The following abstracts were accepted by the Association of Pathology Chairs, without modification, for poster presentation at the 2019 APC Annual Meeting. This content was not peer reviewed by Academic Pathology.

Presenting authors’ names are bolded throughout.

**APC-19-0001PO. Measuring Physician Burnout in Pathology and a Proposal to Combat It**

R. Jug¹, P. Pittman¹, J. Browning¹, L. Havrilla¹, A. Buckley¹, and T. Cummings¹

¹Department of Pathology, Duke University Medical Center, Durham, NC, USA

**Objectives:** Over the past 5 years, there has been a downward trend in US and international medical graduate pathology applications. In a 2017 Medscape survey of 19,270 physicians across 27+ specialties, pathologists were the least likely to choose medicine and the same specialty again. This survey also revealed a significant proportion of pathologists self-identified as burnt out and the severity of pathologist burnout was fourth highest among physicians surveyed. In light of this published data, the aim of our study is to measure the current state of burnout in our department’s pathologists and to assess the learning environment of pathology trainees. Furthermore, we will address burnout prevention and mitigation through our proposal for a Patient Centered Pathology Program (PCP).

**Methods:** Following IRB approval, an anonymous survey based on the Accreditation Council for Graduate Medical Education Back to the Bedside Survey (BTBS) was distributed to Pathology attendings, residents, and fellows by e-mail. The survey included questions to measure burnout (mild, moderate, and severe), meaningful work (positive, neutral, and negative), vitality (high vitality, neutral, and indolence), and trainee learning environment (supportive, neutral, and contradictory). Pathologist physicians voluntarily participated in PCP by scheduling appointments with patients interested in reviewing their slides and learning more about their diagnoses. After the consultation, the physician administered an anonymous Patient Experience Questionnaire (PEQ) to patients. All survey data were collected and stored securely in a REDCap database. Statistical analysis was performed using Microsoft Excel (2010; Microsoft Corporation).
Redmond, Washington). **Results:** Fifteen (of 69 invited) attendings (5%) and residents (10) responded to the BTBS and 3 patients responded to the PEQ. Overall, 53% of respondents reported moderate burnout. Severe burnout was higher in attendings (20%) than trainees (0%). The majority of pathologists reported positive meaning (93%) and high vitality (73%) from their work. Ninety percent of trainees rated the learning environment as supportive. One hundred percent of PEQ respondents completely agreed that meeting their pathologist resulted in a better understanding of the role of pathologists, improved their overall health-care experience, and that they would recommend PCP to other patients. **Conclusions:** The majority of pathologist respondents reported a moderate level of burnout necessitating intervention to improve resiliency in our profession. High levels of meaning and vitality reported by pathologists reveal potential sources of career satisfaction to harness as a means of alleviating burnout. Given the positive patient feedback on the PCP program, we hope it may help improve patients’ health-care experiences while enhancing pathologist-job satisfaction and resiliency through increased recognition of job meaningfulness and reinvigorating career vitality. We anticipate pathology trainees in this supportive learning environment will be empowered to participate in and benefit from PCP.

**APC-19-0002PO. Cross-Residency Radiologic-Pathologic Correlation Curriculum: Teaching Interpretation of Specimen Radiographs to Pathology Residents by Radiology Residents**

M. S. DeSimone¹, A. K. DeSimone², J. E. Brock¹, and S. Matalon²

¹Department of Pathology, Brigham and Women’s Hospital, Boston, MA, USA
²Department of Radiology, Brigham and Women’s Hospital, Boston, MA, USA

**Objectives:** The College of American Pathologists requires pathology residents to attain competency in “Radiologic Pathologic Correlation,” including correlation of radiographic information with histopathologic findings. This training was not formalized in our institution, therefore, we sought to establish a curriculum in the interpretation of specimen radiographs by pathologists. To achieve this, we developed a cross-residency educational initiative bringing together radiology and pathology residents. The main goals of this new curriculum are for pathology residents to learn basic skills in radiologic-pathologic correlation of surgical specimens with preoperative imaging and specimen radiographs and to gain confidence in obtaining and interpreting specimen radiographs. **Methods:** Didactic sessions on the interpretation of specimen radiographs were prepared by 3 pairs of radiology and pathology residents with mentorship provided by radiology and pathology attendings in the following subspecialty areas: breast, head, and neck, and bone and soft tissue. The didactic sessions were held in October 2018. Before and after the sessions, pathology residents completed a survey to assess perceived utility of the curriculum, confidence in their skills of interpretation of specimen radiographs, and understanding of the need for communication with radiologists. Pathology residents also completed a practical assessment of their radiologic-pathologic correlation skills in interpreting unknown specimen radiographs. These quizzes were blindly evaluated by both an attending radiologist and pathologist. **Results:** The primary end point is improved accuracy in the interpretation of specimen radiographs in organ-specific areas and correlation with histological findings in pathology specimens, and improved understanding of their clinical relevance. The secondary end points include improved self-reported confidence in the interpretation of specimen radiographs, increased utilization of radiographs in specimen evaluation, and greater appreciation of the importance of radiologic-pathologic correlation for crafting a final pathology report. **Conclusions:** Competency of skills in “Radiologic Pathologic Correlation” can be achieved by developing a cross-residency educational initiative that utilizes radiology resident skills to teach pathology residents. Survey results and quiz performance will be analyzed to determine the effectiveness of the curriculum. Once proven effective, the program developed will serve as the foundation for future training of pathologists to meet this benchmark. **References:** College of American Pathologists (2016). Competency Model for Pathologists. Accessed January 15, 2018. http://appsuite.cap.org/appsuite/learning/CompModel/Competency_Model.pdf?_ga=2.48293733.2145709169.1543192318-1477840578.1543192318. **Note:** This abstract was accepted for presentation at the USCAP Annual Meeting 2019.

**APC-19-0003PO. Better Together: A Combined Pathology Clinical Competency Committee Structure**

E. G. Brooks¹, R. C. Corliss¹, S. A. Gross¹, D. T. Yang¹, W. N. Rose¹, and S. M. Selvaggi¹

¹Department of Pathology and Laboratory Medicine, University of Wisconsin Hospital and Clinics, Madison, WI, USA

**Objectives:** All ACGME-accredited programs are required to establish clinical competency committees (CCCs) charged with assessing resident/fellow evaluations semiannually and determining milestone competence. There is significant heterogeneity in CCC structure with limited evidence to support best practices, however. To date the potential advantages of a CCC structure in which the core pathology residency and fellowship CCCs are combined has not been reported. **Methods:** Our pathology residency and fellowship directors elected to form a combined CCC with 15 members. There are ≥3 core faculty from each of our 3 ACGME-accredited fellowships on this
CCC which meets twice annually. Prework is assigned in advance of the meeting. Faculty are divided into 4 teams, which are each responsible for reviewing a single PGY class of residents and up to 1 fellow. In addition to faculty end-of-rotation assessments, other data is provided for CCC teams to factor into their assessment (eg, exam scores, 360° and self-evaluations, scholarly activity, QI projects). The teams synthesize the data, assign milestone subcompetency levels, and generate a summary performance comment as well as an individualized learning plan (ILP) for each trainee. At the meeting, each team presents their findings. A short discussion typically ensues which may result in adjustments to the comment, ILP, or milestone levels. A portion of each meeting is devoted to educational issues pertaining to residency/fellowship programs. As per Pathology Review Committee recommendations, a separate set of minutes is generated for each fellowship as well as the core residency program. Results: This approach has reduced administrative burden as our single program coordinator would otherwise have had to annually schedule 8 separate CCC meetings (vs 2). It has also helped mitigate faculty burnout for those who “cross-over” as both residency and fellowship CCC members and has helped us to maintain a diverse array of CCC faculty, thereby increasing our ability to provide comprehensive trainee evaluation. This slightly larger CCC size improved our ability to better assign teams to the PGY class with whom they have most contact. Consistently correlating the same PGY group and team each year, facilitates development of a “shared mental model” of the milestone levels appropriate for their group of learners. One other advantage of the combined CCC is that it provides opportunity for semi-regular collaboration between core residency and fellowship directors on educational initiatives and compliance matters pertinent to both. Conclusions: While the combined approach might not work for larger residencies or programs that are primarily fellow-driven, smaller to medium-sized pathology residency programs with fewer fellows may find that unifying the core residency and fellowship CCC’s into a single team significantly reduces administrative burden, provides for a more robust CCC team composition, improves feedback and team internal consistency, and affords greater opportunity for residency and fellowship directors to collaborate on educational initiatives.

APC-19-0004PO. Predictors of Interviewing and Matching at Our Residency Program: A Review of More Than Two Thousand Applications

S. G. Beal1, A. T. Yachnis1, and J. L. Kresak1
1University of Florida College of Medicine, Gainesville, FL, USA

Objectives: Reviewing Pathology residency applications is a yearly activity for program directors. Understanding trends regarding which applicants interview and match could be helpful in forming an application review strategy. Methods: We downloaded and analyzed all applications submitted to our residency program from the past 4 years (2015-2018) from ERAS. Our residency program is located in the southeast and matches 4 residents per year. Results: A total of 2039 applications were reviewed. We invited 235 (11.5%) candidates to interview. The average USMLE Step 1 and Step 2 Clinical Knowledge scores were 228.7 (n = 222) and 239.6 (n = 215) for invited candidates versus 219.2 (n = 1763) and 224.7 (n = 1720) for noninvited candidates. The average COMLEX Level 1 and Level 2 Cognitive Evaluation scores were 559.9 (n = 43) and 587.2 (n = 43) for invited candidates versus 495.2 (n = 46) and 507.6 (n = 44) for noninvited candidates. Average years since medical school graduation (at the time of match day) were 1.1 for invited candidates and 7.8 for noninvited candidates. Previous medical training was listed for 7.7% of invited candidates compared with 40.5% of noninvited candidates; 60.9% of invited candidates (n = 143) interviewed at our program (the rest declined or canceled the interview). US Citizens/Permanent residents comprised 208 of the 235 invited candidates; 51.6% (n = 120) of these candidates interviewed versus 85.2% (n = 23) of invited non-US citizens/permanent residents (n = 27) interviewed. A total of 296 applicants listed their permanent or contact state as our state or the neighboring 3 states; we invited 83 (28%) to interview and 66 (80%) came. We matched and matriculated 16 residents over the 4 years in this study. Their average Step 1 and 2 scores were 234.6 and 243.2 (n = 14) and Level 1 and 2 scores were 588 and 583.3 (n = 3). Eleven were from our region. Of note, although couples match participants accounted for only 2.4% of the entire applicant pool, they comprised 37.5% (n = 6) of our matched residents. Conclusions: Although applications to our program have remained relatively stable, since more medical students graduate each year, this actually represents a decrease in relative amount of medical students choosing to specialize in Pathology. We were more likely to invite candidates to interview who were current 4th year USA/Canadian medical students, had higher standardized exam scores, and were from our region. Our program matches a high proportion of couples match participants. Knowledge of these factors could help us refine our application review process.

APC-19-0005PO. Improving Patient Safety by Reducing Mislabeled Surgical Specimens—A Multidisciplinary Approach

J. Hagen1, P. Amaro1, R. Tassinari1, J. Ellis1, M. Galan1, J. Perkins1, L. Pinkston1, C. Schmidt1, J. Street1, S. Ruiz1, and X. F. Zhao1,2
1VA Phoenix Healthcare System, Phoenix, AZ, USA
2University of Arizona College of Medicine Phoenix, Phoenix, AZ, USA

Objectives: Patient safety is the utmost concern of every health-care system and preventing patient misidentification is central to reducing avoidable harm. Chronic anatomic
specimen mislabeling and mishandling events were recognized as a significant patient safety issue in the 2016 electronic Patient Event Report and continue to rise each year despite prevention efforts. **Methods:** To improve patient safety at our facility, the Pathology and Laboratory Medicine Service developed an internal protocol to correct the mislabeling of surgical specimens. This consisted of identification of discrepancies between specimen requisition forms and specimen labels, contacting providers to correct any mislabels at the Histology Lab, documentation of corrections, and retraining of the providers for correct labeling by the Lab. **Results:** After implementing this measure, occurrence of mislabeled specimens dropped from 0.5%-0.7% to 0.1%-0.2% and turnaround time decreased significantly as a result. As our goal is to prevent all mislabeling, our QA manager assembled a multidisciplinary work group consisting of the patient safety officer, clinical service nurse manager, QA manager, courier supervisor, and histology supervisor to perform root cause analysis applying the six sigma principles. We found that specimens were batched for transport, labeling nomenclature varied from provider to provider within a service, the facility policies were written by laboratorians and poorly understood by clinicians, inadequate printers in mission critical areas to ensure a computer-generated label was used. To improve the quality of received specimens, we installed education sessions for the providers, revised the Policy Memorandum to require fresh specimens being delivered within 1 hour of resection, communicated with the escort service to eliminate specimen batching, and reminded nurses to check requisition forms and specimen labels with the submitting physicians before transportation. We continued requiring submitting providers correct any mislabels and inconsistencies at the Histology Lab. Because of these additional changes, the mislabeled specimens dropped further down to below 0.1%, an almost 90% reduction in noncompliance. This streamlined process greatly decreased the holding time for mislabeled specimens and prevented later errors in diagnosis. **Conclusions:** Our work suggests a multidisciplinary approach was very effective in preventing incorrect labeling of surgical specimens, reducing diagnostic errors and turnaround time and ultimately improving patient safety.

**APC-19-0006PO. Utility of Artificial Intelligence (AI)/Machine Learning (ML) in Identifying Acute Leukemia, Chronic Lymphocytic Leukemia, and Chronic Myeloid Leukemia in Peripheral Blood Smears**

E. Vali Betts¹, Denis Dwyre¹, Nam Ku¹, John P. Graff¹, and H. Rashidi¹

¹University of California, Davis, Sacramento, CA, USA

**Objective:** To develop a machine learning model through deep learning that could identify and differentiate acute leukemia, chronic lymphocytic leukemia, and chronic myeloid leukemia from nonneoplastic entities in peripheral blood smears. **Methods:** Multiple ML models were built through a transfer learning approach on 2 distinct deep neural networks (ResNet50 and SqueezeNet) on the Turi Create library for distinguishing acute leukemia, chronic lymphocytic leukemia (CLL), chronic myeloid leukemia (CML) from those with no evidence of neoplastic process on peripheral blood smears. These deidentified cases were treated as unknowns and reassessed by 2 boarded hematopathologists who then categorized each into the abovementioned categories prior to the training phase. The training set utilized 40 slides (10 acute leukemias, 10 CLLs, 10 CMLs, and 10 patients with no evidence of leukemia/lymphoma) to generate 2000 images which consisted of 500 acute leukemia images, 500 CLL images, 500 CML images, and 500 images with no evidence of leukemia/lymphoma to train various models on the aforementioned ML platform. The combined images noted above included 1000 at ×20 magnification and 1000 at ×40 magnification proportionately within each category. The performance parameter of the models was then assessed through their accuracy scores. **Results:** Overall, the models tested on the validation accuracy test set showed >90% accuracy. However, the preliminary results of our study demonstrate a difference in the accuracy of each model based on the corresponding platform. Models generated on the ResNet50 deep neural network were shown to be slightly more accurate (>95%) in distinguishing the abovementioned entities from their nonneoplastic counterparts when compared to the SqueezeNet neural network-trained models which were >90%. **Conclusions:** Our hematopathology ML models are capable of distinguishing acute leukemia, chronic lymphocytic leukemia, and chronic myeloid leukemia from those with no evidence of leukemia with a high degree of accuracy. These models can be deployed on user friendly Apps and help triage peripheral blood smears in underserved areas that are devoid of pathology expertise.

**APC-19-0007PO. An Integrated Approach to Clinical Pathology Training**

C. Crutchfield¹, C. Egbert¹, C. Stefaniuk¹, K. Stringer¹, and D. Zander¹

¹University of Cincinnati College of Medicine, Cincinnati, OH, USA

**Objectives:** Conventional pathology residency programs separate exposure to the core clinical pathology subspecialties into independent rotations. The model of subspecialty separation has recently been applied to surgical pathology training, where it has been suggested to be the preferred modality by resident trainees. However, the infrastructural constraints that apply to clinical pathology training differ relative to anatomic pathology. A segregated approach to clinical pathology training, particularly in small training programs, limits resident availability to provide contiguous and effective laboratory medicine consultation services. An integrated 52-week cohort-based approach would increase resident exposure to the
low-frequency consultation events that form an integral component of laboratory management as well as offer a dynamic learning opportunity that fosters resident engagement and interest in the practice of clinical pathology. This is particularly relevant given the anticipated shortage of physician laboratory directors in clinical pathology. **Methods:** We propose a training model deemed that harmonizes the majority of clinical pathology subspecialties (clinical chemistry, microbiology, and hematology in addition molecular pathology, coagulation, and laboratory management). Residents progress in a rotation, “Diagnostic and Laboratory Management,” in concert with their peer residents over the course of 4 years (with a total exposure of 52 weeks divided into 5 blocks). Residents share the responsibility of assisting with professional review of clinical laboratory tests as well as covering a laboratory medicine consultation service. Consultations and relevant case reports are summarized in weekly “DLM Rounds.” Residents attend weekly administrative meetings including physicians, PhD scientists, laboratory administrators, and technical staff. **Results:** The Pathology Residency Training Program at the University of Cincinnati initiated its inaugural “Diagnostic and Laboratory Management” rotation in July 2018. Qualitative descriptions by faculty and residents suggest a preference for integration of clinical pathology subspecialties relative to segregation. Future assessment of outcomes including RISE and Board performance, and resident career choices is planned. **Conclusions:** An integrated approach to clinical pathology training may enhance resident competency and service quality. Adoption and assessment of this model by other small residency training programs may provide sufficient objective evidence to shift the paradigm of clinical pathology training and help direct more qualified pathologists to pursue careers in clinical pathology.

**APC-19-0008PO. Residency Program Reputational Rankings: How Closely Do They Correlate With Institutional Rankings?**

**J. V. Fischer, L. M. Schiffhauer, C. Whitney-Miller**

**Methods:** Data were obtained from Doximity’s 2018-19 RN for 13 specialties (pathology, radiology, surgery, IM, OB/GYN, anesthesiology, EM, radiation oncology, neurology, urology, neurosurgery, psychiatry, and dermatology) and from US News rank lists for Best Hospitals 2018-19 (Honor Roll and Cancer care) and Best Medical Schools 2019 (Research and Primary Care). Correlation analysis was performed between pathology residency program reputation, medical school ranking, hospital ranking/raw score, hospital cancer ranking/score, and residency program reputation of 12 other specialties. The Benjamini-Hochberg procedure was used to adjust for multiple comparisons. **Results:** Residency rankings had a stronger correlation with medical school research rankings than with hospital rankings. Radiology had the strongest correlation with medical school research rank \((r = 0.76)\) and EM had the weakest \((r = 0.18)\), with pathology ranking fifth \((r = 0.67)\). Pathology had the strongest correlation with hospital raw score \((r = -0.47)\) though this did not reach statistical significance; OB/GYN had the weakest correlation \((r = -0.064)\). Anesthesiology had the strongest correlation with cancer score \((r = -0.68)\) and EM had the weakest \((r = -0.13)\), with pathology ranking 10th \((r = -0.54)\). Among the top 50 pathology programs, there was a significant correlation between pathology reputation rank and that of all other examined specialties, except EM. **Conclusions:** Residency Navigator’s pathology residency reputation rank was significantly correlated with the US News rankings for cancer care (rank and score) and medical schools (research rank) and showed the strongest correlation with hospital raw score and rank among the specialties included. Pathology residency reputation was significantly correlated with the reputation of all other examined specialties, except EM, indicating that specialty reputations within the same institution tend to covary.

**APC-19-0010PO. Lab Rounds: Combining Elements of Ward Rounds With TeamSTEPPS Safety Practices in the Gross Room**

**L. M. Schiffhauer, A. R. Huber, and C. Whitney-Miller**

**Objectives:** While developing subspecialty rotations in surgical pathology, an interprofessional working group at the University of Rochester identified a need for increased communication in the gross room due to a large volume of surgical specimens, a large number of team members and recognition that poor communication is often a root cause of adverse and sentinel patient events. The group developed a method for daily communication based on the longstanding practice of patient care (ward) rounds. Traditional ward rounds were adapted for the laboratory setting and salient features of TeamSTEPPS were incorporated into a method of communication dubbed Lab Rounds. Here, we describe the practice of lab rounds in the laboratory setting and salient features of TeamSTEPPS.
A large university hospital with over 85,000 surgical pathology accessions per year. **Methods:** A process for interprofessional communication in the surgical pathology gross room was developed and implemented at Strong Memorial Hospital in 2009 by a working group composed of resident representatives, a pathology assistant and a faculty member (FM) advisor. In 2018, after relatively few changes to the practice of lab rounds, a satisfaction survey was sent to current residents, surgical pathology faculty, and pathologists assistants. **Results:** The interprofessional team that meets in surgical pathology, daily, for this brief 15 minute lab rounds huddle usually consists of 3 to 4 residents, each representing a different SP subspecialty, at least 2 FMs, up to 10 pathologist assistants, a member of the tumor bank staff, rotating students, and other visitors. A FM directs the process, which begins early each morning with debriefing overnight calls, frozen sections performed and specimens prepped, and is followed by a review of the operating room schedule, tumor library cases, handoffs, conferences, and other scheduled events. Each resident presents for their subspecialty service and identifies which specimens they will be grossing that day and the next. The huddle follows a standard process with a written aid posted so that various people can run the meeting. For 92% of survey respondents who had ever attended lab rounds, 73.9% were either very satisfied or satisfied, 8.7% were very dissatisfied, and 8.7% were unsure. Based on survey comments, one reason for dissatisfaction reflects a recent change in the time of lab rounds. **Conclusions:** A daily method for communication between interprofessional team members modeled after ward rounds and incorporating elements of TeamSTEPPS safety practices can be successfully incorporated into surgical pathology practice and residency training.

**APC-19-0011PO. Out of the Labs and Into the Unit**

**N. B. McLamb¹, C. R. Petri², L. Uhl¹, and M. H. Hayes³,⁴**

¹Department of Pathology, Beth Israel Deaconess Medical Center, Harvard Medical School, Boston, MA, USA
²Massachusetts General Hospital and Beth Israel Deaconess Medical Center Combined Fellowship in Pulmonary and Critical Care Medicine, Harvard Medical School, Boston, MA, USA
³Division of Pulmonary and Critical Care, Beth Israel Deaconess Medical Center, Harvard Medical School, Boston, MA, USA
⁴Carl J. Shapiro Institute for Education and Research, Beth Israel Deaconess Medical Center, Harvard Medical School, Boston, MA, USA

**Objectives:** To develop a rotation for a pathology resident (PR) to serve on a medical intensive care unit (MICU) multidisciplinary care team (MCT). The typical MCT consists of nurses, respiratory therapists, pharmacists, internal medicine residents (IMRs), and a critical care attending. The PR’s proposed role, as a laboratory specialist, is to provide education and guidance on laboratory test selection, interpretation, and utilization. **Methods:** A total of 6 days were spent in 3 MICUs to learn the workflow of each team, to discover educational opportunities for the PR during rounds with the MCT, and to identify clinical pathology (CP) topics that would benefit IMRs training (“discovery phase”). The characteristics of each MICU were evaluated to determine the optimal unit for the rotation. After selection of this MICU, the PR completed a 2-week rotation (8 days) during which the PR’s input on patient care was recorded (“rotation phase”). **Results:** The selected MICU contained 12 beds, had a daily census average of 9.5 patients, was closest to the main laboratory, and contained the greatest number of trainees on the MCT. Close proximity to the main laboratory provided quick follow-up on patient issues and made it easier for the PR to perform their daily CP service work. A large number of trainees within the MICU offered increased opportunities to expose IMRs to the benefits of CP consultations. During both the discovery and rotation phases, the PR provided guidance on 29 different topics affecting 19 patients; 24 (82.8%) had direct impact on patient care. The laboratory subspecialty breakdown of the interactions was 8 clinical chemistry (28%), 8 hematopathology (28%), 8 transfusion medicine (28%), 3 clinical microbiology (10%), 1 anatomic pathology (3%), and 1 HLA (3%). The breakdown of type of interactions was 6 (20.7%) test selection, 16 (55.2%) test interpretation, and 7 (24.1%) test utilization. Of the 24 issues having immediate impact on patient care, 12 (50.0%) occurred when the PR first rounded with a patient; the remainder occurred after 1 day (5/24, 20.8%), 2 days (6/24, 25.0%), and 3 days (1/24, 4.2%) of rounding. Lab follow-up was needed for 13/29 (44.8%) interactions. By spending time in the MICU, the PR gained insight into how data is viewed by clinicians, which led to positive changes in their own data reporting practices. The PR also identified patients who would help with current validation studies taking place within the lab. **Conclusions:** The inclusion of a PR on the MCT led to enhanced discussions on test selection, utilization, and interpretation in 29 instances over 14 days, averaging approximately 2 per day. A large proportion (82.8%) of these discussions led to changes in the care of patients. Having a PR on the MCT increased the opportunities for high-value CP consultations, which is a requirement for CP boards. Further examination of PR inclusion is needed to optimize the educational value and impact on patient care and laboratory practice.

**APC-19-0012PO. Pathology Teaching in Pre-Clerkship Elective: A Response to the Changing Curriculum**

**A. Aneja¹, N. Jhala¹, and Y. Persidsky¹**

¹Department of Pathology, Temple University Health System, Philadelphia, PA, USA

**Objectives:** To develop practical and immersive teaching methods in pathology elective to elevate the student
engagement and satisfaction, leading to effective utilization of the services and optimal patient care. **Methods:** A committee composed of a pathology clerkship director and 5 service directors, facilitated by the Chair of Department of Pathology and Laboratory Medicine was created. Potential recommendations for competencies for the key rotations were discussed and clear goals and objectives were established for each service. A final review of the goals was performed by the clerkship director and the chair ensuring more hands-on experience (summarized below); appropriate resources to complement the established goals were made available. End of clerkship feedback session to assess student performance and student assessment of rotation was implemented. **Anatomic Pathology:** Creating an accurate and comprehensive pathology requisition; understanding rationale for frozen section and providing real-time experience; understand gross and microscopic findings of common specimens and interpretation of pathology report; self-paced session of digitized case-based slide set followed by discussion with clerkship director; on-site cytolgy evaluation experience. **Hematopathology:** Understand the principles of laboratory methods; understand CBC, RBC indices, and differential leukocyte count evaluation; understand the clinical indications for bone marrow evaluation; learn handling, preparation, and interpretation of bone marrow specimens; understands basic lymph node pathology of common diseases and lymphomas. **Transfusion Medicine:** Interpret information generated from a “type and screen” order; compare and contrast blood components available for clinical use and their indications; understand the infectious and non-infectious risks of blood transfusion; basic work up of a transfusion reaction. **Apheresis:** Understand the procedure, indications and contraindications. **Microbiology:** Understanding and observing different techniques of diagnostic microbiology work up; making and interpretation of Gram-stained smears; use of cultures and sensitivities in selection of appropriate antibiotic therapy. **Clinical Chemistry:** Gain knowledge and skills in appropriate ordering of lab tests with and understanding the limitation of tests in management algorithm; role of clinical chemistry and point-of-care testing in laboratory medicine. **Results:** Fourteen students, MS3 and MS4, who took revised pathology electives from August 2017 to June 2018 evaluated the rotation as an enhanced educational experience and strongly agreed that would recommend the rotation to other students. **Conclusions:** Transforming the medical student pathology elective to an immersive rotation is an invaluable tool for revival of pathology as an independent subject and appropriate use of pathology services. **Reference:** Magid MS, et al. Consensus guidelines for practical competencies in anatomic pathology and laboratory medicine for the undifferentiated graduating medical student. *Academic Pathology.* 2015;2(4).

**APC-19-0013PO. Enhancing the Learning Environment Through a Program Coordinator Journal Club**

**A. J. Bourgeois**, T. Burns, V. Goodwin, and K. Miller

1University of Vermont College of Medicine, Burlington, VT, USA

**Objectives:** In the constantly evolving health care and GME landscape, the ability to stay current and apply new knowledge is critical to the success of coordinators and programs. Engaging program administrators and GME staff in a GME-topic focused journal club is an innovative way to provide continuing education and professional development. The overarching objective was that by gaining knowledge in GME topics, the program administrators and GME staff would have the skills and knowledge to contribute to program improvement across disciplines through the sharing of best practices in order to enhance the education and training of residents and fellows in the clinical learning environment. **Methods:** A steering committee gathered feedback about GME topics of interest, scheduling challenges, and then developed the format for the journal club. This was followed by an informative and engaging presentation to our program administrators and GME staff, which provided the background, aims, logistics, and scheduling information. The steering committee members led the first 3 journal club sessions to model the process. Initial journal clubs were scheduled for 30 minutes, but due to the robust discussion and participation, we moved to 1-hour sessions. Individuals who demonstrated an interest in facilitating a journal club were offered mentoring and support by the committee. The facilitator identifies several articles and submits these to the GME for final selection. The selected article is then sent to all participants at least 30 days prior to the journal club along with questions to promote critical thinking and preparation. During the session, the facilitator leads the discussion and all participants are given the opportunity to share their individual insights. Discussions center on appraisal of methods used, outcomes, and sharing of best practices. **Results:** Participants were surveyed after each journal club, and at after the completion of the second academic year. Respondents reported (1) Participating in the GME journal club was a beneficial professional development opportunity, in gained or improved skills. (2) Articles were very or somewhat helpful, and discussions were informative, and an opportunity to change, incorporate, or potentially propose a new idea to their program directors, and beneficial to their program. (3) Improved professionalism in team building, bonding, inclusion, and interactions with their colleagues. (4) An increase in their self-confidence and self-esteem in learning or in their thought process. **Conclusions:** Our journal club provides a positive learning environment for program administrators and GME staff who promotes and fosters professional development, knowledge acquisition, critical
help triage peripheral blood smears in underserved areas that these models can be deployed on user friendly Apps and no evidence of leukemia with a high degree of accuracy. Tumor leukemia, and chronic myeloid leukemia from those with capably distinguishing acute leukemia, chronic lymphocytic leukemia, and chronic myeloid leukemia from nonneoplastic counterparts when compared to the corresponding platform. Models generated on the ResNet50 (nearly 100%) performance parameter of the models was then assessed through their accuracy scores. Results: Overall, the models tested on the validation accuracy test set showed >99% accuracy. However, the preliminary results of our study demonstrate a difference in the accuracy of each model based on the corresponding platform. Models generated on the ResNet50 deep neural network were shown to be slightly more accurate (>95%) in distinguishing the abovementioned entities from their nonneoplastic counterparts when compared to the SqueezeNet neural network-trained models which were >90%. Conclusions: Our hematopathology ML models are capable of distinguishing acute leukemia, chronic lymphocytic leukemia, and chronic myeloid leukemia from those with no evidence of leukemia with a high degree of accuracy. These models can be deployed on user friendly Apps and help triage peripheral blood smears in underserved areas that are devoid of pathology expertise.

**APC-19-0014PO. Utility of Artificial Intelligence (AI)/Machine Learning (ML) in Identifying Acute Leukemia, Chronic Lymphocytic Leukemia, and Chronic Myeloid Leukemia in Peripheral Blood Smears**

_E. Vali Betts¹ and H. Rashidi¹_

¹University of California, Davis, Sacramento, CA, USA

**Objectives:** To develop a machine learning model through deep learning that could identify and differentiate acute leukemia, chronic lymphocytic leukemia, and chronic myeloid leukemia from nonneoplastic entities in peripheral blood smears. **Methods:** Multiple ML models were built through a transfer learning approach on 2 distinct deep neural networks (ResNet50 and SqueezeNet) on the Turi Create library for distinguishing acute leukemia, chronic lymphocytic leukemia (CLL), chronic myeloid leukemia (CML) from those with no evidence of neoplastic process on peripheral blood smears. These deidentified cases were treated as unknowns and reassigned by 2 board hematopathologists who then categorized each into the abovementioned categories prior to the training phase. The training set utilized 40 slides (10 acute leukemias, 10 CLLs, 10 CMLs, and 10 patients with no evidence of leukemia/lymphoma) to generate 2000 images which consisted of 500 acute leukemia images, 500 CLL images, 500 CML images, and 500 images with no evidence of leukemia/lymphoma to train various models on the aforementioned ML platform. The combined images noted above included 1000 at x20 magnification and 1000 at x40 magnification proportionately within each category. The performance parameter of the models was then assessed through their accuracy scores. **Results:** Overall, the models tested on the validation accuracy test set showed >99% accuracy. However, the preliminary results of our study demonstrate a difference in the accuracy of each model based on the corresponding platform. Models generated on the ResNet50 deep neural network were shown to be slightly more accurate (>95%) in distinguishing the abovementioned entities from their nonneoplastic counterparts when compared to the SqueezeNet neural network-trained models which were >90%. **Conclusions:** Our hematopathology ML models are capable of distinguishing acute leukemia, chronic lymphocytic leukemia, and chronic myeloid leukemia from those with no evidence of leukemia with a high degree of accuracy. These models can be deployed on user friendly Apps and help triage peripheral blood smears in underserved areas that are devoid of pathology expertise.

**APC-19-0016PO. Perinatal Autopsy Pathology: A Novel Approach to Subspecialty Education When There is No Subspecialist**

_J. Rueckert¹, R. Martindale¹, S. Mount¹, and M. Wills¹_

¹University of Vermont Medical Center, Burlington, VT, USA

**Objectives:** Pathology residency programs will be forced to find novel approaches to provide resident education during times when the program lacks faculty members with subspecialty expertise. After adjusting for population growth from 2001 to 2017, the number of pediatric pathology fellowship programs decreased.¹ This deficit of pediatric pathologists poses challenges for pathology residency programs, particularly regarding instruction focused on procedures such as perinatal autopsy external examination. Prior to our pediatric pathologist leaving our department and in anticipation of a lengthy recruitment process, we created an instructional video for residents demonstrating in detail the external examination procedure as part of a fetal/pediatric autopsy. **Methods:** In conjunction with the Educational Technologies Team at the University of Vermont, a video utilizing a simulation laboratory pediatric mannequin was created which demonstrates a systematic approach to the performance of the external examination of the fetal/pediatric autopsy. Additional images obtained from textbooks and the literature were incorporated into the video to illustrate frequently encountered syndromic and nonsyndromic abnormalities identified on the external examination. The pediatric pathologist was able to annotate these still images. The video was broken into body regions, allowing the resident to watch and review smaller segments at one sitting. **Results:** A video was created to supplement resident education on the external examination of the fetal/pediatric autopsy. **Conclusions:** The projected pathologist shortage, including shortages in subspecialists, may result in pathology graduate medical education programs struggling to fill faculty positions. We present this novel approach of collaborating with the Education Technology Team at the University of Vermont to create an educational training video to supplement resident education. Such a video can be used to support resident education, particularly when instruction involves a procedure and the training program lacks a faculty member with subspecialty expertise. **References:** Petrickes AH, Salmi D. Trends in pathology graduate medical education programs and positions, 2001 to 2017. *Acad Pathol.* 2018;5:2374289518765457. doi:10.1177/2374289518765457.

**APC-19-0017PO. Development and Implementation of a Resident Training Tracking Tool Targeted to the Documentation of Milestone Fulfillment**

_C. King¹, P. Adams-Lewis¹, L. Bachmann¹, S. Roseff¹, M. Contos¹, D. Wilkinson¹, and S. C. Smith¹_

¹Virginia Commonwealth University School of Medicine, Richmond, VA, USA

**Objectives:** Pathology residency programs will be forced to find novel approaches to provide resident education during times when the program lacks faculty members with subspecialty expertise. After adjusting for population growth from 2001 to 2017, the number of pediatric pathology fellowship programs decreased.¹ This deficit of pediatric pathologists poses challenges for pathology residency programs, particularly regarding instruction focused on procedures such as perinatal autopsy external examination. Prior to our pediatric pathologist leaving our department and in anticipation of a lengthy recruitment process, we created an instructional video for residents demonstrating in detail the external examination procedure as part of a fetal/pediatric autopsy. **Methods:** In conjunction with the Educational Technologies Team at the University of Vermont, a video utilizing a simulation laboratory pediatric mannequin was created which demonstrates a systematic approach to the performance of the external examination of the fetal/pediatric autopsy. Additional images obtained from textbooks and the literature were incorporated into the video to illustrate frequently encountered syndromic and nonsyndromic abnormalities identified on the external examination. The pediatric pathologist was able to annotate these still images. The video was broken into body regions, allowing the resident to watch and review smaller segments at one sitting. **Results:** A video was created to supplement resident education on the external examination of the fetal/pediatric autopsy. **Conclusions:** The projected pathologist shortage, including shortages in subspecialists, may result in pathology graduate medical education programs struggling to fill faculty positions. We present this novel approach of collaborating with the Education Technology Team at the University of Vermont to create an educational training video to supplement resident education. Such a video can be used to support resident education, particularly when instruction involves a procedure and the training program lacks a faculty member with subspecialty expertise. **References:** Petrickes AH, Salmi D. Trends in pathology graduate medical education programs and positions, 2001 to 2017. *Acad Pathol.* 2018;5:2374289518765457. doi:10.1177/2374289518765457.
Objectives: Despite adoption of the 2015 Accreditation Council for Graduate Medical Education (ACGME) and American Board of Pathology Milestones for the assessment of resident education, few tools are available to organize the longitudinal collection of residency trainee data relevant to the milestones. With the goal of being able to efficiently and accurately convert resident accomplishment data into milestone scores during biannual resident evaluations, we devised a user-friendly tracking tool to collect, display, and map this data to relevant ACGME milestones. Methods: A committee was convened to overhaul the existing system, consisting of representatives from throughout the Department of Pathology. The committee assigned each resident accomplishment datapoint historically tracked by the program (eg, frozen section numbers, licensure status) to a corresponding ACGME milestone (eg, PC6, PROF1, respectively). A spreadsheet (tracking tool) was created to present these datapoints under the appropriate milestone. A prototype of the tool was piloted by a resident, and changes were made for clarity. The final version was populated by all residents and used by the clinical competency committee (CCC) during subsequent 6-month evaluation meetings. Deidentified data measuring the degree of milestone changes were abstracted to assess the impact of the tracking tool. Results: The tracking tool was successfully used by the CCC for assessment of resident milestones and was favorably received by program leadership and faculty. Use of the tool was associated with increased (positive) changes in resident milestones in 8/12 residents, when compared to changes in paired milestone levels from the preceding evaluation period. Moreover, the degree of change in resident milestone level scores was statistically significant in 4/12 residents. Conclusions: The resident data tracking tool was used successfully for data collection and CCC milestone assessment. This tool may be associated with greater fidelity between milestone levels assessed and relevant internal resident performance. (Preliminary findings presented previously at the 2018 ASCP Resident Poster Session).

APC-19-0018PO. An Interpretable Machine Learning Pipeline for Identifying Pathologies Within Archival Human Tissues

Z. Tang1, K. Chuang2, L. Beckett1, C. DeCarli1, L. Jin1, M. J. Keiser2, and B. N. Dugger1

1University of California, Davis Medical Center, Sacramento, CA, USA
2University of California, San Francisco, San Francisco, CA, USA

Objectives: Standard criteria for assessing pathologies can have interrater variances and few broad categories. Other methods such as manual counts or positive pixel algorithms can be difficult to scale or tedious. Methods are needed to increase reliability, provide more detailed and sensitive measures, and reduce the burden placed on pathologists. Convolutional neural networks (CNN), a form of machine learning, have been successfully used for image analysis. Methods: As a proof of concept, we formed a multidisciplinary team and created an innovative CNN pipeline to identify Aβ plaques, a pathological hallmark of Alzheimer’s disease. Our CNN development pipeline followed 3 phases: (1) automated segmentation of objects of interest, (2) web-based interface for rapid annotation, and (3) model training and evaluation. Saliency mapping determined model relevance and interpretable patterns. Digital whole slide images were generated from Aβ-stained slides of temporal cortex. Open source libraries were used for tiling of images. Tiles were subject to an applied mask and bounding boxes to highlight candidate plaques generating over 65,000 small images. All images were annotated by an expert neuropathologist for the presence or absence of plaques. A random split of annotated tiles into training and validation sets was conducted for development and evaluation of a 6-layer CNN. Results: The CNN achieved an area under the precision recall curve (AUPRC) of 0.842 and area under the receiving operator characteristic (AUROC) of 0.983. On the hold-out test set, the model likewise performed well for unseen images (AUROC = 0.993, AUPRC = 0.744). Saliency maps visualizing the features underlying predictions were consistent with defining features of each pathology. Conclusions: To our knowledge, these studies are the first to demonstrate CNN recognition of Aβ-plaque pathologies that enhance a neuropathologist’s expertise in a scalable and interpretable way. We anticipate that banks of annotated data sets from multiple sources and annotated by multiple experts will improve the robustness, sensitivity, recall, and accuracy of these models and support training of yet more sophisticated model architectures.

APC-19-0020PO. A Comparative Analysis of Learning Styles in Pathology and Implications in Personalized Training

A. Ahmed1, V. Ananthanarayanan1, and K. M. Mirza1

1Loyola University Chicago, Maywood, IL, USA

Objectives: Personalized training models have been reported to be linked to successful educational outcomes of learners. Pathology is a unique specialty in which learning is primarily dependent one-on-one sessions between resident and faculty (learner/teacher) providing the ideal setup for active involvement of the trainee in the learning process. The first principle of learner-centered training is based on identifying the needs and preferred learning style of the learner. David Kolb described 4 major learning styles that depend on how people perceive and transform experiences into memory. Kolb’s tool has been extensively utilized by different medical specialties to understand and maximize learning outcomes (PMID26154861). The aim of this study was to identify whether pathologists have a preferred learning style, if it changes with time and experience and how this information can be used to enhance the learning process. Methods: Kolb’s learning style inventory v3.0 was sent to pathology-inclined medical students, residents, fellows,
Results: Complete data from 79 of 100 respondents (6 medical students, 36 residents, 11 fellows, and 26 faculty) was analyzed. Medical students demonstrated “dominance” >> “converging” learning styles, consistent with prior published studies (PMC2909974). Pathology residents’ data showed scattered distribution of 4 learning styles by each postgraduate level. Fellows and faculty showed similar learning styles, revealing a dominance of “assimilating” followed by “diverging” learning styles (P < .01). Multinomial logistic regression did not show any correlation with demographic data within each group. Conclusions: It is not surprising that as a very “visual” field, “assimilating” and “diverging” learning styles were consistently noted among fellows and faculty. The unequal distribution of learning styles among residents is curious and may suggest an evolving learning process that needs acclimatization to the learning requirements of our field. Interestingly, the dominance of converging style of learning in residents may be explained by the practical skills required in grossing and/or residual styles from medical school. Moreover, the multimodal learning styles in residents suggests that learning curve of residents can be improved using resident-centered blended learning models to cater different styles. The data can also be used to group residents and faculty with similar styles for a successful mentorship program.

APC-19-0021PO. Development and Implementation of a Collaborative Leadership Model for a Network Department of Pathology and Laboratory Medicine

M. R. Lewis1, T. C. Hong1, and M. J. Towle1

1Department of Pathology and Laboratory Medicine, University of Vermont Health Network, Burlington, VT, USA

Objectives: To devise and implement an effective, collaborative leadership model for a Department of Pathology and Laboratory Medicine that spans a health network composed of an academic medical center and 5 community hospitals.

Methods: In FY2015, our department was tasked with integrating Pathology and Laboratory Medicine to form a single laboratory involvement in population health management. Clinical leadership is coordinated through the activities of the High Value Patient Care Council, which meets monthly, is composed of the Medical Directors and Administrative Directors of the hospital laboratories, and is led by the Network Operations Director and the Vice Chair for Quality and Clinical Affairs. High Value Patient Care Council has collaboratively developed guiding principles for a testing location model, and these have been applied in initiatives such as regionalization of microbiology testing and standardization of reference laboratory partnerships. Coordination of major equipment purchases, leveraging of Network-scale pricing structures, and operational changes have resulted in substantial capital savings and reduced operating expenses that have favorably impacted budgets at all 6 hospitals. Leaders and subject matter experts from each of the laboratories are working together to develop a unified test compendium and to prepare for a phased rollout of the Epic Beaker LIS beginning in 2019. The increased level of trust among leaders and staff members in the Network’s laboratories has facilitated rapid, effective responses to scenarios such as a nationwide shortage of influenza test kits in early 2018.

Conclusions: Implementation of a collaborative leadership model at the Network level is improving coordination of laboratory services for patients in our region while yielding measurable financial savings and laying the groundwork for increased laboratory involvement in population health management.

APC-19-0023PO. Strategies to Enhance Social Media Engagement at Academic Conferences: The Association of Pathology Chairs 2018 Meeting SoMe Committee Experience

Yonah Ziemba1, Dana Razzano2, Timothy Allen3, Scott Anderson4, Anne Champeaux5, Michael Feldman6, Valerie Fitzhugh7, Simone Gittens1, Marilea Grider8, Mary Gupta9, Christina T. Hanoś10, Karen Kelly11, Tarush Kothari11, Jennifer LaDadio11, Amy Lin12, Kamran Mirza13, Kathleen Montone6, Victor Prieto14, Daniel Remick15, Nicole Riddle5, Michael Schubert16, Kelley Suskie17, Nadeem Zafar18, and Priscilla Markwood19

1Zucker School of Medicine at Hofstra/Northwell, Hempstead, NY, USA
2New York Medical College at Westchester Medical Center, Valhalla, NY, USA
3University of Mississippi Medical Center, Jackson, MS, USA
4University of Vermont Medical Center, Burlington, VT, USA
5University of South Florida, Tampa, FL, USA
6University of Pennsylvania, Philadelphia, PA, USA
7Rutgers New Jersey Medical School, Newark, NJ, USA
8Emory University, Atlanta, GA, USA
9University of Tennessee Health Science Center, Memphis, TN, USA
10SUNY Upstate Medical University, Syracuse, NY, USA

These results highlight the importance of a collaborative leadership model in the context of academic medical centers, providing a structured approach to manage clinical operations effectively.

Experience: The Association of Pathology Chairs 2018 Meeting SoMe Committee Experience

Yonah Ziemba1, Dana Razzano2, Timothy Allen3, Scott Anderson4, Anne Champeaux5, Michael Feldman6, Valerie Fitzhugh7, Simone Gittens1, Marilea Grider8, Mary Gupta9, Christina T. Hanoś10, Karen Kelly11, Tarush Kothari11, Jennifer LaDadio11, Amy Lin12, Kamran Mirza13, Kathleen Montone6, Victor Prieto14, Daniel Remick15, Nicole Riddle5, Michael Schubert16, Kelley Suskie17, Nadeem Zafar18, and Priscilla Markwood19

1Zucker School of Medicine at Hofstra/Northwell, Hempstead, NY, USA
2New York Medical College at Westchester Medical Center, Valhalla, NY, USA
3University of Mississippi Medical Center, Jackson, MS, USA
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5University of South Florida, Tampa, FL, USA
6University of Pennsylvania, Philadelphia, PA, USA
7Rutgers New Jersey Medical School, Newark, NJ, USA
8Emory University, Atlanta, GA, USA
9University of Tennessee Health Science Center, Memphis, TN, USA
10SUNY Upstate Medical University, Syracuse, NY, USA

The successful mentorship program is described, with a focus on utilizing blended learning models to cater to different styles. The data can be used to group residents and faculty with similar styles for a successful mentorship program.

Objectives: To devise and implement an effective, collaborative leadership model for a Department of Pathology and Laboratory Medicine that spans a health network composed of an academic medical center and 5 community hospitals.

Methods: In FY2015, our department was tasked with integrating Pathology and Laboratory Medicine to form a single laboratory involvement in population health management. Clinical leadership is coordinated through the activities of the High Value Patient Care Council, which meets monthly, is composed of the Medical Directors and Administrative Directors of the hospital laboratories, and is led by the Network Operations Director and the Vice Chair for Quality and Clinical Affairs. High Value Patient Care Council has collaboratively developed guiding principles for a testing location model, and these have been applied in initiatives such as regionalization of microbiology testing and standardization of reference laboratory partnerships. Coordination of major equipment purchases, leveraging of Network-scale pricing structures, and operational changes have resulted in substantial capital savings and reduced operating expenses that have favorably impacted budgets at all 6 hospitals. Leaders and subject matter experts from each of the laboratories are working together to develop a unified test compendium and to prepare for a phased rollout of the Epic Beaker LIS beginning in 2019. The increased level of trust among leaders and staff members in the Network’s laboratories has facilitated rapid, effective responses to scenarios such as a nationwide shortage of influenza test kits in early 2018.

Conclusions: Implementation of a collaborative leadership model at the Network level is improving coordination of laboratory services for patients in our region while yielding measurable financial savings and laying the groundwork for increased laboratory involvement in population health management.
Objectives: Social media benefits academic conferences by promoting an atmosphere of excitement, amplifying, and communicating content to people who were unable to attend, and providing a forum for continued discussion. Proven methods to improve social media engagement at academic meetings are limited. A dedicated social media committee was formed at the 2018 Association of Pathology Chairs meeting to implement strategies to enhance social media involvement. After the meeting, data was analyzed to identify strategies that can be effective at future meetings. After the meeting, data was analyzed to identify strategies that can be effective at future meetings. Methods: All meeting attendees were invited to join the committee via a premeeting questionnaire, and the volunteers were distributed evenly across the meeting’s 5 sections. A training session was held to align goals and to share skills with committee members who were new to social media. Committee members used their personal Twitter accounts to share about the meeting. In addition, they ensured coverage of presentations that typically receive less attention and availed themselves to other meeting participants who wanted guidance to be more involved in social media. All tweets bearing the meeting hashtag were analyzed. In order to quantify the effect of the committee, statistical Twitter coverage was compared to the APC meeting of the previous year. Results: The APC meeting received 2978 tweets in 2018, compared to 264 tweets in 2017. Tweets were posted throughout the 4 days of the meeting at an average rate of 31 tweets per hour. Every single abstract poster that was presented at the meeting was represented on Twitter. The tweets were insightful and positive, garnering interest and discussion. Each tweet was retweeted more than 2 times on average. Collectively, tweets were potentially viewed 2.099 million times. Conclusions: There was an 11-fold increase in social media presence and engagement at the 2018 APC meeting compared to the year prior. Implementation of the social media committee at the 2018 meeting was the main driver of this dramatic increase in engagement. Although a small fraction may be due to an overall increase in social media adoption in general, the magnitude of this change indicates that a dedicated committee has great potential to increase social media engagement at academic meetings. Many qualitative advantages were noted as well; the tweets promoted a “common mission” around the organizational goals and having the committee gave opportunity for conference organizers to direct social media engagement in a way that would most benefit the meeting. Our experience shows that formation of a dedicated social media committee is an underutilized strategy that can provide valuable benefits to academic meetings.

APC-19-0024PU. Optimization of Medical Student Cardiovascular Pathology Education: A Critical Review of Topics and Teaching Modalities With Incorporation of 3D Printed Congenital Heart Disease Models

P. J. Boyer1, A. T. Ray1, C. L. Pratson1, C. J. Karr1, W. H. McAllister1, T. N. Edwards1, A. T. Deyrup2, J. R. Butler1, and K. L. Kelly1
1Brody School of Medicine, East Carolina University, Greenville, NC, USA
2Duke University, Raleigh, NC, USA

Objectives: Pathology is a cornerstone of medical student education and pathology content comprises a significant proportion of knowledge tested in the United States Medical Licensure Examination Step 1. We evaluated the current content and teaching modalities used to educate students about cardiovascular diseases in our institution’s pathology course curriculum. Methods: An Index of Learning Styles survey was administered to all students. Literature searches identified resources detailing curriculum topics and teaching modalities for the cardiovascular component of undergraduate medical pathology courses. Course learning objectives were compared to those cited in widely used resources. Second-year medical students enrolled in the pathology course were surveyed to assess how they value optional laboratory sessions using gross specimens. A new, optional congenital heart session was implemented based on previous feedback. Participating students were polled regarding the usefulness of the congenital heart laboratory relative to other pathology sessions and the role of 3 dimensional (3D) printed models utilizing National Institutes of Health 3D print exchange offers reliable anatomical models that are compatible with 3D printers. Conclusions: While various teaching modalities are conducive to learning, an Index of Learning Styles survey indicates that medical students at our institution strongly value visual learning. The review of current pathology course content and
teaching modalities (1) validates the content covered against various resources and (2) documents perceived usefulness of laboratory demonstration of gross pathologic specimens as a learning modality. The use of 3-D models in cardiovascular pathology labs has the potential to improve visual and kinesthetic learner satisfaction and understanding of congenital heart pathology.

APC-19-0025PU. Medical Student Pathology Study Materials: New and Digital Resources Are in and Traditional Resources Are Out

P. J. Boyer¹, J. S. Jenkins¹, J. M. Wooten¹, W. H. Mcallister¹, C. L. Pratson¹, A. N. Botros¹, and A. T. Deyrup²

¹Brody School of Medicine, East Carolina University, Greenville, NC, USA
²Duke University, Raleigh, NC, USA

Objectives: Medical students have an increasingly diverse set of resources available to them as they navigate through course materials and prepare for Step 1 of the United States Medical Licensure Examination. Based on course feedback sessions, it was clear that students at our institution appeared to strongly favor electronic resources over traditional, hard-copy textbooks. We sought to quantify this impression among our students. Methods: A literature search for studies documenting use by medical students of resources in studying for pathology content was conducted using PubMed.gov and Google.com. Medical students were surveyed using a SurveyMonkey.com poll regarding the resources they used during their pathology course studies. The survey listed all available references and available formats (videos, textbook, audio recordings) and asked students to indicate their use of the specific resource on a scale including 1 (not used), 2 (light use), 3 (moderate use), and 4 (heavy use). Results: A literature search identified no published references documenting which resources medical students used in studying for pathology content as part of a medical school curriculum. For the pathology course at our institution, summarizing self-reported moderate and heavy use, the vast majority of students utilized the pathoma.com videos (97%) and textbook (92%) and 51% also utilized the First Aid for the USMLE Step 1 textbook. In contrast, few students reported either moderate or heavy use of the recommended Robbins and Cotran Pathologic Basis of Disease textbook in either the hard copy (2%) or electronic (6%) format and only 2% utilized the Robbins and Cotran Review of Pathology review book. Conclusions: Most students use electronic resources in studying for our institution’s pathology course First Aid for USMLE Step 1 and Pathoma.com books among the only hard copy resources used by most students. Traditional textbooks, in both the hard copy and electronic formats, have been largely abandoned by most students. To our knowledge, no published study has quantitatively evaluated this transition away from traditional resources. These findings have significant implications for course instructors and textbook publishers.

APC-19-0026PU. Teaching Stewardship in the Undergraduate Medical Curriculum: Pathology-Teaches

C. G. Roth¹, W. Huang², N. Sekhon³, J. Purkiss⁵,⁴, and N. Ismail⁵,⁴

¹Department of Pathology & Immunology, Baylor College of Medicine, Houston, TX, USA
²Department of Family Medicine, Baylor College of Medicine, Houston, TX, USA
³Department of Emergency Medicine, Baylor College of Medicine, Houston, TX, USA
⁴Office of Undergraduate Medical Education, Baylor College of Medicine, Houston, TX, USA
⁵Department of Internal Medicine, Baylor College of Medicine, Houston, TX, USA

Objectives: Current health care spending is unsustainable. In order to deliver the highest possible quality at the lowest cost, there is a need to teach high value care across the continuum of medical education, and better match the needs of the healthcare delivery system with the undergraduate medical education curriculum. Pathology-Teaches is an educational intervention designed to teach laboratory stewardship early in clinical training, at the level of the medical student in their core clinical clerkships. Instructional cases were designed following a needs analysis, which identified 2 major themes for student-level laboratory stewardship content: appropriate test ordering (knowledge of pre-/posttest probability, appropriateness criteria, recognition of unnecessary testing) and interpretation (test specifications, factors which impact the test results, recognition of inaccurate results). We assess the pilot implementation of 2 case-based educational modules in the Family Medicine and Emergency Medicine core clerkships at our institution. Methods: Students on their 4-week Family Medicine and 2-week Emergency Medicine core clerkships were invited to participate in the pathology-teaches pilot. The 2 online cases were developed using a multidisciplinary approach with input from clinician educators in pathology, family medicine, emergency medicine, and internal medicine. In the Pathology-Teaches educational module, students make decisions regarding the ordering or interpretation of laboratory testing within the context of a clinical scenario, and they receive immediate feedback during the case. The intervention was assessed using pre and posttests. Student feedback was also collected from 2 questions on their end of rotation evaluation. Results: Forty-six students completed the pathology-teaches pilot, 39 in Family Medicine (initiated 7/2018) and 7 in Emergency Medicine (initiated 10/2018). Pathology-Teaches utility was demonstrated by significantly increased improvement between pretest and posttest scores (pretest mean = 52, standard deviation (SD) = 24.4, vs posttest mean = 92; SD = 13.3,
P < .05, Cohen d = 2.01). The majority of students (32/43, 74%) perceived value in the educational intervention; 37% (16/43) rating the activity as “extremely valuable” or “very valuable” and 37% (16/43) as “some value.” Conclusions: Pathology-Teaches effectively teaches stewardship concepts, and most students perceived value in this educational intervention. Future efforts will extend this pilot into other required core clinical clerkships at our institution.

APC-19-0027PU. Multidisciplinary Conferences to Enhance Appreciation of Pathology

A. T. Deyrup 1
1Duke University Medical Center, Durham, NC, USA

Objectives: Two factors that have been identified as contributing to the decreasing number of medical students entering pathology are (1) perceptions regarding the role of pathologists and (2) negative stereotypes of pathologists. 1 Pathologists may be perceived by students as isolated medical practitioners with minimal contribution in patient care other than providing a diagnosis. Multidisciplinary conferences (MDC) clearly demonstrate the significance of the pathologist in clinical decision-making and as part of the medical team; however, most students attend MDC during their surgery rotations on the wards when their attention is focused on patient details to the detriment of the larger picture. Our goal was to increase student awareness of the role of pathologists in clinical care in the context of a multidisciplinary conference during the first-year Pathology course. Methods: During the first-year Pathology course, medical students at Duke University were assigned to attend a multidisciplinary conference in groups of 3 to 4 students. Following the conference, they selected one patient and received the medical record number and surgical pathology number from the attending physician. In the subsequent week, the students explored the patient’s electronic medical record and then met with a pathology resident to review the patient’s slides and acquire histologic images. The students then identified an area of interest (eg, prognosis, treatment) and submitted an abstract from a primary research article to the pathology course director for feedback/approval. Finally, the students prepared a 30-minute presentation to their pathology small group. Results: Based on end of course survey data, students had a generally favorable response to the assignment and there were multiple comments regarding the utility of the experience and an increased awareness of the role of pathologists in patient care. Conclusions: Exposure to a multidisciplinary conference during pathology coursework can focus student attention on the role of the pathologist in clinical decision-making and as a member of the patient care team. Furthermore, this exercise provides context for the basic biomedical sciences.

APC-19-0028PU. Blended Case-Based Learning Environment to Enhance Undergraduate Pathology Education

J. Pandey 1
1Foundational Sciences, Central Michigan University College of Medicine, Mount Pleasant, MI, USA

Objectives: Blended case-based learning (CBL) has the potential to enhance the student experience, engagement, and learning. In order to restructure and integrate the undergraduate pathology course to a novel blended learning environment; we adopted an approach that combines interactive flipped classroom; small group discussion by CBLs and team-based learning (TBL) principles for assessment. Methods: Central Michigan University College of Medicine (CMED) has an integrated organ system based curriculum. For each of the organ system modules, cases were developed that covered the organ system pathophysiology and pathology concepts. The learning week starts on Friday; the students get the learning objectives, prereading, and faculty selected learning resources, for example, videos, web-based animations, lecture notes or narrated slides. The first teaching-learning activity on Monday is a standard TBL for previously learnt anatomy, physiology, or histology content needed for the week, for example, blood smears and bone marrow. This is followed by a large group interactive session of pathophysiology principles or virtual microscopy of a disease group, for example, anemia. A mandatory small group “unfolding CBL” session follows the large group session. Home work for the day is a to-do list and relevant pathology learning objectives. Pharmacological principles are also incorporated into the CBL. The CBL is assessed following case conclusion on the second day by TBL consisting of individual Readiness Assurance Test (iRAT), Group Readiness Assurance Test (GRAT), and application questions. Each week has 3 CBLs. There is a review on Friday. The weekly cycle is repeated till all pathology concepts of an organ system are covered. Evaluation data consists of faculty and student feedback on case content, effectiveness, engagement, and ease of learning. Team-based learning assessment not only reinforces the required concepts but also provides feedback on student learning outcomes at least in the short term. An evaluation of the iRAT score as a predictor for end of module score was done to assess long-term retention. Results: Student evaluations reflect that the Monday TBLs promote reinforcement of previously learnt concepts. The CBL modules are described as enjoyable, motivating, and are appreciated for their contextual application of concepts that enable students to learn from each other and learn by teaching. The iRAT score is a good predictor for final exam performance and is used for early risk prediction and follow-up of at-risk students. Conclusions: In transforming the organ system pathology by integrating it in a blended learning model, we demonstrate that we are able to improve outcomes and provide a learning environment that achieves high levels of comprehension of difficult concepts, satisfaction, and value for learning.
APC-19-0029PU. Starting the Pipeline Early: Engagement of High School Students in Pathology

J. J. Findeis-Hosey1 and A. Lott Limbach1

1University of Rochester Medical Center, Rochester, NY, USA

Objectives: The projected decline of pathologists entering the workforce necessitates continued examination of methods to engage learners in pathology and laboratory medicine. The 2013 Pathology Workforce Summit identified the need to recruit bright students into the field. While a significant proportion of the published literature has focused on engaging medical students in pathology, there are fewer instances of pathology-specific programs for high school students. Here, we assess the impact of a 3-week intensive summer program in pathology and laboratory medicine for high school students. Methods: Ten high school students were enrolled in the University of Rochester’s Explorations in Pathology (EIP) program taking place over 3 weeks in July 2018. The EIP program consisted of 90 contact hours during which students were introduced to pathology and laboratory medicine through a wide range of didactics and participatory activities. Students encountered a diverse array of laboratory professionals, including pathologists, pathology assistants, and cytotechnologists. Capstone projects were mentored by faculty members and involved student examination of clinicopathologic features of selected disease processes with final poster and on-line video presentations. Students and parents completed optional surveys following the completion of the program. Results: All 10 (100%) students responded that the EIP program improved their overall knowledge of pathology. Students self-reported that their knowledge of pathology increased from a preprogram average of 3 of 10 (range: 2-6) to a postprogram average of 7.4 of 10 (range: 4-9). Five parents completed surveys, with all 5 (100%) strongly agreeing that the EIP program broadened the educational experience of their student learner. At least 3 (30%) of the students have subsequently participated in additional shadowing sessions with pathologists following the completion of the EIP program. Conclusions: Accounts of pathology-specific programs for high school students are uncommon. Here, we present a model for engaging high school students in pathology, with immediate positive impact and demonstrating of student involvement in pathology beyond the completion of the program. The course design allows for students to become acquainted with multiple different areas and professions within the realm of pathology and laboratory medicine. Consideration for the development of pathology-specific experiential programs to engage students during the formative high school years should be further explored.

APC-19-0030PU. A Single-Institution Experience of Increasing Pathology Visibility to Medical Students With Resident as Teacher

D. Kwon1 and M. A. Furlong1,2

1Department of Pathology and Laboratory Medicine, MedStar Georgetown University Hospital, Washington, DC, USA
2Georgetown University School of Medicine, Washington, DC, USA

Objectives: A recent prospective, national longitudinal study concluded that role model exposure is a strong predictor in specialty selection by fourth year medical students. Although limited, increasing number of studies show that medical students often regard residents as role models and teachers, indicating that students’ career trajectory can be shaped by formative experiences with the residents. Unfortunately, the opportunities for students to interact with pathology residents are frequently limited. The lack of pathology resident visibility to the medical students can perpetuate the misconception and stereotypes of the field and the absence of role model can make it harder for students to envision pathology as their choice of residency. The aim of this study is to share a single-institution experience of increasing pathology visibility and exposure to medical students by incorporating several specific pathology-resident driven teaching opportunities predominantly in the early years of medical school. Methods: The department of pathology at MedStar Georgetown University Hospital has incorporated resident teaching of medical students at Georgetown University School of Medicine into its foundational and clinical curriculum. These activities are focused on expanding pathology exposure beyond the typical classroom setting to enhance the learning of pathology concepts and to intentionally increase interaction with residents. Results: Gross conference: Complex specimens are presented by the residents to a small group of students in the first (M1) and second (M2) years. Medical Student Grand Rounds: Pathology residents present relevant pathologic findings and laboratory diagnostic modalities to M1 and M2 students. Small group sessions: Residents facilitate 5, 1-hour sessions for M1 and M2 students using the Robbins and Cotran case studies. Summer fellowship program: M1 students with a strong interest in pathology are selected to spend 1-month in the department and are paired with pathology residents for direct mentorship. Cancer center summer research internship program: Undergraduate and M1 students spend 2 full days in the department and complete a curriculum developed and directed by residents, including clinical activities, a mock-grossing session, and microscopic reviews. Pathology student interest group: A resident medical education director leads various annual pathology-related activities. Conclusions: Narrative feedback from the school of medicine indicates an overall positive impact. Resident-driven teaching may serve as a mechanism to enhance visibility of the field and
provide an opportunity for specialty advising. Pathology residents can collectively promote early interest during the preclinical years by serving as a role model, a teacher, and a mentor to medical students.

**APC-19-0031PU. The “Race” toward Diversity, Inclusion, and Equity in Pathology: The Johns Hopkins Experience**

A. D. Ware¹, T. Murdock¹, L. Voltaggio¹, A. Windon¹, J. C. Troncoso¹, R. H. Hruban¹, and M. J. White¹

¹Department of Pathology, Johns Hopkins University School of Medicine, Baltimore, MD, USA

**Objectives:** Medical student interest in pathology is declining, with 28.8% fewer US applicants in 2017 versus 2008. Many pathology residency programs have improved gender diversity with females representing 50% of pathology trainees in 2017. With only 3.8% black trainees in 2012 (at a time when 13.6% of the US population was black), pathology still has significantly fewer underrepresented individuals (URI) compared to other specialties. Johns Hopkins’ core values include diversity and inclusion; accordingly the Johns Hopkins Department of Pathology established an active outreach program and a funded rotation for URI and other disadvantaged groups. The goal of these efforts was to expose students to the field and to improve diversity, inclusion, and equity in our department. **Methods:** A 1-month rotation in pathology for URI was established in 2013. Rotation schedules tailored to specific interests included rotations on AP/CP services, attendance at resident conferences, and one-on-one meetings with selected faculty. In 2016, we initiated a proactive outreach program, in which diverse faculty from our department visited historically black universities and programs for URI student groups at other schools. The faculty gave presentations on “Careers in Pathology” targeted to second and third year medical students. The format of the sessions varied from large group presentations to smaller group meetings. Our faculty also attended URI medical student conferences, and participated in high school student programs such as the National Native American Youth Initiative to increase the pipeline of URI students into medicine, and hopefully pathology. **Results:** Following 10 outreach presentations, the number of rotators in pathology at Hopkins increased from 1 in 2013 to 15 as of November 2018. Rotators self-identified as African, African American, Hispanic, and Native American. Most were second and fourth year medical students, and 1 was a pathology resident. Three rotators are now AP/CP residents, 3 are applying to pathology residencies, and 1 intends to apply next year. Feedback from the outreach and rotation has been positive. One shared “my participation in the program represents a crucial and seminal moment during medical school which solidified my decision to not only become a pathologist, but to strive to cultivate and emulate the positive traits of the pathologists at Johns Hopkins….” **Conclusions:** The impact of active outreach can be profound, and in our experience directly accounts for the success of our program. We recognize the barriers to URI retention, and in the future intend to enhance professional development activities to address the long-term challenge of equity.

**APC-19-0032PU. A University of Michigan Experience: Increasing Exposure to Pathology During Surgery Clerkship**

M. Lew¹, D. Baber¹, K. Konopka¹, S. Li¹, and A. M. Wilson¹

¹University of Michigan, Ann Arbor, MI, USA

**Objectives:** The University of Michigan Medical School has undergone a curriculum change in which the didactic curriculum has been reduced from 19 to 13 months, drastically reducing students’ exposure to pathology. To remedy this decrease and enhance understanding of the clinical practice of pathology, our curriculum now includes a 1-week rotation through Pathology as part of the Surgery & Applied Sciences (SAS) clerkship. This project illustrates the design of this week-long curriculum. **Methods:** The 3-month SAS clerkship consists of 2 months of clinical surgery rotations and 1 month of an applied sciences rotation, which is composed of 1-week rotations through 4 specialties—anesthesiology, anatomy, radiology, and pathology. The week-long pathology rotation provides an opportunity for students to explore facets in anatomic and clinical pathology (CP) in clinical and small group settings, respectively. Pathology faculty created key learning objectives for students in order to create a consistent, sustainable 1-week curriculum. **Results:** Four to 5 medical students now rotate through Pathology on a weekly basis (Figure 1). Students observe autopsies on Monday morning. If there are none available, students take part in a faculty-led gross pathology session with formalin-fixed and/or plastinated organs with classic disease entities. From Tuesday to Thursday mornings, each student observes sign-out in an assigned surgical pathology subspecialty. Tuesday to Thursday afternoons are dedicated to small group sessions (SGS) using case-based presentations and laboratory tours to highlight key topics in Clinical Chemistry, Microbiology, and Blood Bank. Small group sessions highlight the utility of various CP laboratories and promote lab stewardship in students’ subsequent rotations and careers. To further enhance student understanding of how pathology plays a role in health-care delivery, interactive web-based modules were developed on www.MDCases.net. These modules are case-based scenarios that provide information through text, videos, hyperlinked references, and have multiple choice questions with immediate feedback to enhance learning. There are 9 mandatory modules that cover key principles established by faculty with clinical expertise in frozen section, clinicopathologic correlation, microbiology, immunology, hematopathology, and transfusion medicine. **Conclusions:** Curriculum changes have reduced the overall number of contact hours pathologists have with medical students. However,
implementing an interactive curriculum within the clerkship-year of medical student education can increase exposure to pathology while also giving a more accurate impression of the daily workflow and impact pathology has in health-care delivery.

**APC-19-0033PU. Engaging Ideas for Pathology Student Interest Group Meetings**

**K. W. Sanford¹, L. E. Sterling¹, A. D. Hadjis¹, and L. Colon-Cartagena¹**

¹Virginia Commonwealth University School of Medicine, Richmond, VA, USA

**Objectives:** Our medical student Pathology Interest Group named “N2Path” wanted to increase the engagement of medical students by using digital technology in an off-campus venue. **Methods:** The Pathology Club faculty advisor spent 1 week at the Harvard Macy’s Institute enrolled in the course “Health Care Education 2.0 Transforming Your Teaching for the Digital Age.” The course focused on implementing innovative digital technologies to engage medical students in activities that enhance their learning. One application taught during the course was the online game-based platform, “Kahoot!” This application has a social learning design that allows students to gather around a digital screen and answer questions while using their own devices. “Kahoot!” seemed applicable for an off-campus venue to increase student participation while promoting overall student, resident, and faculty engagement. The student copresidents, faculty advisor, and pathology residents helped to plan a “Zombie Doctor” themed Halloween party at a local restaurant. The faculty advisor created 3 “Kahoot!” digital quizzes as well as other contests including a costume contest and a Mummy wrapping finale contest.

**Results:** The copresidents advertised the party to their classmates and 40 medical students attended the event, doubling our normal interest group attendance on campus. The students were separated into 6 teams and answered the questions in the 3 quizzes titled, “Name that Pathology,” “Name that Cause of Death,” and “Name that Poison.” Residents and faculty were present to help the students without providing them the answers. This created a highly interactive, academic, and engaging environment between students, residents, and faculty. **Conclusions:** The feedback from the students was overwhelmingly positive. The student comments from the event were favorable regarding an off-campus social venue and a competitive and fun digital gaming tool. We will continue to use digital media techniques and off campus venues to enhance our medical student experiences with the Pathology Interest Group.

**APC-19-0034PU. Tips to Increase Recruitment of Medical Students to Pathology Specialty: A Faculty’s Experience**

**C. J. Prasad¹**

¹Western University of Health Sciences-College of Osteopathic Medicine of the Pacific, Pomona, CA, USA

**Objectives:** An average 1 to 2 students per medical school enter into pathology residencies. Students do not understand pathology during the preclinical years and are eager to put it behind them. They rarely undertake pathology rotations and have no exposure to laboratory medicine, an area that is critical to all specialties. My hypotheses was that an increasing awareness of pathology, early in medical school curriculum, would help recruit medical students into the pathology specialty. **Methods:** In an attempt to change these deficiencies, I attempted the following: (1) Gave presentations to osteopathic medical students (OMS) 1 and 2 students about the pros and cons of pathology as a career option. (2) Offered shadowing opportunity in preclinical years. (3) Started a pathology interest group that offered leadership positions. (4) Offered research projects to OMS 1 and 2 students. (5) Offered the opportunity to write up case reports. (6) Offered clinical laboratory rotation to OMS 3 and 4 students. (7) Mandatory, graded, laboratory research proposal needed to be completed. **Results:** At our school, 0 students matched into pathology in 2016, 3 in 2017, and 7 in 2018 and a potential 10 students in 2019. All students have matched into top notch ACGME residencies. From 2016 to the present time, I have used several measures to engage students early on in the game. My goal was to (1) Engage students early. (2) Educate them about pathology and laboratory medicine. (3) Increase awareness of pathology as a viable career option. (4) Help students, regardless of their specialty interests, strengthen their resumes. (5) Provide leadership opportunities by starting a Pathology Interest Group. I have over 40 students enrolled in the PIG group, over 16 students are involved in my research projects. Over 11 students have given presentations and conducted workshops with me at national conferences. **Conclusions:** This strategy has been successful and is also easily applicable to all specialties. It does involve active faculty participation, but the outcome outweighs the efforts.