real-time laboratory information integrated with pharmacy data. **Objectives:** We describe the creation of a pathology-led enterprise-wide “warfarin international normalized ratio (INR) dashboard” that tracks and predicts INR overshoots and provides timely and actionable laboratory information to clinical pharmacists (CPs) to target patients at risk for warfarin ADEs. **Methods:** A gap analysis conducted by a pathologist (T.K.) by interviewing 4 CPs revealed that they had to manually screen patients for high INR results and then correlate with medication history in the EMR for each such patient. Clinical pharmacists spent between 1 and 3 hours daily manually reviewing INR results, sometimes with a lag of >24 hours after results verification. There was no consistent way to identify patients with high INR who needed immediate warfarin dose adjustment. The pathologist (T.K.) in collaboration with CPs, anticoagulation specialists, and enterprise data warehouse team created an automated dashboard which stratifies INR values for all inpatients being administered warfarin. In addition, it tracks frequency of INR testing and delta INRs—important since lapses in INR measurement can lead to overanticoagulation and delta INR—difference between 2 consecutive INR values—has been shown to be a predictor of INR overshoots. **Results:** The dashboard is live for >6 months and presents real-time information on all hospitalized patients receiving warfarin—average 150 patients/d across 8 hospital facilities. It risk stratifies patients most likely to have warfarin ADEs or INR overshoots based on most recent INR (high to low) and delta INR results. It lists important data elements such as demographics, unit and bed location, admit date, and current length of stay. It allows drill down capabilities on an individual patient to monitor temporal trends in INR and correlate with warfarin dosing (initial and maintenance). Warfarin drug–drug interactions and parameters such as hemoglobin and platelet count are highlighted in real-time. **Conclusions:** Laboratory and pharmacy data when analyzed together provide significant opportunities for targeted intervention. This dashboard has increased time savings for CPs and provides a standardized approach for risk stratification for improving patient safety and reducing warfarin-associated ADEs. This is an example of how pathologists can leverage laboratory data to improve care coordination, efficiency, and system-based practice.

**APC-18-0003PC. Improving Time-in-Therapeutic Range for Warfarin Monitoring: Role of Pathologist in Anticoagulation Disease Management**

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**Background:** Standardizing anticoagulation care for patients on warfarin presents a major clinical and operational challenge in outpatient settings. Laboratory international normalized ratio (INR) time-in-therapeutic range (TTR) data provide actionable information to improve disease monitoring for such patients. **Objectives:** We describe our experience and results from an interdisciplinary disease management (DM) program to improve warfarin outpatient anticoagulation. **Methods:** Pathology department was one of the earliest contributors to this DM effort, and a multidisciplinary clinical transformation team consisting of an anticoagulation expert
(A.C.), a pathologist (T.K.), and 2 nurse practitioners (C.P., M.V.) was assembled. In 2013, based on claims and laboratory data, we estimated that >5000 patients in our outpatient practices were on long-term warfarin. There was lack of standardized anticoagulation management protocol and measures to track optimal care processes and outcomes. Time-in-therapeutic range is the most valid measure for outpatient warfarin monitoring. We aggregated 2013 outpatient laboratory INR results from our Cerner Millennium Laboratory Information System to calculate the percentage of patients in therapeutic range. We targeted 25 high-volume internal medicine and cardiology outpatient practices for this standardization effort. Using aggregated PT/INR results, we calculated the mean TTR for each practice using the Roosendaal equation. The mean TTR for the 25 practices was about 58% (range: 45%-67%), the optimal being greater than 65%. Based on 2013 baseline data, a systematic education and quality improvement program was initiated by our team with a goal to improve mean TTR above 65% over the next 12 months. Interventions included the installment of clinical decision support software for using the Hamilton dosing nomogram, provider education, and standardization of testing equipment and operating procedures. We tracked the monthly mean TTR metric for each practice using aggregated laboratory INR results. Results: Since the initiation of this DM effort, the mean TTR for all 25 practices has improved to greater than 65% (range: 62%-70%). The results have been sustained over a 5-year period from 2014 to 2017. In addition to improvement in the TTR metric, we have created standardized protocols for point-of-care PT/INR testing in the laboratory patient service centers and outpatient practices. Conclusion: Laboratory TTR data are essential for monitoring variability in standards of care for patients on warfarin anticoagulation. Pathologists can play a crucial role in population health efforts by aggregating and analyzing laboratory INR data, creating actionable metrics, and being part of DM teams.

APC-18-0004PC. Utilization of Whole Slide Imaging in a Multicenter Health Network: Contribution to Better Patient Care, Education, and Research

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Background: Digital whole slide imaging (WSI) provides rapid scanning of histopathology slides and high-resolution images that can be retrieved via the Internet, thereby enabling the implementation of WSI in routine pathology practice. Moreover, WSI also facilitates pathology education and research. Our medical center is a multisite academic institution with 10 hospitals and 8 clinical labs. All pathology technical work is centralized at 1 site. In this study, we aim to present 2 years of experience of deployment of WSI in our multicenter health network. Design: We evaluated the efficiency and accuracy of remote interpretation of after-hour frozen sections and routine diagnosis from satellite hospitals. In addition, we also assessed the application of WSI in multidisciplinary tumor boards and the organization of images for research projects. Results: (1) Whole slide imaging decreased after-hour frozen section turnaround time (eg, decreased the commuting time) with high accuracy. (2) Whole slide imaging decreased the turnaround time of routine diagnosis at satellite hospitals compared to physically transferring glass slides. (3) Whole slide imaging facilitated the preparation and running of the multidisciplinary tumor boards; compared to representative digital snapshots, WSI can provide a complete digital replica of the slide that can be viewed on a computer screen. Moreover, the preparation time was also decreased with high flexibility. (4) Whole slide imaging has been used in multiple research projects for image capture and storage. Conclusion: The ability to rapidly access high-resolution pathology images is important for pathology practice, education, and research. This study demonstrated that WSI improved the turnaround time in both after-hour frozen section and remote diagnosis. Moreover, WSI also facilitated the presentation in the multidisciplinary tumor boards and image organization of research projects. This study demonstrates a pivotal role of WSI in pathology practice, education, and research.

APC-18-0005PC. The Use of Pathology Data to Improve High-Value Treatment of Cervical Neoplasia

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Objectives: Loop electrosurgical excision procedure for the removal of the transformation zone in preinvasive cervical disease has many advantages and has become the dominant treatment for preinvasive cervical neoplasia. However, there is a corresponding concern that this intervention is overutilized, subjecting some patients to unjustified costs and risks, particularly preterm labor in those patients of reproductive age. Methods: We investigated the influence of pathology data to improve patient outcomes in the treatment of high-
grade cervical neoplasia in a joint pathology and gynecology collaboration. Two of us reviewed all cytology, colposcopy, and surgical pathology results, patient history, and pregnancy outcomes from all patients with loop electrosurgical excision procedure specimens for a 33-month period (January 2011 to September 2013). We used this to determine compliance to 2006 consensus guidelines for the performance of loop electrosurgical excision procedure and shared this information in 2 interprofessional and interdisciplinary educational interventions with obstetrics/gynecology and pathology faculty at the end of September 2013. We simultaneously emphasized the new 2013 guidelines. During the postintervention period, we continued to provide follow-up using the parameters previously collected. Our postintervention data include 90 cases from a 27-month period (October 2013 to December 2015).

**Results:** Our preintervention data include 331 cases in 33 months (average 10.0 per month) with 76% adherence to guidelines. Postintervention, there were 90 cases in 27 months (average 3.4 per month) and 96% adherence to the 2013 (more conservative) guidelines ($P < .0001$, $\chi^2$ test). Preintervention, the rate of high-grade squamous intraepithelial lesion in loop electrosurgical excision procedures was 44%, whereas postintervention, there was a 60% high-grade squamous intraepithelial lesion rate on loop electrosurgical excision procedure ($P < .0087$ by 2-tailed Fisher exact test). The duration between diagnosis of low-grade squamous intraepithelial lesion and loop electrosurgical excision procedure also increased significantly from a median 25.5 months preintervention to 54 months postintervention ($P < .0073$; Wilcoxon Kruskal-Wallis test). Postintervention, there was a marked decrease in loop electrosurgical excision procedure cases as well as better patient outcomes. **Conclusions:** The use of pathology data to inform and educate clinical colleagues about health-care outcomes for their patients can improve quality and decrease costs. Thus, pathologists should be proactive in looking for opportunities to work with clinicians to improve value and outcomes.

**APC-18-0006PO. Development of a “Patient Harm Index” in Anatomic Pathology: A More Patient-Centric Adverse Event Measurement That Can Also Be Aggregated Into System-Wide Safety Metrics**  
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**Objective:** Errors/adverse events in anatomic pathology (AP) such as significant changes in diagnosis and frozen section (FS)/final discrepancies are often expressed as rates. Although such rates are useful to determine benchmarks and compare different labs, they are very dependent on the denominator (total volume) and often less so on the numerator (impacted patients). The goal of this study is to describe the development and use of a more patient-centric metric for measuring adverse events in AP. **Methods:** As part of an institution-wide quality improvement project, service lines (SL) developed lists of preventable adverse events to aim for reduction. The sum of such adverse events in each SL represented their Patient Harm Index (PHI). Historic data were used to develop threshold, target, and reach goals for AP. **Results:** Cases with one of the following events resulting in patient harm or potential harm constituted the AP PHI: (1) major diagnostic error, (2) major FS discrepancy due to sampling, (3) major FS discrepancy due to interpretation, (4) significant/unexpected finding without documented communication in report, and (5) significant diagnostic delay, specimen loss, or results reported on wrong patient. Threshold, target, and reach goals were set as 48 (4% reduction), 45 (10% reduction), and 40 (20% reduction), respectively. Progress toward these goals was discussed at faculty, staff, and quality management meetings. By year-end, 38 patients had potential/adverse events. This 24% reduction in the potential/adverse event rate (0.061%-0.046%) appeared more meaningful when communicated as 12 less patients with potential/adverse events. **Conclusions:** By aggregating the total number of potential/adverse events in time and supplementing other, more traditional “rate-based” metrics, the PHI emphasizes the numerator and deemphasizes the denominator, keeping the focus on the patient rather than the total number of specimens. We believe that this, along with the ability to add up all events together into a single more comprehensible number, provides greater motivation for error reduction and the drive toward high reliability and also allows for easier incorporation into system-wide patient safety metrics.

**APC-18-0007PC. Rapid On-Site Evaluation (ROSE) by Cytopathologists of Image-Guided Biopsies in the Radiology Department Increases Specimen Adequacy**  
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**Objective:** Rapid cytologic analysis of image-guided biopsies can quickly evaluate cellular content and viability of CT and ultrasound (US)-guided fine needle aspirations (FNAs) and core biopsies, enabling the on-site cytopathologist to provide face-to-face communication and feedback to the interventional radiologist who has obtained the specimens. Pathology and radiology residents and fellows are involved in the process. Information regarding adequacy, the need for further specimen, and at times a preliminary diagnosis is provided. Further material can be obtained while the patient is still on the imaging table for molecular studies, cyto genetics, flow cytometry, and microbiology. We introduced this ROSE service, then compared the pre-ROSE versus post-ROSE adequacy rate for CT and US-guided FNAs and core biopsies. **Methods:** The cytopathology department was relocated to enable rapid cytology staff travel to radiology.
A room near the interventional radiology control room was obtained to store/use a double-headed microscope and other supplies. Pathology trainees examine radiology patient lists to identify procedures which may require ROSE and review patient medical history. When paged, the cytology team proceeds to radiology with DiffQuik stains, slides, and various fixatives. Fine-needle aspiration smears and core touch preps are made, stained, and interpreted. Preliminary findings and recommendations to obtain further passes for various tests are made to the radiologist. Specimen adequacy during a 3-month pre-ROSE period (off-site evaluation of slides, with many patients discharged from radiology prior to reporting) was compared to adequacy in the first 3 months post-ROSE period. Results: Twenty-nine procedures were performed during the pre-ROSE implementation period versus 103 in the post-ROSE period. The adequacy rate pre-ROSE was 66%, compared to 85% in the post-ROSE period. Conclusions: On-site cytopathology services in radiology improved our adequacy rate for FNA and core biopsies and more than tripled the number of procedures cytology was called to participate in likely due to increased radiologist satisfaction. Improved specimen adequacy along with collection of further passes for various tests based on preliminary findings may reduce repeat patient visits adding value and safety, may increase patient satisfaction, and ease radiology scheduling. Trainee involvement contributes to the institution’s educational mission. Appropriate triage of collected materials and face-to-face pathologist radiologist communication including on-site clinical, pathologic, and imaging correlation with next best step determination yields high-quality care and the best, most complete final diagnosis possible.

APC-18-0008PO. Cross-Validation of Pareto Principle in Pathology as an Evidence-Based Rationale for Management

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Objectives: Pareto principle (ie, “20/80 rule”), an extensively validated observation, states that, for many events, roughly 80% of occurrence can be attributed to 20% of possible causes. Based on this principle, we hypothesized that 20% of diagnostic entities in surgical pathology account for 80% of actual cases for each organ/site encountered. We previously tested and validated this hypothesis by a text-parsing method. The objectives of current project are (1) to further confirm it by cross-validation with 2 different methods and (2) to show representative results. The ultimate goal is to introduce Pareto principle as an evidence-based rationale for strategic decision-making in management and educational endeavors. Design/Method: Routine surgical pathology reports in laboratory information systems of several separate institutions were exported out as text files and regrouped by organ/anatomic sites via text-parsing (nature language processing) method as we previously described (2). Alternatively, pathology reports were exported and regrouped by associated ICD-10 code. The frequency of the diagnoses occurring in each organ/anatomic site was collated. At least 6000 reports were tested by both methods for result confirmation. The process with cross-validation is depicted in a flowchart. Result: The results confirm our previous finding that Pareto principle also applies to diagnostic pathology. The diagnosis profile and its ranking list were affected by different practice settings (ie, expertise of clinical and pathology subspecialty). Both validation methods independently reach the same conclusion. Each of the methods has its pros and cons but they are mutually complimentary in analyzing a large number of pathology reports and can be easily adapted to different practice settings. Conclusion and Discussion: Scientific validation of Pareto principle establishes it as an evidence-based rationale to guide executive decisions in pathology and related educational and clinical fields. Identifying the “vital few” of specimens/diagnoses that account for main workload can guide resource allocation and strategic planning at management level. The diagnosis profile (ie, diagnoses by each organ/site) revealed by such studies is vital in designing educational curriculum in medical schools and training plan for resident physician to combat information overload.

APC-18-0009PC. Securing Part A Funding Commensurate With Professional Effort in an Academic Pathology Department: Utility of APC Benchmark Data

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Objective: To ensure that sufficient funds are available to support pathologist effort in providing professional component services such as medical direction of laboratory sections. Methods: The pathology faculties are employed by the multispecialty practice group of an academic medical center. The practice group’s compensation plan directs funds for approved faculty positions to departments based on the academic rank of the incumbent, applying blended benchmark data from MGMA (community and academic) and the Association of American Medical Colleges (AAMC). The pathology department updates its staffing plan at least annually to align pathologists’ effort allocations with clinical, research, educational, and administrative needs. Work relative value unit–generating effort is derived...
from comparison of budgeted workload to AAMC benchmarks, and medical student teaching effort is derived from 3-year rolling average data. Over a 3-year period, effort allocations for directorships in anatomic pathology were migrated to benchmark figures. Once Association of Pathology Chairs (APC) benchmark data became available for weeks on service and for part A allocations per pathologist full-time equivalent (FTE), these were incorporated into the planning process and used as comparators for departmental budgets submitted to the practice group for approval.

**Results:** Directorships of laboratory sections are assigned FTE percentages based on APC benchmark data, and assigned service effort on anatomic pathology services has been adjusted based on APC benchmark data. Comparisons of proposed effort allocations and budgeted part A funding to APC benchmarks were provided with budget submissions for practice group and medical center review. Over a 3-year period, part A funding from the academic medical center to the pathology department increased by an average of 15% per year. **Conclusions:** When developing a sustainable compensation plan for an academic pathology department, incorporating APC benchmark data can support the interpretation of budgetary requests for increased FTE, making possible an effective case for increased funding.

**APC-18-0010PO. Next-Generation Sequencing Evidence-Based Antimicrobial Stewardship Program for Reducing Daptomycin-Nonsusceptible Enterococcus faecium**

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**Objectives:** The emergence of daptomycin resistance represents a serious clinical problem for treatment of severe vancomycin-resistant Enterococcus faecium (VREfm) infections. We recently identified a novel VREfm clone, ST736, and its association with daptomycin resistance. The objectives of this study were to assess the mechanisms of resistant and transmission of daptomycin-nonsusceptible E. faecium (DNSE) using next-generation sequencing (NGS) and the effectiveness of NGS-based antimicrobial stewardship program in promoting appropriate use of daptomycin and reducing DNSE in a tertiary hospital setting. **Methods:** Selected daptomycin-susceptible and daptomycin-resistant VREfm clinical isolates were analyzed by NGS using the Illumina systems. Multilocus sequencing type and single-nucleotide variants analysis were employed to explore the population genetics, resistance mechanisms, and transmission. The utilization of individual antibiotics and patients infected with DNSE were extracted from the hospital pharmacy and medical information systems. **Results:** A total of 250 E. faecium isolates from 1994 to 1995 (n = 43), 2009 to 2012 (n = 115), and 2013 (n = 92) were analyzed by NGS. Comparative genomics and evolutionary analysis confirmed a shift in VREfm population over 20 years and the emergence of clone ST736 in the mid-2000s. Further analysis of ST736 isolates (n = 113) identified genetic alterations in liaFSR (100%) and cls (14.2%) genes that predisposed to daptomycin resistance. Genomic and epidemiological evidence suggests that the observed high prevalence of DNSE at our institution had resulted from the development of resistance during daptomycin therapy and/or from nosocomial transmission. Subsequent hospital antimicrobial stewardship program aimed to restrict the use of daptomycin and enhanced infection control measures led to a significant reduction in patients infected with DNSE. **Conclusions:** The implementation of NGS in molecular epidemiology at a pathology laboratory directs more precise institutional antimicrobial stewardship program and infection control practice, which promotes the appropriate use of antibiotics, improves patient outcomes, and decreases the development and spread of infections caused by multidrug-resistant organisms.

**APC-18-0011PC. Leveraging Outpatient Inquiries Into Comprehensive Clinical Pathology Consultations**

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**Objectives:** In hospitals, clinicians become aware of the important role of clinical pathologists through rounds, tumor boards, diagnostic management groups, and so on. In outpatient settings, laboratories and laboratorians are geographically removed, with limited opportunities for collaboration. Consultations are usually handled by core laboratories on a one-by-one, one-to-one basis. Here, we describe efforts to leverage this activity into a clinical consultation service (CCS) handling inquiries with a team-oriented approach, evaluating them in the context of all pertinent information, with input from all sections involved and with attention to teaching and quality improvement. **Methods:** The CCS meets in weekly rounds and consists of a clinician, pathologists, scientists, and residents. In 2017, it implemented these changes:
Results: A total of 175 cases were logged in 7 months after CRM\textsuperscript{2} implementation:

| Phase | Previous System | New System | Action |
|-------|-----------------|------------|--------|
| (1) Receipt of the inquiry | Customer service | All medical consultations are directed to a CCS member as a single point of contact | An experienced professional assesses the inquiry and, if necessary, triages it to other CCS members |
| (2) Response preparation | Variable | Review of test results, literature, etc | Improved understanding prior to full response |
| (3) Response | One-to-one phone call | One or more calls involving one or more members | Centered on clinical context. If appropriate, provides action plan and follow-up |
| (4) Documentation | Minimal | Use of a customer relationship management system (CRM) | Activities and documents kept in the CRM, with 100% audit review of outcomes |
| (5) Reviews | Seldom | Weekly rounds | Select consultations discussed |
| (6) Quality management (QM) | Occasional | Active search for improvement opportunities | Often generates improvement initiatives |
| (7) Organizational optimization | Rarely | Continuous enhancement of consultation workflows | Based on aggregate data and weekly discussions |

Clinical Category | Number | Percentage |
|------------------|--------|------------|
| Infectious diseases | 89 | 50.9 |
| Chemistry | 19 | 10.9 |
| Immunology | 18 | 10.3 |
| Endocrinology | 15 | 8.6 |
| Genetics | 8 | 4.6 |
| Coagulation | 7 | 4.0 |
| Hematology | 6 | 3.4 |
| Drugs of abuse | 5 | 2.9 |
| Therapeutic drug monitoring | 4 | 2.3 |
| Oncology | 3 | 1.7 |
| Toxicology | 1 | 0.6 |
| Total | 175 | 100 |

About half (51\%) of the inquiries pertained to infectious diseases. Sixty-one percent involved result interpretations, 21\% test performance, and 18\% test ordering issues. Conclusions: Triage ensured that the best suited expert(s) answered the inquiry regardless of their laboratory section, reflecting the cross-sectional nature of the inquiries themselves. Result interpretation inquiries prompted a project to redesign several test result reports. The higher levels of satisfaction in 2017 laboratory customer surveys might reflect increasing awareness among outpatient health-care providers of the important role of pathologists and other laboratory professionals.

APC-18-0012PC. Pathology Exposure in Gifted High School Students: A Unique Opportunity in a Unique Population

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Objectives: To build a pathology pipeline through providing early exposure to gifted high school students. Methods: The Penn State Hershey Medical Center (PSHMC) is surrounded by local high schools filled with young talented individuals with strong interests in the basic sciences and the intention of pursuing health science careers. The PSHMC hosts students in the Pennsylvania Youth Apprenticeship Program and Health-care Career Exploration Program programs: These programs allow high-achieving high school juniors and seniors to spend time exploring a variety of disciplines within the medical center over the course of a year. More recently over the past 4 years, pathology has been consistently chosen as one of the experiences. The pathology experience has included didactic presentations on general and subspecialty practice in pathology and hands-on active learning in anatomic pathology and laboratory medicine clinical areas. Recently, we have also established a pathology day at the Hershey High School for advanced science classes. We also participate in a summer high school science camp at a local college (Lebanon Valley College), which is also for gifted students who are pursuing careers within medicine. These experiences utilize PowerPoint style presentations with visual and tactile exploration of bagged gross specimens and plasticized specimens from our extensive teaching collection. We can effectively accommodate groups of 25 to 30 students in each experience. Cumulatively over each year, approximately 10 to 12 hours of contact time was recorded for the different groups. Results: The outcome of these ongoing experiences has been positive with sessions getting excellent reviews. The students were engaged and asked intelligent questions. Additionally, many expressed further interest in pathology and many have sought out supplementary observerships in the department. At least 1 very competitive student is in the Pathology Match for AY 2018/19. Conclusions: Opportunities abound to get academic pathologists in front of talented high school students who are interested in pursuing medicine as a career. Meaningful, relevant, and interactive experiences are key to making a formative impression on this high potential audience. Matriculated medical students often have preconceived notions of pathology, and unfortunately, those notions are
often negative. As the trend continues of fewer and fewer medical graduates choosing pathology as a career, it is never too early to enlighten captive ears. A concerted effort to further develop pathology experiences for gifted high school students interested in medicine will hopefully aid in reversing the current trend and encourage the best and brightest to enter our field.

APC-18-0013PC. The Utility of Early Intervention in Helping Medical Students Consider Pathology

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Objectives: Bias among medical students toward popular specialties and against pathology may remain deeply rooted because our culture categorizes physicians by amoral factors including earning potential, perception of influence, and lifestyles of power. It is the objective of this study to quantify if simple intervention in the preclinical years by addressing these biases via introductory pathology informational session can help students consider pathology. Methods: We designed an informational session confronting bias against pathology as a medical specialty including the following 5 arguments and communications: (1) contrasting the differing roles of surgeons and pathologists, (2) highlighting the uniquely cerebral aspect of understanding and discovery not found in other specialties, (3) addressing flaws in the “need for patient interaction” defense, (4) introducing the role of social media in the field, (5) cultivating an institutional pathology student interest group. Data were collected from first- and second-year medical students who completed surveys before and after sessions. The following questions were examined: “How well do you understand pathology as a medical specialty?” and “How well do you understand the roles and responsibilities of the pathologist?” Responses were categorized and converted to “percentage understanding” values (not very well = 0%, somewhat well = 25%, fairly well = 50%, well = 75%, and very well = 100%). Data were subjected to $\chi^2$ statistical analysis with 5% significance. Average percentage understanding was calculated between groups (before and after). Results: Our data demonstrate a significant difference in percentage understanding of pathology as a specialty among medical students before and after informational sessions addressing aspects of bias in specialty choice ($P = .004$). The average percentage understanding was 31.0% before the session, compared to 65.9% after. Similarly, there is a significant difference in student comprehension of the roles and responsibilities of pathologists (increasing 39.9%, $P = .0066$). Conclusions: Because societal bias continues to drive talented medical students toward popular specialties in medicine, efforts must be made to prevent individuals with a true interest in pathology from exiting the preclinical years without the proper exposure to pathology to make an informed decision about it. This small, single-institution study suggests that even informal sessions can change medical student opinion. The pathologist should therefore be aggressive in his or her early outreach efforts by addressing the 5 aspects outlined by this study.

APC-18-0014PO. Integrated Training in Clinical Laboratory Management and Administration, Quality Improvement and Assurance: Methods and Outcomes

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Objectives: Graduating pathology residents often lack skills in laboratory management, the only discipline that touches every corner of both anatomic pathology and clinical pathology (CP). In 2013, we recognized that we could improve with better integration of residents in our laboratory administration and management problem-solving efforts. We aimed to establish structured expectations for productivity in quality assurance/quality improvement (QA/QI) projects and accreditation inspections. We describe the ongoing effort and outcomes to date. Methods: We have augmented our existing laboratory administration curriculum. During CP rotations, residents acquire both the discipline-related knowledge and skills in laboratory administration and management. This is achieved by working with faculty to solve laboratory management problems when encountered in a respective section. These experiences are then shared with all residents as problem-solving exercises via weekly CP service review. Each year, all residents undertake a formal mentored QA/QI project, structured with rigorous deadlines for a written report and presentation of findings. Rubric scoring by faculty ensures fairness and enables feedback to the residents. Based on rubric scores, the resident with the best QA/QI project earns special commendation at our annual graduation dinner. Residents are involved in the state and CAP inspection preparation process. During off-cycle years, residents are assigned to inspect areas where they have previously rotated; they produce and present deficiency reports to the group in a mock summation session. Seniors are well prepared to participate in off-site CAP inspections and routinely accompany our teams. When we are inspected, all residents attend summation conferences and they participate in root cause analysis and corrective action planning for deficiencies. Results: We have observed improvements in resident in-service performance, as well as ACGME survey performance in laboratory administration and management. For both 2015 to 2016 and 2016 to 2017 academic years, 25% of resident QA/QI projects have been accepted for presentation at national meetings. Conclusions: Our laboratory administration curriculum has moved to higher levels on Bloom’s taxonomy with continuous practical reinforcement of laboratory administration concepts and QA/QI methods. Via integration, we have mitigated
some key weaknesses of standalone block scheduling for laboratory management and administration rotations. The high quality of these experiences ensures that all of our residents are well prepared for the laboratory leadership roles expected of them in the future.

APC-18-0015PC. Training the Next Generation of Pathologists: A Novel Residency Program Curriculum

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Objectives: Pathology residency training is currently a time-intensive process, frequently extending up to 6 years in duration as overwhelming majorities of residents complete 1 or 2 fellowships. Montefiore has created a novel residency training program aimed at accelerating the acquisition of competency in pathology. Methods: To achieve an accelerated acquisition of baseline foundational knowledge and critical thinking skills, the new program is composed of 2 years of foundational anatomic and clinical pathology rotations, a third year of subspecialty rotations and graduated responsibility, hybrid rotations incorporating interaction with clinical teams, and a fourth year for residents to pursue areas of special interest in depth, with tracks offered as guidelines. Key aspects of the new pathology residency curriculum include an online onboarding process, a 1-month introductory “boot camp,” a unique surgical pathology teaching service for first-year residents, a standard introduction to the clinical laboratory, didactic, and small group learning, and an integrated pathology informatics essentials for residents approach throughout the residency. The following assessment tools are being used in this education program: daily surgical pathology assessments, entrustable professional activities, summative evaluations, boot camp tests, in-service examinations, and 360° evaluations. Results: We are in the second year of this new curriculum. The feedback from residents on the onboarding program has been universally positive. The resident survey at the completion of the onboarding program assessed the effectiveness from 1 (low) to 5 (high). The average score evaluating the onboarding curriculum was 4.24. Similarly, the residents have assessed the boot camp curriculum with positive reviews. Further, our data indicate that hands-on experiences were the most effective for knowledge retention. Regarding the new surgical pathology teaching service, faculty noted that it has allowed us to identify struggling residents much earlier and to more effectively intervene. Conclusions: To achieve accelerated competency, we have already learned from the data collected, and implemented or augmented our approach, such as enhancing and adding more hands-on learning activities. We will continue to measure our progress using the tools outlined above. It is our conviction that this new curriculum provides the framework to allow Montefiore residents to find employment with just 1 fellowship, or even no additional fellowship training. We are hopeful that our curriculum will become a model for pathology residency education in the United States.

APC-18-0016PO. Advocacy and Leadership During Residency Training

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Introduction: Pathologists need to advocate for themselves so that the importance of pathology services in patient care and health-care systems can be correctly represented to hospitals, political leaders, and payers. Learning advocacy early-on in training can mold physician leaders to face the next generation of challenges. Because residents have already chosen pathology as their specialty, they are likely to care about issues that will affect their futures. We sought to understand how highly involved staff and trainees first became interested and what exposures were meaningful and inspired them toward political advocacy and leadership. Methods: Questionnaires, with a few follow-up interviews for clarification, were conducted with politically active senior staff (>40 years; 4), new-in-practice junior staff (within first 5 years; 4), and trainees (4), to see how they became involved and what early experiences they found most inspiring for future involvement. Results: The senior staff reported being involved in departmental and hospital-based advocacy meetings during their training and could name specific staff mentors who urged them into leadership. In some cases, this was the residency program directors. They were not involved with national resident advocacy groups or national leadership during training. New-in-practice staff and trainees were uniformly involved with national initiatives, such as national resident forums, and the CAP policy meeting. They were less involved with local advocacy, although a few did indicate that shadowing a staff member who was performing advocacy made a deep lasting impression and was inspired them to want to do more themselves. One factor that was significant to leadership across older and younger staff was being chief resident during training. Conclusion: Although opportunities for national participation have increased through the years, a constant between old and new is involvement during training. A senior pathologist stated that it was the residency leadership’s job to notice which trainees have a leadership spark. Pushing trainees into leadership tasks, to see which trainees rise to the occasion, is one way to test the spark. Particularly powerful is allowing trainees to shadow staff during advocacy events. This allows the trainee to see their staff mentors wearing more than 1 hat, that is, as an academic teacher and a professional advocate. Selecting a chief resident is a combination of seeing and encouraging a spark.
APC-18-0017PC. Quality Residents: Developing a Quality Improvement Curriculum That Doesn’t Merely Check the Box

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Objectives: The Accreditation Council for Graduate Medical Education (ACGME) mandates that resident trainees in all specialties receive training and experience in quality improvement (QI). Michigan Medicine (MM) Department of Pathology’s Divisions of Quality and Health Improvement and Education developed a QI curriculum (QIC) aimed at fulfilling this accreditation requirement and shaping future leaders in laboratory QI.

Methods: At MM, we developed and implemented a 5-month, lean-based QIC delivered every year to first- and second-year pathology residents in a “flipped classroom” format with 1-hour sessions integrated into a regular departmental education series and devoted to case studies and group work. We emphasized the “hands-on” involvement of residents in practical, focused QI projects that directly impact clinical operations and which are endorsed by laboratory leadership to ensure alignment with departmental priorities. Potential project lists were solicited from laboratory managers and directors, ensuring a focus on issues directly impacting clinical operations. A flipped classroom design allowed use of dedicated class time for teamwork and consultation. Pre- and posttests measured knowledge, a postcourse survey provided feedback for course leadership, and each team gave a final presentation that included a completed A3 form and initial project results.

Results: Our QIC occurred in 2016 and 2017. Scores increased significantly from pre- to posttest both years (mean pre = 12.6, post = 16, P = .0001 in 2016; pre = 14.2, post = 16.2, P = .04 in 2017; paired t test). Seven total projects resulted in countermeasures judged generally effective in mitigating the issue(s) addressed based on feedback from laboratory stakeholders. Results of the course at our institution have been positive and a number of resident-driven projects resulting in positive changes to laboratory workflow. Conclusions: Our experience at MM suggests that the Department of Pathology has one of the only residency programs in the institution that has developed a formal curriculum to address the ACGME requirements. Our QIC is an effective means of both fulfilling training requirements and systematically involving pathology residents in operational QI. Assessment methods, lessons learned, and strategies for integrating the projects and course output into the department’s holistic QI activities will be discussed. The strategies described may also be applicable to other types of trainees as well as laboratory staff, resulting in a department-wide training program in QI and lean principles that may be useful in institutions with pathology residency programs.

APC-18-0018PO. Leveraging Rich Medical Student Curriculum Content to Enhance Introductory Pathology Resident Onboarding Instruction

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Objectives: While developing an onboarding month for incoming residents covering anatomic and clinical pathology knowledge content and basic grossing, dictating, frozen sectioning, microscopy, and histotechnology skill sets, it was apparent that there was a critical need for a defined, polished curriculum to serve as an instructional infrastructure. Methods: Existing medical student teaching materials focused on basic and organ system-based topics were configured within the learning management system Blackboard for use during an onboarding month and elsewhere during resident training. This content was supplemented with existing histology and histotechnology teaching materials and vetted PDFs of key journal articles. Results: Well-developed content from 165 contact hours of medical student lecture and laboratory sessions was configured in Blackboard for use by junior residents during an onboarding month and for subsequent study as a total of 25 learning modules. The curriculum portal includes (1) teaching content including extensive outline-focused objectives and key words and topic summaries in Word syllabus and PowerPoint document for each module, (2) self-study content utilizing a PowerPoint-based question and answer format focused on key topics with relevant diagrams, tables, and summary slides providing comprehensive context to answers, (3) a broad array of test and quiz questions configured as (a) a pretest and posttest for the onboarding session and individual modules along with (b) quizzes during the navigation of specific topics, with grading done automatically by the learning management system, (4) faculty-vetted, key articles posted as PDFs, keyed to covered content, and separately assessable, and (5) links to electronic texts and other resources including whole slide imaging collections. During the onboarding month, this content is supplemented by exposure to gross organ sessions illustrating both normal anatomic features and critical pathologic topics. Conclusions: This repository of content, providing a comprehensive coverage of key pathology topics, has been well received by residents during its rollout. Both (1) pretest and posttest data and (2) surveys of incoming residents will be used to assess the value and gauge the effectiveness of this new curriculum portal and identify areas which need further development. It will provide an instructional infrastructure for an intensive month of onboarding instruction and experience and should serve as a rich teaching resource during residency.
APC-18-0019PO. Implementation of In-House Genomic Testing in a Medium-Sized Hospital: Contribution to Resident Education

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Background and Objectives: Molecular genomic testing has become an integral and crucial aspect of patient care, influencing clinical decision-making in dictating treatment regimens, patient response, individual prognosis, and overall survival. Moreover, the incorporation of molecular pathology in resident training has improved the overall educational experience and resident career opportunities. Here, we aim to demonstrate the pivotal and positive role that the molecular laboratory has had on the education of pathology residents as part of a Graduate Medical Education training program. Methods: A retrospective review was performed for the residents at our institution between 2007 and 2017, which trains 12 residents over a 4-year AP/CP training program. Residents were assessed for the number of accepted journal publications and United States and Canadian Academy of Pathologists (USCAP) Annual Meeting presentations. Results: (1) Thirty seven posters/abstracts were presented at USCAP in the past 3 years (2016-2018) including 2 platform presentations. This correlated with >1 poster per resident every year for all residents. (2) Almost all residents have journal publications before graduation. At least 2 resident’s publications with an accumulated impact factor >10. Several residents published in prestigious pathology journals, such as American Journal of Surgical Pathology. Conclusions: This study demonstrates the increased role of molecular genomic testing in pathology as a pivotal tool for fostering research and scholarship productivity during resident training. The increased exposure has produced resident involvement on a national and international level through various collaborations and publication.

APC-18-0020PO. Pathology Mortality and Morbidity Conference as a Model for Trainee Patient Safety Education

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Background: In 2015, The National Academy of Medicine issued a call to action to the pathology community, identifying diagnostic error as a major, unaddressed patient safety concern. The Accreditation Council for Graduate Medical Education has also recently augmented requirements for trainee patient safety education; however, few pathology-specific patient safety curricular resources exist. Without structured, practical instruction, pathology trainees will not acquire critical skills in adverse event analysis and management. Design: To encourage trainees’ participation in adverse event management, we transformed our monthly Pathology Morbidity and Mortality Conference (MMC) from laboratory manager- and director-led to trainee-led presentations for adverse event review. An MMC guide was developed as a checklist, allowing trainees to take a structured systems approach to investigating incidents by engaging stakeholders, developing a time line of events, classifying errors, and identifying systems vulnerabilities. The MMC guide also provided guidance for conducting a root cause analysis (RCA) using tools such as cause maps and fishbone diagrams. Patient safety resources such as articles and web site links were embedded in the guide. An MMC PowerPoint presentation template was created to assist trainees in translating their findings into a logically organized presentation. For additional reference, previous MMC presentations were made available. Results: Five residents and 1 fellow have utilized the MMC guide to analyze adverse events and develop MCC presentations in the 4 months since its rollout. Adverse events covered included both preanalytical (eg, missed test order) and analytical incidents (eg, misdiagnosis). Early feedback from participating trainees was obtained by using an anonymous survey with a Likert scale. Regarding the MMC guide, 100% of trainees strongly agreed or agreed that the resources were helpful and that their ability to investigate adverse events had improved. All trainees agreed they had learned RCA skills useful for their future practices. Eighty percent strongly agreed or agreed that the experience had helped them to become better practicing pathologists, while 20% felt neutral. Conclusion: Trainee-led MCCs can be used as a model for pathology trainee patient safety education. Trainees found the process helpful in learning RCA and as a preparation for their future careers. Our novel MMC guide and practical MMC templates facilitated trainee learning experiences. Current data reflect trainee experiences only. Next steps include developing a validated assessment tool to determine overall quality and utility of MMC.

APC-18-0021PO. Preparing Our Residents, Medical Students, and Fellows for a Digital World

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Background: With the FDA approval of digital pathology for routine use, many departments are rushing to purchase scanners and digital pathology infrastructure. These are huge investments and can be more than half a million dollars, besides the personnel and service contracts. However, once a diagnosis will be made, they have no means to make use of the digital slides in a meaningful way. The prime responsibilities of
pathology departments besides providing pathology services include training, education, and research. As pathology transitions to digital, trainees need to feel comfortable at viewing slides on a computer and confident about making diagnoses. All this can only come with practice. PathPresenter.net (PP) provides easy and free access to thousands of digital slides from any device and the tools to use the slides in a meaningful way. The platform has been built by pathologists who understand the requirements of pathologists and pathology departments. Methods: Digital slides can be uploaded into MySlideBox. Slides from MySlideBox and PP open library (over 10,000 slides) can be searched and grouped into folders for teaching specific topics. Integration of PowerPoint presentations allows the development of spectacular medical presentations for intradepartmental and interdepartmental conferences. Radiology images and videos can easily be integrated into these presentations. Slides can be annotated prior or during the presentation to highlight areas of interest. Screen and voice recordings allow development of teaching videos that can be uploaded to social media platforms or departmental sites for teaching. Results: The high-yield section contains handpicked cases for each subspecialty and essentially converts the computer into a multileveled scope where the specialists point out histologic features in the digital slide. These cases are integrated with clinical, radiological, and IHl images for a complete teaching experience. A medical school section covers entities that medical students should be familiar with and gives them an introduction to digital pathology. For departmental use, there is a quiz building modality that allows faculty to build quizzes and assign to residents. Assigned administrator(s) of the department can also create graphs and overviews of trainee progress, which can be used to provide feedback to the ACGME. Conclusion: The platform facilitates sharing of slides, cases, or entire presentations. These features can be used to get or give second opinions. Other features include capturing pictures for publications, adding slides to social media feeds, blogs, and discussion forums. I will walk the audience through the features of PP in my presentation.

APC-18-0022PO. Implementation of a Global Health Elective at New York Medical College at Westchester Medical Center: A Model for the Global Health Elective in Pathology Residency Programs

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Objectives: To establish an elective rotation to participate in global health as a unique training opportunity for current pathology residents, to develop a formal rotation curriculum, and to develop a framework for future program expansion.

Methods: Starting with 1 pathology resident, a 4-week elective rotation was created to allow for participation in an internationally located pathology laboratory. The creation of the elective included an outline of educational goals and objectives and a list of requirements for reporting postreturn. An active pathology laboratory at the Mbarara University of Science and Technology training hospital was identified in Mbarara, Uganda that is home to a small residency program with access to limited resources. The resident was expected to take notes on interesting cases, journal about time spent, and reflect on the unique obstacles and offer theoretical solutions. After completion, the resident was expected to give a 1-hour presentation summarizing the experience. Results: Completion of this elective was deemed an extremely successful venture and plans to expand to include more residents are currently being discussed. As per the final resident presentation, there was abundant knowledge gained of how laboratories function in low-resource settings, enormous exposure to the pathology of advanced and rare diseases related to the developing world, and ample opportunities for team work and problem-solving in an unfamiliar setting. The resident found the training time to be extremely worthwhile. Conclusions: Participation in global health is something most clinical residency programs have access to but is rare in pathology training programs. Giving residents the opportunity to improve their diagnostic and clinical skills in a low-resource setting is a highly valuable training tool. An elective in Global Health provides a unique training opportunity to foster communication skills, work in teams, and expand comfort zones. Creation of a Global Health curriculum and international rotation is a worthwhile endeavor and can help to enrich the pathology resident’s training.

APC-18-0023PO. Orientation of Incoming Pathology Residents—Implementation and Testing of a New Approach

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Objectives: This study aimed to assess the effect of modification to the pathology resident orientation procedures at Westchester Medical Center in order to increase the ability of residents to independently problem-solve and acclimate to the residency program with increased efficiency. Methods: An orientation committee was formed of 2 second-year AP/CP residents to analyze the current protocols and resources provided to the incoming residents. The information was then organized into 1 main network folder to centralize the information. Any information that was traditionally only provided through verbal instructions was written out and included in this folder. The entirety of this material was reviewed with the incoming first-year residents at the end of their standard orientation period. The residents in the 4 years prior to the incoming
first-year residents were surveyed with a 12-question survey assessing their ability to independently problem-solve given no additional orientation materials. The same survey was given to the incoming first-year residents at the completion of their orientation. The survey was composed of 12 questions in total, with 9 containing information that was present in the newly created orientation folder and 3 questions with answers that were given during the orientation period but were not included in the centralized folder materials. **Results:** Nine residents between PGY-2 and PGY-4 and 4 PGY-1 residents responded to the survey. Out of the 12 questions, the PGY-1 residents scored significantly higher than the PGY-2-4 residents (68.75% ± 20.90% vs 39.17% ± 10.78%, \( P = .00013 \)). Out of the 9 questions that assessed self-sufficient ability to answer each question, the PGY-1 residents scored better than the more senior residents in 8 of 9 questions (\( P = .005 \)). One of 9 questions showed an equal ability to answer independently (72.78% ± 22.24% vs 36.67% ± 11.11%, \( P = .0002 \)). Of the 3 remaining questions that assessed knowledge based on orientation only, the first-year residents scored similarly to the senior residents (56.67% ± 11.55% vs 46.67% ± 5.77%, \( P = .13 \)). **Conclusions:** The results of this survey indicate that the introduction of a centralized and easily accessible folder of orientation materials has provided a repository for the incoming residents to access information to acclimate to the program with increased independence compared to their seniors. When the residents are answering questions without this additional resource, the outcomes of independent problem-solving ability are similar, as was exposed by the 3 survey questions that tested for this. The pathology program at Westchester Medical Center continues to strive to attain excellence in the training provided to the resident pathologists.

**APC-18-0024PO. A Strategy for Wellness in a Pathology Residency Program**

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**Purpose:** Physician burnout is a national crisis and is among occupations with higher suicide risk, at 1.8 times the national average. Few pathology departments address this issue, and even fewer pathology residency programs offer formal resilience training. Learning from the business world, we implemented a high-stress environment resiliency strategy to our pathology residency program, and its purpose was to analyze and apply initiatives utilized in the high-stress business world and measure their effectiveness. **Methods:** A survey of pathology residents indicated need for resilience training. Utilizing methods from companies like Goldman Sachs, we adopted initiatives in our residency program:

- Approach burnout as a dilemma that needs a tridimensional strategy: wellness initiatives for the individual, group strategies for the program, and an institutional plan that considers wellness.
- Formalize curriculum with wellness talks focusing on stress prevention, management, and treatment.
- Offer free sessions with trained resilience coaches, psychological help, employee assistance program, and chaplain services.
- Implement mentorship program.
- Pair first-year residents with senior residents.
- Implement mindfulness during wellness talks.
- Provide easy access to volunteer activities and networking.
- Offer fitness center discounts.

A pulse survey to identify one positive, one frustration, and one thing needing change was conducted at the beginning of this study. At 6 months, we evaluated the efficacy of the initiatives with another survey. We will continue assessing our program at 1 year. **Results:** An anonymous survey of 15 residents was conducted during a staff meeting. After implementing the strategies mentioned above, a 6-month survey was conducted. Data indicated that residents were more educated about tools to improve wellness after 6 months. **Conclusions:** A recent study showed that resident burnout among residents ranged from 59% to 75%. While pathology is not considered a high burnout discipline, in 2016, a Maslach Burnout Inventory put our department at the same burnout rate as that of our clinical colleagues. Our goals are to increase wellness among pathology residents to prepare them for a high-stress environment before entering the work force and to increase their ability to bring tools to their new work places. The 6-month survey shows positive movement toward our goals. We are providing our residents with tools to maintain the joy, humanity, and satisfaction of practicing pathology throughout their careers.

**APC-18-0025PO. Evaluation of Transfusion Medicine Instruction During Medical School**

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**Objectives/Background:** Traditionally, transfusion medicine education has been an underemphasized discipline of course instruction in medical school education. In the current environment, striving for excellence in quality care and quality assurance, hospital systems have sought the expertise of the transfusion medicine subspecialty to evaluate blood utilization and laboratory utilization within their systems. The aim of our study is to determine how effective current educational practices are and how pivotal introducing transfusion medicine and its practices early on and throughout the 4 years of medical education could potentially impact blood ordering confidence and practices among graduates. **Methods/Design:** An
interview of the fourth-year medical student class of 2018 (160 students) at Loyola Stritch Medical School in Maywood, Illinois, with the use of a Google Forms survey was conducted. The survey included questions about general transfusion medicine practices, length of transfusion medicine instruction, information about obtaining consents, and recommendations on length and format of transfusion medicine instruction.

**Results:** (1) We received 54 (33.75%) responses. (2) Of the 54 responses, 38 (70.4%) stated that they do not feel comfortable adequately ordering blood products in their future residency career, while only 16.7% (9/54) did not feel comfortable obtaining consent for transfusing blood products. (3) At Loyola Stritch Medical School, the pathology department assists in providing medical school instruction during their first and second years of medical school. (4) With that in mind, only 38.9% (21/54) felt that they received adequate instruction during their first 2 years in medical school. (5) The class provided opportunities for improvement in transfusion medicine instruction, which ranged from lecture format in the first 2 years to cheat sheets to use while on rotations and their residency years. **Conclusion:** Overall, we believe, and our brief study demonstrates, that providing continued assistance and education in transfusion medicine practices throughout medical school and residency career, while only 16.7% (9/54) did not feel comfortable obtaining consent for transfusing blood products. (3) At Loyola Stritch Medical School, the pathology department assists in providing medical school instruction during their first and second years of medical school. (4) With that in mind, only 38.9% (21/54) felt that they received adequate instruction during their first 2 years in medical school. (5) The class provided opportunities for improvement in transfusion medicine instruction, which ranged from lecture format in the first 2 years to cheat sheets to use while on rotations and their residency years. **Conclusion:** Overall, we believe, and our brief study demonstrates, that providing continued assistance and education in transfusion medicine practices throughout medical school and residency training is not only preferred but also could impact transfusion ordering practices providing better quality care to the patients we serve.

**APC-18-0026PC. Introducing Laboratory Medicine to Medical Students Before They Enter Clinical Clerkship: Oakland University William Beaumont School of Medicine’s Experience**

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**Objectives:** The transition between second and third year of medical school is a huge change. Although students are taught by both pathologists and clinicians in courses on anatomic/biomedical foundations and organs/systems, they have very little understanding about laboratory operations and test utilization when they start their third year of medical school. Therefore, we organized a short course to introduce laboratory medicine before they enter clinical clerkships at Oakland University William Beaumont School of Medicine (OUWBSOM).

**Methods:** As the first part of a longitudinal diagnostic medicine clerkship, this has been a single-day course offered to the entire class of medical students together at the end of their second year. A variety of classroom activities are organized on topics including STATS, critical values, turnaround time, chemistry panels, preanalytical variables, analytical variability, reference intervals, laboratory formulary, send-out tests, search lab test directory, anatomic pathology service, and how to use microbiology laboratory. All students are brought to tour representative sections of anatomic and clinical pathology laboratories. Attendance is mandatory for all medical students. Students are not graded but feedback from students is collected. **Results:** Five classes of OUWBSOM students have completed this course. Significant improvements have been made over the last 5 years. Hour-long didactic lectures have been replaced with half-hour-long lectures. Lecturing to the entire class together has been replaced with small-group interactive sessions and case studies. Continuous long laboratory tours have been reconfigured into small fragments and mixed with short classroom interactive didactic lectures or case discussions. In the most recent class, students considered it as one of the best organized days they have ever experienced. Not 1 minute was wasted. The entire experience was interactive and engaging. This course did a great job of connecting the basic science foundations to the clinical aspects of applying this knowledge. They all considered it a great course in introducing them to the operations of the pathology laboratory and how is used in the context of treating patients. This course greatly piqued their interest in pathology. **Conclusion:** Combining small-group classroom activities and laboratory tours at the end of the second year approves to be a very effective approach to introduce laboratory medicine to an entire class in a single day. It can be successfully done with careful planning and coordination and commitment by a large group of faculty, laboratory staff, and residents.

**APC-18-0027PC. Teaching Medical Students Choosing Wisely in Diagnostic Medicine Clerkship: Oakland University William Beaumont School of Medicine’s Experience**

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**Objectives:** Based on published literature, 10% to 40% of laboratory tests have been considered unnecessary. The Choosing Wisely campaign launched by ABIM Foundation 5 years ago has increased the awareness among health-care providers and patients. To prepare our medical students to become wiser laboratory users, we have devoted a significant portion of our laboratory medicine curriculum to teach them how to choose laboratory tests wisely in the diagnostic medicine (DM) clerkship at Oakland University William Beaumont School of Medicine (OUWBSOM). **Methods:** As the second part of a longitudinal DM clerkship, all medical students must rotate in the pathology department in their fourth year at OUWBSOM. For example, half of a day is allocated for the anemia session. Prior to this session, students were asked to perform a pretest. Within this session, students were provided with 8 representative cases selected from common or critical setting for...
diagnostic workup where inappropriate test utilization is frequently observed in clinical practice. Students were asked to first formulate a list of differential diagnosis, then to order appropriate laboratory tests to confirm the most likely diagnosis or to rule out a specific disease among their differential diagnosis. The diagnostic utility and cost of the tests are discussed. **Results:** The pretest has helped to identify a significant knowledge gap in test utilization for anemia workup after the third year of clerkship (mean % score: 50; SD: 13). This knowledge gap was essentially the same among students who rotated the DM clerkship at different times in their fourth year, indicating additional clinical rotations did not fill this learning gap. This gap was consistent with the inappropriate utilization pattern frequently seen among the practicing physicians within our hospital system and community. For an example, flow cytometry and molecular studies were overused to rule out homological malignancy in the blood. Reticulocyte was underused in anemia workup. Students lacked clear understating of diagnostic utility of blood smear review. Generation of appropriate differential diagnosis based on CBC and differential count was hard for many of them. They essentially had no clue of the cost of the commonly used hematology tests. **Conclusions:** Pathologists are in a unique position in teaching medical students to choose laboratory tests wisely because of their domain expertise of the diagnostic utility and cost of tests and observation of ordering mistakes clinicians frequently make. A curriculum in medical education focused on choosing wisely, such as in our DM clerkship, may help improve test utilization.

APC-18-0028PU. Pathology for Generation Y in New Integrated Curriculum

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**Objectives:** Almost 80% of US medical school use integrated curricula in their preclerkship years. At Eastern Virginia Medical School, the new integrated curriculum was launched in August 2016. From this moment the year-long pathology course previously offered to second-year medical students was no longer needed. To ensure pathology was retained in the curriculum pathology, faculty took an active role in designing the new integrated curriculum. Pathology content was securely divided among 9 modules spanning the first and second years. Besides organ modules, a general mechanism of disease module was designed to introduce first-year students to basic concepts of diseases. **Methods:** In each module, the discipline of pathology is introduced by live lectures intermixed with online recordings of concise material. Application of this knowledge is later acquired during small groups and whole class sessions based on clinical scenarios and integrated with other disciplines such as histology, physiology, microbiology, immunology, pharmacology, and clinical skills, and so on. Clinical cases range from less complex for early learners to more complex cases for organ-based modules and almost exclusively are built by pathologists and then reviewed by other experts. They are formatted as question and answer sessions reported by online tools and then verbally in a class. **Results:** Based on the responses of a cohort of 142 second-year students from the longest, 11-week module, 78% strongly agreed/agreed that those sessions facilitated their learning. Based on the NBME exam results, those students scored 5% to 6% higher than the predictive mean on pathology portion of the integrated exams. This was comparable to their peers’ scores taking our year-long pathology course in the discipline-based curriculum from previous years. **Conclusions:** Creating clinical cases with the integrated approach is time-consuming venture and it seems to erase delineations between pathology and other disciplines. Providing a particular format (small groups vs whole class, questions and answers vs discussion with experts in the room) has its own challenges also. We do not know how well those students will apply the basic disease concepts during their future clinical rotations and we do not have any methods to measure those outcomes yet besides their satisfaction and their performance on licensing exams. Present trainees belong to generation Y, grew up with technology, are team-oriented, and prefer hands-on, nontraditional knowledge acquisition. Our approach seems to appeal to their characteristics and invoke active participation and engagement during sessions. We contribute this to providing context to the content and avoiding situations where pure memorization is rewarded.

APC-18-0029PU. Maintaining Pathology in the Era of Integrated Curricula

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**Objectives:** As most US medical schools transitioned to an integrated preclerkship curricula, traditional pathology-disciplined courses disappeared. Eastern Virginia Medical School (EVMS) launched its new integrated curriculum in August 2016. Pathology faculty insured involvement in its creation and implementation. Pathology was securely divided among our various modules spanning first and second years. Besides system modules, a general mechanism of disease module was designed to introduce first-year students to general pathology concepts and reinforce disease mechanisms. We hypothesize that this approach is necessary to prepare our learners adequately for the organ-based modules and standardized board exams as well as future practice. **Methods:** Eastern Virginia Medical School General Mechanisms of Disease module consists of 6 weeks of instruction based on content from Robbins Basic Pathology but also includes pediatric disorders, fundamentals of microbiology, and pharmacokinetics. Red and white blood cell disorders were also introduced to illustrate application of general mechanisms to an
organ system. Material is taught by live and online lectures, by problem-based learning sessions, called minicases, and through virtual patients. Students participate in tumor board, opioid, and HIV panel discussions and are introduced to the process of autopsy and filling out death certificates to reinforce disease mechanisms. **Results:** Data from NBME exams in general pathology category during the general mechanisms module (integrated curriculum) and general mechanisms block in our discipline-based curriculum show no difference in our students’ performance: 83% predictive and 81% achieved versus 80% predictive and 78% achieved in 2016, and 81% predictive, 79% achieved in 2015, respectively. Although there is no difference in grades, we argue that this organization provides our students with the foundation to understand organ system disorders throughout subsequent modules under the guidance of pathology and nonpathology faculty. Our first cohort of students in the new integrated curriculum is preparing to take step 1 within the next few months. At that time, we will be able to compare their board scores with the scores of previous cohorts of students taught in the traditional discipline-based curriculum. **Conclusions:** Inclusion of a dedicated general mechanism of disease module in the new integrated curriculum at EVMS was possible due to engagement of the pathology faculty. This approach prepares our learners to understand organ system disorders throughout the curriculum under these modifications, and there is a danger that students will fail to learn the essential messages of diagnosis and management that pathology and laboratory medicine embody. Furthermore, a pipeline of medical students choosing pathology as a career may suffer if the visibility of pathology in the curriculum continues to erode. We aim to mitigate these challenges with a new clinical rotation for our medical students. **Methods:** We are collaborating with radiology to create a new clinical rotation called diagnostic medicine that will be required for all medical students at our institution. It combines radiology and imaging with pathology and laboratory medicine over a 3-week rotation. Importantly, this rotation is positioned early in the medical students’ clinical schedule exposing students to these career options well before their commitment to residency training. **Results:** We are only at the pilot stage. **Conclusions:** We discuss the goals, mechanics, and advantages of this new clinical experience.

**APC-18-0031PO. Early Exposure and Recruitment to Pathology Through a 2-Week Summer Experience**

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**Objective:** Traditional lecture formats, often including pathologists, are being replaced by active learning approaches that focus on more exposure to clinical practices earlier in medical school training. There is a risk that pathologists may experience a reduction in visibility as a career choice among medical students during their formative first 2 years prior to making residency decisions. Our department has set forth to expose medical students to pathology early in their medical education in order to increase early interest and personal commitment to the specializations within pathology. **Method:** To combat the misperceptions students may have of pathology early in their medical education, our department has devised a paid 2-week summer program. This intensive program took place between the students’ first and second years, when the students had fewer clinical commitments. Each day students would rotate through a pathology subspecialty and interact with both pathologists and clinicians, in order to observe the importance of the clinical–pathological correlation needed for good patient care. **Results:** This program allowed a small group of first-year medical students to rotate through and observe the vast pathology services within anatomical and clinical pathology. Topics focused on the relationship between pathologists and their clinical counterparts, which is rarely noticed by students during the third- and fourth-year clinical rotations. Whenever possible, experiences began with patient interviews and interactions and ended with a pathological diagnosis. For example, students observed ultrasound-guided fine needle aspirations. The students then followed the specimen through the pathology department, which culminated in the medical student sitting with the pathologist to develop the final diagnosis. Students also attended tumor boards and other interdepartmental conferences and experienced the critical role the pathologists play in patient care. **Conclusion:** Many medical
students view pathology as a subject that one merely memorizes in preparation for an exam or a hurdle to their experiences on the clinical floors. This trend is unfortunate and concerning, as within pathology lays the basis of all diagnosis and subsequent therapies. All too often, medical students do not realize the far reaching role pathology plays in the day-to-day within medical practice. This 2-week paid summer program has evolved over the last several years and has resulted in early exposure to the many career options within pathology prior to a personal commitment to other medical fields and a better appreciation of the daily role a pathologist plays in patient care.

**APC-18-0032PC: Forensic Autopsy Experience and Core Entrustable Professional Activities: A Structured Introduction to Autopsy Pathology for Preclinical Students**

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**Objectives:** The forensic practice provided an autopsy experience for our school’s MS1&2 students, reinforcing forensic autopsy pathology as the practice of medicine and highlighting core entrustable professional activities (Core EPA) in an autopsy. **Methods:** Students self-selected for an autopsy observership. Prior to the experience, we reviewed the expectations with students and assured that all HIPAA and safety training was completed. Groups of up to 4 students were on call for a weekend autopsy. They observed and participated, ideally from scene review through autopsy performance, slide review, and toxicology/laboratory results. The group had a structured presentation format for summarizing the autopsy experience, forming a differential and final diagnosis, completing the death certificate, discussing quality management, and learning issues in the case. At the end of the semester, all students participating in the experience met and each group had 10 minutes to provide the structured review of “their” case. **Results:** A high number of students completed the voluntary observership (32/79) with 10 cases reviewed. The structured, 10-minute review forced student groups to collaborate and select critical issues for Core EPA: documenting (EPA5) and preparing an oral (EPA6) presentation of clinical encounter, EPA 1 gathering history and physical examination, and EPA 2 prioritizing a differential diagnosis. A discussion of autopsy consent and forensic/public health ordering of an autopsy along with cultural sensitivity and respect provided an excellent example of EPA 11, obtaining informed consent from patients. Many cases required integration of past medical or mental health encounters, social work, EMS, police, and other personnel; students needed to address the team work needed in these cases (EPA 9). Finally, a required element of the presentation was documenting unexpected findings at autopsy. Although many were diagnostically minor, some rose to reportable discrepancies and students had to address how autopsy contributes to EPA 13: system failures and culture of safety. **Conclusions:** The program received high ratings by students; 50 are participating this year. At least 6 core EPAs were addressed in every autopsy review; some had more when advanced clinical questions or safety issues were identified. Additionally, 1 student presented his case at a national meeting and publication is pending. The experience (1) provided a positive introduction to autopsy pathology, (2) reinforced the role of pathology in medicine, and (3) provided concrete examples of core EPA within pathology for students in preclinical years.

**APC-18-0033PO. Incorporating Hematology Quiz Application in Hematology Education**

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**Abstract**

Medical students and other trainees are continuously in search of assessment tools to improve their collective educational experience. Digital online quiz banks in particular are popular assessment tools but are mostly provided by nonexperts or those in private industry, which can render them less accurate. Additionally, many students prefer that these assessment tools be on mobile platforms, which poses additional challenges. To address these issues, we have developed a mobile hematology quiz bank application edited by experts in hematology. This new application allows medical students and residents to assess their medical knowledge in a user-friendly digital environment throughout medical school and beyond. **Objectives:** At the University of California at Davis School of Medicine, we have developed a quiz bank application containing hundreds of questions on various topics in non-neoplastic hematology, neoplastic hematology, molecular hematology, and transfusion medicine. This quiz bank is now available to resident and fellow trainees as well as medical students. As an adjunct to our regular teaching sessions on hematology, the quiz bank provides the opportunity for self-assessment while also allowing the learner to compete or compare scores with a peer at the end of the session through its game center feature. **Methods:** This native application is built with Objective-C and X-code. Hence, it is only available on the iOS platform (iPhone and iPad). **Results:** This quiz bank provides hundreds of hematology and hematopathology multiple-choice questions with full answer explanations. The questions are separated into 17 hematology categories, including normal hematopoiesis, anemias, hemoglobin disorders, coagulation, clotting and bleeding disorders, acute myeloid leukemias, B- and T-ALLs, myeloproliferative neoplasms, myelodysplastic syndrome, B-cell and T-cell non-Hodgkin lymphomas, plasma cell neoplasms, Hodgkin lymphomas, molecular hematology, and transfusion medicine. The questions in each
category are written and edited by content experts from various institutions of higher learning. Colorful microscopic pictures and illustrations are incorporated into many questions. Additionally, randomization ensures that each question and the respective answer choices will be presented in a different order with each new session. This will minimize memorization recall by the user and will reinforce learning based on true knowledge retention. After each question is answered, full answer explanations are provided for both correct and incorrect answer choices. This application also incorporates game center capability to allow students to compete against their peers and compare scores, resulting in a more enjoyable user experience. Conclusion: Question banks that utilize technological advances give medical students the flexibility of self-assessment at their convenience and help with learning and knowledge retention throughout all 4 years of medical school and beyond. We anticipate that the use of this quiz bank will continue to grow, thereby facilitating learning for our medical students and other trainees, and we plan to expand testing to include other pathology subjects with the same platform.

**APC-18-0034PU. Microscopic Examination of Lesions Discovered in Anatomy Lab: Fostering Medical Students’ Interest in Pathology**

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**Objectives:** In recent years, there has been a downward trend in interest among medical students in pursuing careers in pathology. In 2015, a program was developed at the University of Alabama at Birmingham (UAB), which aimed to expose first-year medical students to the medical specialty of pathology by giving them the opportunity to “biopsy” and subsequently microscopically examine lesions they discovered during cadaver dissections. Groups of students were encouraged to integrate cadaver’s clinical histories, gross findings, and microscopic findings and presented correlations with the rest of the class in oral presentations in a formal classroom setting. The purposes of this presentation are to share our experience integrating this project into a traditional dissection curriculum, consider students’ evaluations of the activity, and consider the potential positive impact educators can have on early pathology education. **Methods:** Samples were obtained during the thoracic and abdominal cavity dissection laboratory sessions of the fundamentals course. A pathologist and course instructor were available for consultation for medical students regarding which tissues may be useful and educational to sample and view microscopically. Standard tissue processing was performed, and tissues were placed on slides and scanned for virtual microscopic viewing. Groups orally presented their findings to the rest of the class. Students were surveyed after the activity. **Results:** Tissue was obtained from a total of 19 cadavers. Ninety-two percent of students indicated that microscopic examination of lesions helped emphasize the basic mechanisms involved in the development of those lesions. Eighty-two percent of students indicated that microscopic examination of lesions helped them better understand the pathologists’ role in patient management. Eighty percent of students recommended making microscopic evaluation of lesions a routine part of the dissection course. Twelve percent of students indicated they might consider pursuing a pathology residency as a result of some of their experiences in the course. **Conclusions:** Integration of biopsies into medical students’ dissection curriculum can be a useful way to expose medical students, at an early time in their training, to pathology and how the pathologist is integrated into the health-care system. Nonetheless, there are some practical challenges that must be considered anytime a new activity is introduced into a curriculum. Starting in 2017, this project was fully integrated into the first-year fundamentals curriculum as a participation component, and all groups were required to take biopsies and do 15-minute oral presentations. This project was funded by the UAB Faculty Development Grant Program.

**APC-18-0035PC. Case-Based Asynchronous Interactive Modules in Undergraduate Medical Education**

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**Objectives:** Undergraduate medical education is evolving toward non-lecture-based integrated curriculums. Although this provides students with repeated exposure to pathology in a clinical context, it requires collaborative curriculum design with a focus on new educational technology. At Thomas Jefferson University, the Pathology and Obstetrics/Gynecology (ObGyn) departments are collaborating to pilot a series of case-based asynchronous interactive modules (AIMs) to teach gynecologic pathology in a clinical context, interweaving other educational components, such as evidence-based medicine, clinical skills, and basic sciences. Case-based modules highlight principles of pathology and the role of pathologists. In this study, we used a case-based AIM to teach pathology to third-year medical (MS3) students during their ObGyn clerkship. **Methods:** An AIM was coded by the ObGyn and pathology clerkship directors to simulate 4 colposcopy clinic patients. The AIM was presented to MS3 students midway through their ObGyn clerkship. Students interpreted histologic and clinical images while being evaluated on clinical management skills, gynecologic diagnoses, general principles of population health,
and pathology throughout the AIM. The students also completed a 7-question pre-and posttest which had no bearing on the students’ course grade. Commentative learner feedback was also solicited. **Results:** One hundred thirty-nine students from 5 blocks did the pretest, of which 68 students from 3 blocks completed a posttest with the following scores: Block 1—6.30 (pre, 90.90%) to 6.67 (post, 95.29%); block 3—6.13 (pre, 87.57%) to 6.40 (post, 91.43%), and block 4—5.44 (pre, 77.71%) to 5.99 (post, 85.87%). The average score increased by 5.7%. Learner feedback was positive, with suggestions to apply this method to other medical specialties, particularly radiology. **Conclusions:** Asynchronous interactive modules are an efficacious and popular method of pathology education. All participants showed improvement in interpreting history and physicals, lab data, and gynecologic pathology findings in routine clinical scenarios as well as improved case-based decision-making. Future directions include collaborating with other departments to create modules that help teach and contextualize the role of both pathologists and principles of pathology in clinical decision-making.

**APC-18-0036PU. Teaching Pathology From Human Gifts Registry Donations: An Innovative Approach**

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**Objectives:** To evaluate the feasibility and perceived value of integrating pathology into gross anatomy. **Methods:** Study cohort was 18 dissection teams each with 8 to 9 preclinical medical students. Selected pathologic abnormalities (n = 8) were reviewed, discussed side-by-side, and sampled for routine histology processing. H&E tissue sections were digitized. The images, relevant normal histology, and differential diagnostic entities were presented and discussed with the team. The pathology correlations were posted to the schools’ learning management system with tracking of student views (hits). An end of course evaluation (Likert scale 5) with narrative comments was obtained. **Results:** (1) Embalmed cadaveric tissue was suitable for processing and evaluation. (2) Student satisfaction was highly favorable—average score of 4.42 (±1.00); overall course average score 3.81 (±1.01). (3) There were 47 student hits to review the posted material. (4) Student comments included “For the purposes of teaching future doctors to understand disease pathology much better, it is a great idea; I did not get much time with Dr X in the lab, but I did review his pathology correlations posted on UB Learns and I think more like this would definitely be helpful; to me, this seems like the best way to learn both subjects. Synthesis of the two of them, at the same time (even if it requires a longer course) would not only improve performance in both disciplines but would result in a more complete understanding of both going forward as well.” **Conclusions:** Review of cadaver pathology begins to integrate pathology with clinical medicine. Minimal knowledge of pathology did not limit the educational value nor reduce student satisfaction. Inclusion of all dissection groups with photographic documentation of the abnormalities and presentation of the findings as a “case of the week” would enhance the educational value. A student-prepared final anatomic diagnosis could be required to confirm or refute the cause of death as recorded on the death certificate.

**APC-18-0037PO. Use of Online Tools in Improving Medical Student and Resident Education in Anatomic Pathology**

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**Background:** Medical students, residents, and fellows are exposed to a wide expanse of medical knowledge every day, which can be challenging for them to synthesize and apply. One means of encouraging knowledge retention in trainees is through the provision of question banks. Given the preferences of our current generation of trainees, technological tools in the form of applications or “apps” on smart phones and tablets are highly convenient and portable, and as such are often used. At the University of California at Davis School of Medicine, we have developed an application that contains questions on various subspecialties in anatomic pathology. This application allows medical students, residents, and fellows to evaluate their own knowledge base, identify areas for improvement, and compare personal performance with that of their peers. **Objectives:** We have developed a new anatomic pathology question bank application for medical students and residents at the University of California at Davis School of Medicine. This application serves as a self-assessment tool for the trainees and helps them identify and correct knowledge gaps through use of the provided answer explanations. **Methods:** This native application is built with Objective-C and X-code. Hence, it is only available on the iOS platform (iPhone and iPad). **Results:** Experts in different areas of anatomic pathology (eg, gastrointestinal and liver pathology, renal pathology, bone and soft tissue pathology, etc) have crafted numerous multiple-choice questions on each topic. Gross and microscopic images are incorporated into some questions. An explanation for correct and incorrect answers is provided at the end, accompanied by a score. Peer review of the questions, answers, and answer explanations is performed to ensure content accuracy. Application users can elect to answer questions by topic or by randomization and can compare scores with their peers. **Conclusion:** Technological tools can be incorporated in medical student and resident education to improve and enhance their learning experience and self-assessment.
Background: In 2015, the University of Pittsburgh Medical Center, Department of Pathology began offering medical students performing pathology research during the summer between first and second year of medical school the opportunity to participate in pathology-specific clinical enrichment activities. We named the new initiative Summer Training Experiences in Pathology for Medical Students (STEPS) and developed it with the intention of augmenting students’ limited exposure to the discipline of pathology afforded during medical school training at the University of Pittsburgh. Methods: Pathology education at our institution consists of a 2-week introductory course during the first-year basic science core, while organ-specific pathology is taught during the organ systems courses which extend from the end of the first year through the second year. Summer Training Experiences in Pathology for Medical Students are composed of 8 unique pathology-centric clinical offerings held weekly over the course of the 8-week summer research fellowship. Each STEPS activity lasts up to 3 hours and typically occurs on Monday morning. The offerings include participating in an autopsy, practicing fine needle aspirations, exploring molecular testing, rounding with the blood bank attending, performing a point-of-care testing exercise, attending an unknown slide conference, observing slide preparation in the histology lab, and learning about intraoperative consultation. Results: From 2015 to 2017, 13 students participated in the STEPS program. We reviewed anonymized student responses to a University of Pittsburgh IRB-approved survey of the STEPS program and found that all students responding to the survey (9/9) agreed that participating in the STEPS program was enjoyable and beneficial to their medical education. All respondents (9/9) agreed that participating in the STEPS program did not interfere with their ability to conduct research during the summer fellowship. The majority of respondents (8/9) agreed that participating in the STEPS program made them feel better equipped to contact a pathologist to discuss a patient or specimen issue in the future. Students described the best features of the STEPS activities to be “the hands-on chance to actually see what a pathologist does,” “getting an up close and personal view of pathology with residents and attendings,” “participating in the personalized medicine session,” and “the opportunity to assist in an autopsy,” among others. Areas of improvement to be considered include altering the day and time of STEPS activities (as Monday morning happened to coincide with some research lab meetings) and providing parking for those students who travel to the hospital from distant research labs to participate. Conclusion: The STEPS program offers early career medical students performing summer research in pathology a variety of opportunities to interface with pathologists and actively engage in activities related to clinical pathology practice. One benefit of participating in this program, among several, may be to increase the comfort level of the medical student to interact with pathologists and pathology laboratories in the care and management of their future patients.

APC-18-0039PU. Pathology Education in an Integrated Medical School Curriculum: The UCSF Bridges Experience

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Objectives: In 2017, UCSF implemented Bridges, a 4-year MD curriculum with 3 phases: foundations 1 (F1, pre-clerkship), foundations 2 (F2, clerkship), and career launch (advanced studies). We describe our strategies for integrating pathology content in this curriculum; the emphasis is on clinico-pathologic correlation in F1, guidance on utilization of diagnostic pathology services in F2, deep exploration of diagnostic pathology in career launch, and career advising throughout. Methods: As UCSF pathology co-stewards, the two of us communicate closely about all aspects of UME teaching and are members of the leadership team for each block, a necessary step for success in overhauling pathology curricula. The F1 pathology curriculum has been significantly restructured, with faculty- and fellow-facilitated small-group discussion sessions used as the main teaching modality in all blocks. Additional F1 teaching methods include classroom lectures, online learning resources (such as prerecorded lectures and annotated self-study modules), and gross specimen review labs. For F2, we developed 2 new elements—the pathology portion of the longitudinal course “Appropriate Use of Diagnostic Tests” and a 2-week introductory pathology elective; in Career Launch, we offer the 2- and 4-week advanced pathology electives. The two of us write all pathology assessments for Bridges, including required weekly checkpoints; we also grade all pathology questions on block exams, which in this curriculum consist exclusively of open-ended questions that require knowledge application. Results: To evaluate the success of the redesigned pathology curriculum, we plan to use several independent quantitative measures including (1) student evaluations of small-group facilitators, (2) facilitator evaluations of the teaching experience and materials, (3) enrollment in the career launch electives (also available in the prior curriculum, enabling direct comparison), (4) performance on USMLE step 1, which is scheduled post-F2 for Bridges students, and (5)
performance on the annual graduation questionnaire. As Bridges was implemented only 1.5 years ago, data collection has just begun; however, our experience already underscores the value of close teaching oversight by pathology education leaders. **Conclusions:** Curricular reform can result in positive changes for pathology teaching in the modern training environment. Pathologists are key stakeholders in the design and implementation of new programs, and leveraging the clinical and diagnostic aspects of pathology in teaching facilitates a positive outcome in student and physician perception of our field.

**APC-18-0040PU. Core EPAs in Basic Science Courses: An Important Role for Pathology**

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**Background:** Many medical schools have begun to utilize some of the core EPAs for entering residency, developed by the AAMC, as a framework for their medical school competencies or outcomes. The EPAs were developed for a clinical context and most are being evaluated in the clinical years of medical school. However, the medical knowledge essential for many of the core EPAs is learned in the basic science courses. **Methods:** We have developed an online system for providing formative feedback to medical students during the second-year pathology teaching for two of the core EPAs: EPA 2 (develop a prioritized differential diagnosis and select a working diagnosis) and EPA 3 (recommend and interpret common diagnostic and screening tests). Our online system charts levels of achievement and also allows students to do self-evaluations to compare to the faculty evaluation. **Results:** In an initial pilot, students have been excited to understand how the case-based pathology teaching sessions allow them to become better prepared for their clinical rotations and to realize the value of informed selection of laboratory tests. **Conclusion:** We will present our preliminary data in our presentation and emphasize how pathologists can directly demonstrate the value of informed selection of laboratory tests.

**APC-18-0041PU. Using Virtual Images From BEST Network to Integrate Pathology and Immunology in Teaching M1 Foundation Science Module**

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**Objectives:** At Eastern Virginia Medical School, innovative digital tools and virtual images are being used to teach immunology with histopathological context to engage the first-year medical students. The purpose of this study is to demonstrate the effectiveness of these technology tools in their learning. **Methods:** The basic concepts of immunology—the innate and adaptive immunity—are taught in the foundation science (FS) module II module of the M1 curriculum. An interactive learning session with the integration of immunology concepts with pathological examples (pneumonia and lymph node hyperplasia) was developed by using an adaptive e-learning platform (smartsparrow.com) and high-resolution virtual images from Slice digital database of Biomedical Education Skills and Training (BEST) Network. The students were engaged in a live demonstration by a tutor, problem-solving exercises, and discussion in small groups. A survey questionnaire to assess the students’ perception was deployed at the end of the FS-II module. **Results:** Forty students out of 117 students enrolled in the course (34% participation rate) and completed a survey questionnaire. Ninety percent of the respondents either agreed or strongly agreed that designed interactive session was interesting and engaging. Eighty-eight percent of the respondents felt that it was valuable to their understanding of concepts. Eighty-five percent wanted more lessons in a similar format. Sixty-four percent felt that it was easy to navigate the lesson in the adaptive learning platform. The exam data for the FS-II module during 2016 and 2017 were compared, which showed no statistically significant change in grades. The comments from students indicated that it was a helpful activity, appropriate for first-year medical students, consolidated their knowledge, and enhanced their understanding of complex concepts. **Conclusions:** With a number of institutions moving toward integrated curriculum, educators often struggle to provide clinical relevance and pathological correlations while teaching basic sciences. The BEST network has a database of over 20,000 macroscopic and microscopic images in partnership with leading institutions across Australia and the United States. Our results showed that the virtual images with annotations from BEST network are an effective tool to engage medical students and promote active learning.

**APC-18-0042PU. Multidisciplinary Electives for Medical Students: The View of Pathology Departments in Large Metropolitan Areas**

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**Objectives:** One approach for exposing medical students to the field of pathology and to the meaning of being a pathologist is
to provide a combined elective in which the pathology department formally pairs up with a clinical service. The student thus might “follow the specimen” in a structured manner, for example, witnessing the processing and analysis of a lesion surgically removed from a patient who the student had followed at the bedside or in the radiology suite during preceding days. Although some senior pathologists attest that such multidisciplinary electives were usefully offered in decades past, it is unclear how commonly they are offered in the present training landscape and it is unknown how enthusiastically such joint ventures might be embraced by more recently hired pathologists in the teaching arena. Methods: In order to examine these questions in 1 selected setting—the academic training program in the major metropolitan area—we distributed surveys seeking the views of directorship-level pathologist teachers working in the 25 largest metropolitan areas in the United States (cities that together hold over 40% of the nation’s population). Pathologist educators from multiple cities in each of the 5 major national regions responded to the survey. Results: The survey results reveal a striking incongruity, namely that although more than 70 percent of respondents ranked such electives highly (“excellent” or “good” both for teaching about pathology department activities and for raising awareness of pathology as a career option), less than 25% of respondents reported that their department presently offers such an elective. Conclusions: If multidisciplinary electives are as promising for student enlightenment as our survey estimates suggest, then there is clearly ground for expanding such offerings nationwide.