



Innovations in Fellowship Education

2023 Highlights Book

 **ATS** 2023

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TABLE OF CONTENTS

The following programs were selected by the ATS Training Committee as the standout programs in educational excellence this year.

Institution	Abstract Title	Page
Loyola University Medical Center	Implementing a Multidisciplinary Curriculum to Enhance Cultural Competency Surrounding Death and Dying in an Effort to Mitigate Moral Injury	5
Yale University School of Medicine	A Comprehensive Approach to Pulmonary & Critical Care Fellow Ambulatory Training with the Implementation of Dedicated Ambulatory Blocks and a Novel Curriculum	7
The ATS would like to showcase the additional institutions who submitted an abstract to the 2023 Innovations in Fellowship Education program.		
Children's Mercy – Kansas City	Implementing Kern's Model to Define Strategies on Improving Fellow Recruitment and Quality of a Small Pediatric Pulmonology Fellowship Program.	9
Northwestern University Feinberg School of Medicine	Impact of Simulation-based Mastery Learning on Airway Bleeding Management for Pulmonary Fellows and Advanced Practice Providers.	10
Oregon Health & Science University and Portland VA Medical Center	Sleep Medicine Fellowship Orientation: Sleep Medical School	12
University Hospitals Cleveland Medical Center	Leadership Curriculum for All Critical Care Medicine Fellows	14
University Hospitals Cleveland Medical Center - 2	Mortality Rounds: Fellow-Led Multidisciplinary Intensive Care Unit Rounds Discussing of End-of-Life Care	16
University Hospitals Cleveland Medical Center - 3	Swipe for Success: A Novel Platform for the Humble Fellowship Manual	18

TABLE OF CONTENTS CONTINUED

University of Alabama Birmingham - 1	Implementing a Structured Multidisciplinary Critical Care Curriculum for Critical Care Fellows.	20
University of Alabama Birmingham - 2	Developing and Implementing a Fellow Tele-ICU and eICU Rotation	22
University of Alabama Birmingham Heersink School of Medicine	A Track for Trachs: Implementation of a Formal Curriculum, Checklist, and Feedback Protocol in Trainees Performing Percutaneous Tracheostomy at a Tertiary Academic Center.	24
University of Colorado	Ultrasound Guided Pleural Biopsy: Description of a Model and Trainee Preferences with Respect to Technique	26
University of Toronto Adult Respirology Training Program	Pilot Virtual Pulmonary In-training Oral Exam in the Era of COVID-19	27
Wayne State School of Medicine	An Innovative Interactive E-Learning Based Curriculum in Non-Invasive Ventilation For Pulmonary And Critical Care Fellows.	28

PROGRAM DETAILS

The American Thoracic Society greatly values a strong fellowship program as a means of academic and clinical success. To recognize programs that implement exceptional practices, the ATS Training Committee developed the Innovations in Fellowship Education program. All pulmonary, critical care, sleep, and allergy fellowship programs (adult and pediatric) are invited to submit abstracts showcasing a novel and innovative best practice.

Abstracts are reviewed and ranked based on the following criteria:

- Innovation: How unique is the educational program? What is new and different?
- Implementation/Sustainability: How was the program implemented and how effective was such implementation? Is this program sustainable?
- Transferability: How easily might this educational program be adopted by other fellowship programs?
- Outcomes: Are there reported outcomes or plans to measure them?

The goal of this program is to recognize fellowship programs that demonstrate educational excellence and to share these best practices with other programs.

There is a focus on fellowship innovations addressing racial/ethnic disparities or improving diversity, equity, or inclusion.

This award focuses on projects related to fellowship education and curricula.



Loyola University Medical Center

Implementing a Multidisciplinary Curriculum to Enhance Cultural Competency Surrounding Death and Dying in an Effort to Mitigate Moral Injury

Authors: Anila N. Khan, MD; Paul Hutchison, MD; Rishi Mehta, MD

RATIONALE:

BACKGROUND:

Moral injury (MI) was first described in 2009 in reference to combat soldiers experiencing “acts that transgress deeply held moral beliefs and expectations.”¹ The term has since been applied broadly, including to physicians in training. Rates of MI in trainees have risen in the setting of the COVID-19 pandemic^{2,3}. While there are innumerable proposed causes of MI, we suspect one cause in critical care trainees may be related to distress at the end of life. As beliefs surrounding death are varied across different individuals and backgrounds, decisions made by families may cause MI if they are incongruent with the trainee’s beliefs. Furthermore, we hypothesize that the implementation of a multidisciplinary curriculum to enhance cultural competency may help to improve rates of MI.

METHODS:

The Moral Injury Symptom Scale: Healthcare Professionals Version (MISSHP) is a ten-item questionnaire that has been validated to both screen for MI and to monitor response to treatment in healthcare professionals³. We distributed the MISS-HP to twelve fellows in our fellowship training program to establish a baseline level of MI. To gather demographic information, we developed and distributed a cultural competency questionnaire, which incorporated five validated points from a questionnaire that described discussion of religious and spiritual beliefs⁴. All results were obtained anonymously.

Subsequently, we developed a curriculum to enhance cultural competency surrounding death and dying. We coordinated with inter-faith chaplains at our institution and the surrounding community to host sessions in which the thoughts and beliefs surrounding death and dying in different faiths and cultures are described in a traditional lecture and small group format. It is worth noting that the object of these sessions is not to develop an expertise in each culture or faith, but rather to gather an understanding of different beliefs that exist across groups and individuals.

As a corollary to these sessions, select readings from the text “Being Mortal” are assigned. A flipped classroom model will be implemented to foster

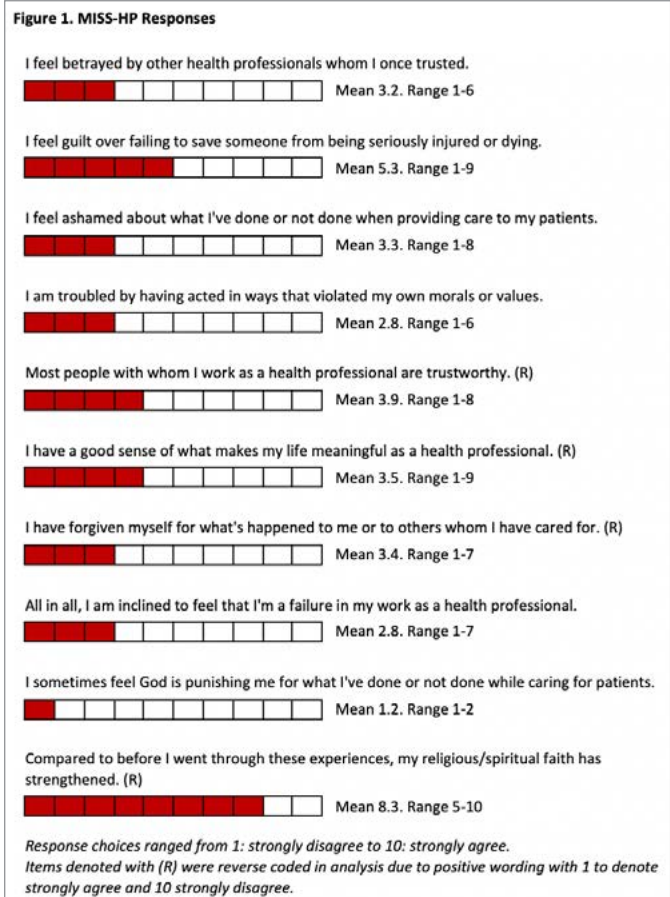
discussion surrounding the themes of uncertainty and stigmas around death and dying.

These sessions will continue through the end of this academic year, at which time the MISS-HP questionnaire will be re-administered.

RESULTS:

Eleven of the twelve fellows completed the initial questionnaires. A score of 36 or higher on the MISS-HP is established to be 84% sensitive and 93% specific for MI. The scores in our cohort ranged 22 to 64, with a mean score of 38. Five fellows (45%) had a score of 36 or greater. Further breakdown of scores on the MISS-HP are shown in Figure 1.

Figure 2 describes results from the cultural competency questionnaire. Notably, all eleven respondents noted that they are having conversations surrounding death and dying with patients and their



family members in the ICU often. All respondents noted that they disagreed with decisions patients, or their family members make surrounding end of life care at least sometimes, and 7 (63%) reported that these decisions transgress their personal deeply held moral beliefs and expectations at least sometimes.

CONCLUSION:

MI is present in our fellowship cohort. A majority of fellows report that decisions made at the end of life could at times transgress their moral beliefs. Most fellows feel knowing a patient’s beliefs are important, but few ask their patients these questions. A curriculum to broaden our understanding of death and dying across different cultures may help mitigate MI.

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Yale University School of Medicine



A Comprehensive Approach to Pulmonary & Critical Care Fellow Ambulatory Training with the Implementation of Dedicated Ambulatory Blocks and a Novel Curriculum

Authors: Kathleen McAvoy, MD; Shyoko Honiden, MD; Jennifer Possick, MD

RATIONALE

In a multi-institutional survey of Pulmonary & Critical Care Medicine (PCCM) fellows, fewer than 50% felt their ambulatory pulmonary training adequately prepared them for independent practice (Kassutto et al. 2021). Prior interventions in PCCM fellowships to improve ambulatory pulmonary training have focused on didactic curricula without changing clinic structure. Internal medicine residencies addressed similar challenges by implementing the “x+y” scheduling model of dedicated outpatient time separated from inpatient service, and enhanced ambulatory education (Mariotti et al. 2010). Our project aimed to improve fellow ambulatory pulmonary training by pairing dedicated ambulatory blocks to expand outpatient exposure with a novel ambulatory pulmonary curriculum that leverages adult learning theory.

ambulatory pulmonary education were included in fellow schedules (Figure 1). A 3-year ambulatory pulmonary curriculum spanning 24 core topics was developed for small group learning. These case-based sessions highlighted both disease and practical skill content (airway clearance, inhaler technique, home oxygen), leveraged flipped classroom models, and incorporated multi-professional team teachers (respiratory therapists, pharmacists). Knowledge transfer and self-assessed confidence were evaluated by pre- and post-session tests. Subspecialty clinic exposure (number and type) was compared pre- and post-intervention. A mixed-methods analysis evaluated the impact of our interventions 9 months after implementation, through both fellow and faculty surveys and fellow focus groups. Surveys utilized 5-point Likert scales with aggregate reported agreement defined as a response of “agree” or “strongly agree.”

METHODS

A targeted needs assessment was performed in May 2021 by anonymously surveying PCCM fellows and faculty in an academic fellowship program. In the 2021-2022 academic year, four 2-week ambulatory blocks including fellow longitudinal clinics, themed subspecialty clinics, and a dedicated half-day for

RESULTS

Ambulatory blocks increased the average number of subspecialty clinics attended (6.4 to 21.8) and the different subspecialties experienced (1.4 to 5.4) per fellow. Post-intervention, there were significant improvements in fellow and faculty satisfaction with ambulatory pulmonary education (6.7% to 85.7%,

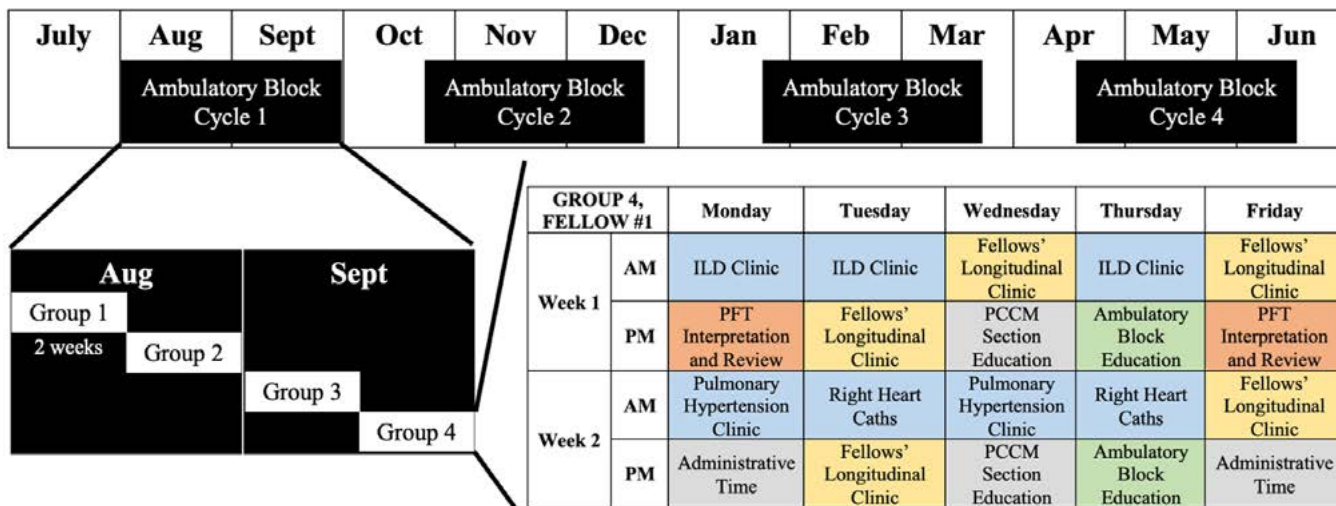


Figure 1 Ambulatory block structure and example 2-week fellow schedule. Example schedule includes week 1 subspecialty theme of ILD and week 2 pulmonary vascular disease. Week 1 also demonstrates time for PFT interpretation and review in the role of “PFT fellow of the week.”

ILD interstitial lung disease, PFT pulmonary function test, PCCM pulmonary & critical care medicine

and 30% to 77%, respectively; $p < 0.03$). Fellow self-assessed readiness for independent practice also significantly increased (26.7% to 78.6%, $p < 0.01$). Fellows noted a significant improvement in their ability to focus on their ambulatory pulmonary education when in clinic (27% to 100%, $p < 0.01$). Analysis of fellow focus groups revealed 5 major themes describing the benefits of the ambulatory block structure (Figure 2) – the ambulatory block allowed for focused topical learning, facilitated a broader exposure to the breadth of pulmonary medicine, fostered career development, enhanced interaction with engaged faculty experts, and facilitated interprofessional competence.

Aggregate curricular pre- and post-session tests demonstrated significant improvements in content knowledge (1.77 to 2.56 correct answers out of 3, $p < 0.001$), and fellow-assessed confidence with management of topics addressed (10% to 55%, $p < 0.001$). In the post-intervention survey, aggregate fellow-assessed confidence with management of topics addressed in the curriculum showed sustained improvement compared to the needs assessment survey (35% to 64%, $p < 0.001$). 100% of fellows agreed that receiving education from multi-disciplinary team members enhanced their education. Fellows highlighted the breadth of content delivered and variation of teaching methodologies when discussing the ambulatory pulmonary curriculum in focus groups.

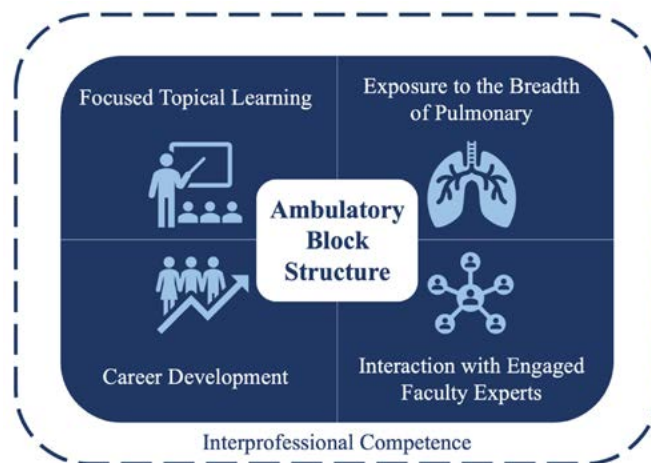


Figure 2 Conceptual model describing the benefits of the ambulatory block structure.

CONCLUSIONS

Incorporation of dedicated ambulatory blocks and a corresponding novel curriculum significantly improved PCCM fellow satisfaction with pulmonary education, self-assessed readiness for independent practice, content knowledge, and confidence in fund of knowledge. Ongoing analysis of fellow focus groups may uncover additional benefits of this comprehensive ambulatory training structure that can be generalized across fellowship programs regardless of program size or resources.

Children's Mercy – Kansas City

Implementing Kern's Model to Define Strategies on Improving Fellow Recruitment and Quality of a Small Pediatric Pulmonology Fellowship Program.

Authors: Alvin Singh, MD and Erin Khan, MD

RATIONALE:

The pediatric pulmonary fellowship program at Children's Mercy – Kansas City graduated its first fellow in 2018 but has not been successful in matching applicants yearly. New leadership in 2021 determined that a problem identification and targeted needs assessment should be performed to identify reasons for poor fellowship enrollment and overall program quality.

METHODS:

Referencing Kern's Model, a problem identification and a targeted needs assessment was performed through individual interviews with faculty and reviewing responses from the yearly Accreditation Commission of Graduate Medical Education (ACGME) program evaluations.

RESULTS:

After interviewing faculty and organizing responses, three broad deficiencies within the program were identified and listed below. Broad goals and objectives were then defined along with strategies to increase the likelihood of successful recruitment and program quality.

Difficulties with Fellow Recruitment: Individualizing an applicant's interview day based on aligning interests with faculty both within and outside the division became a strategic focus as was deliberate recruitment of applicants from varying backgrounds to foster an inclusive and diverse background, like faculty in the division. New and more streamlined post-interview surveys were also created.

Curriculum Development: Using American Board of Pediatrics entrustable professional activities (EPAs) as a framework, new program goals and objectives were created along with a didactic curriculum focusing on clinical exposures and fostering an educational environment for all learners and faculty. More balance to the inpatient and outpatient (with focus on many multi-disciplinary clinics) experiences became a priority as well as involving faculty from other disciplines outside the division to discuss pulmonary-relevant topics.

Faculty Engagement: To enhance communication, a brief update about the program is given during monthly staff meetings. Drastic changes to the program are communicated to faculty through hour-long didactic sessions which are recorded and available for all to view. Evaluations of learners was changed to an EPA-based survey which allows for a less cumbersome evaluation form, thereby reducing "survey-fatigue". ACGME milestones are still being mapped to the EPA-based evaluations and are reviewed by the clinical competency committee every 6 months.

CONCLUSION:

Incorporation of dedicated ambulatory blocks and a corresponding novel curriculum significantly improved PCCM fellow satisfaction with pulmonary education, self-assessed readiness for independent practice, content knowledge, and confidence in fund of knowledge. The focus group themes describe additional benefits of this comprehensive ambulatory training structure that can be generalized across fellowship programs regardless of program size or resources.

Northwestern University Feinberg School of Medicine

Impact of Simulation-based Mastery Learning on Airway Bleeding Management for Pulmonary Fellows and Advanced Practice Providers.

Authors: Clara Schroedl, MD MS; Timothy Rowe, MD

INTRODUCTION:

Massive hemoptysis is a challenging clinical scenario which continues to have high mortality despite advances in medical imaging, fiberoptic technology and interventional radiology [1]. Management of airway bleeding is a high-risk, low-volume procedure which lacks dedicated training in nearly half of Pulmonary and Critical Care Medicine (PCCM) fellowship programs [2]. A scalable educational intervention to address such a gap may play an important role in patient safety and outcomes. Existing simplified frameworks to manage massive hemoptysis [3] have potential for cognitive offloading in this high stress scenario, but real situational experience is both crucial and difficult to guarantee. Simulation-based education (SBE) may provide an answer to the concern of inconsistent trainee exposure. Prior studies have established the effectiveness of SBE in difficult psychomotor tasks such as emergent airway management [4] and complex situations such as advanced cardiac life support [5], although objective skills assessments of massive hemoptysis management have not been described. In contrast to traditional SBE, simulation-based mastery learning (SBML) reduces or eliminates variability in trainee skills after an educational intervention and assures each learner achieves a minimum passing standard (MPS) [5-9]. Our aim was to modify an existing high-fidelity simulation for massive hemoptysis to create a rigorous, competency-based standard and assess the impact of this intervention.

METHODS:

A curriculum simulating massive hemoptysis management has been conducted semiannually since 2020 at our academic PCCM fellowship program and among advanced practice providers (APPs). This simulation (Figure 1), which takes place in the hospital bronchoscopy suite, utilizes a high-fidelity manikin, real bronchoscopy equipment and involves the interprofessional bronchoscopy team. In 2021 a survey was conducted among 9 participants. These results were used to develop an asynchronous “flipped classroom” session to prime learners and to refine the curriculum to an SBML framework including rapid cycle deliberate practice [10] and individualized feedback. A novel 27-item

checklist-based skills assessment was created using a modified Delphi method and will be subjected to a Mastery Angoff standard setting procedure in which expert judges will review individual checklist items and estimate the percentage of trainees who would perform each item correctly at posttest, creating an MPS. Pre- and post-intervention skills and learner perceptions of self-confidence will be evaluated. This will be piloted in January-February 2023 on the PCCM fellowship class of 2025.

RESULTS:

A novel SBE for massive hemoptysis was developed. In our 2021 survey of 9 learners (8 PCCM fellows, 1 thoracic surgery APP), all respondents agreed that the simulation experience would improve team performance in bronchoscopy emergencies, and that the manikin realistically simulated massive hemoptysis. Effective use of debriefing, realistic team dynamics and the opportunity to use a bronchial blocker were identified as most valuable. More hands-on time for learners was identified as an area for growth. The scenario has been modified to incorporate an SBML framework to facilitate skills transfer. Our 27-item checklist (Table 1) will assess learners' abilities to independently manage massive hemoptysis.

CONCLUSION:

We created a novel simulation for massive hemoptysis, a high-risk, low-volume procedure with high mortality that lacks established training standards among PCCM fellows. Pilot results suggest that our experience is realistic to technical components of procedure and an effective exercise in inter-professional team dynamics. Our SBML curriculum will empower learners to safely and competently manage airway bleeding emergencies on future patients.

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Oregon Health & Science University and Portland VA Medical Center

Sleep Medicine Fellowship Orientation: Sleep Medical School

Authors: Tanvi Mukundan, MD; Jeremy Wearn, MD; and John Mastronarde, MD

BACKGROUND/ RATIONALE:

Our Sleep Medicine Fellowship is based at Oregon Health & Science University and the Portland VA Medical Center. Historically, the fellowship orientation was brief and primarily focused on orientation to the electronic health record at our respective institutions.

In 2021 we launched Sleep Med School at our program, a month-long orientation during July of each year. The goal of this program is to provide incoming sleep medicine fellows with foundational lectures and hands on experience during a period free of primary clinical responsibilities. Didactic lectures and online resources are provided which review basic sleep physiology and common sleep disorders. Hands on sessions include introduction to positive airway pressure devices with a sleep technician and observation of new and follow up patient care visits in CPAP clinic with a sleep technician. Fellows spend one evening in the sleep lab observing a patient set up for a sleep study and the initial recording of the study with a similar opportunity to observe set up of a home sleep apnea test for a patient.

Embedded within the month-long program is a longitudinal polysomnography (PSG) curriculum. This curriculum, which occurs throughout the fellowship, is designed to provide guided introduction to review and interpretation of PSGs with a graduated increase in fellow interpretation responsibilities. During sleep medical school, the fellows are taught basics of PSG staging and scoring in 4 individual sessions. Each session reviews topics such as electroencephalogram staging, respiratory event scoring, movement disorder scoring, and pediatric specific staging and scoring. After each of these sessions, the fellows are given dedicated time to practice the skill with a preselected PSG to allow for hands on review of this complex information. This PSG is then reviewed with a faculty member to ensure retention of the material. This pattern is repeated until a full PSG is completed, and fellows then independently score a full PSG with subsequent review and discussion. At the end of sleep med school, the fellow is expected to be able to interpret 2 PSGs and 1 HSAT independently with review with a faculty for discussion.

Dedicated sessions are also in place to review clinical templates and optimal patient flow in clinic. Learning resource availability is reviewed with a specific session done by a medical librarian on optimal use of the online medical library resources. Quality improvement resources and research opportunities for fellows are reviewed during specific sessions

PSG Goals:

- 7/8: Stage 200 epochs from scratch
- Week of 7/11: 1 PSG
- Week of 7/18: 1 PSG + 1 HSAT
- Week of 7/25: 2 PSGs + 1 HSAT

Self Study:

Required:

- Prior to dental clinic: Dental Webinar
- TMS modules, computer set up, etc
- AASM Fatigue Module
- [Choose Sleep Webinars:](#)
- Hypersomnolence (Trotti)
- RBD (St. Louis)
- Technical Aspects of PSG (Epstein)
- NREM Sleep Parasomnias (Schenck)
- What the Savvy Sleep Fellow Should Know About Pediatric SDB (Rosen)
- Chronobiology (Khalil)
- Advanced PAP Therapy (Selim)
- Neurobiology of Sleep (Scammell)
- [ATS Sleep Modules](#)

Recommended:

- [Choose Sleep Webinars:](#)
- EEG Engineering Principles, Artifact, and Sleep Neuroanatomy (Guardia)
- Patient Centered Medicine and Five Finger Approach to Sleep Medicine Clinical Problem Solving (McCarty)
- Trauma Associated Sleep Disorders (Mysliwiec)
- NIV in NMD (Iber)
- Overview of Sleep Disordered Breathing (Kapur)
- Pediatric OSA (Perez)
- Case Study on VAPS (Wolfe)
- It's Time for Circadian Neurobiology (Goldstein)
- [ATS Adult Sleep Medicine Reading List:](#)
- [ATS Pediatric Sleep Medicine Reading List](#)

including an informal research roundtable discussion with research faculty and the fellows. Wellness, mental health, and suicide prevention resources are also reviewed in specific sessions.

JULY 2022: SLEEP MED SCHOOL SCHEDULE

Mon	Tue	Wed	Thu	Fri
				1 OHSU Orientation: GME check-in All day
4 FOURTH OF JULY: DAY OFF!	5 OHSU and VA Orientation	6 OHSU and VA Orientation	7 Sleep Med School Starts! • 9-12: General Fellowship Overview: Curriculums, Schedules, Quarterly Goals, Research/QI, Tour, introductions, etc • 1-end of day: pending computer needs	8 • 8-9: Computer set up • 9-10 OSA basics • 10-12: Intro to PSG and intro to EEG staging at VA • 1-end of day: stage sleep study
11 • 9-10: Respiratory Physiology During Sleep • 10-11: Cardiac Physiology During Sleep • 11-12: Normal Sleep Across the Lifespan • 1-2: HSAT overview • 2-end of day: Review Staged Study	12 • 9-10: Peds epic templates, Cadwell PSG system overview at OHSU • 10-11: Pediatric Insomnia • 11-12: OHSU Adult Overview: Epic Templates, insurance requirements for devices, OHSU adult call, patient safety reporting • 1-end of day: Intro to CPAP and Data Downloads and Shadow in CPAP Clinic	13 • 8-10: Research Roundtable • 10-12: Computer Nuts and Bolts: CPRS templates, CPRS organization, Patient Safety Reporting and Communication • 1-2: Intro to Resp Scoring • 2-end of day: Score OSA study	14 • 8-12: shadow in VA clinic • 1-end of day: Review OSA study with faculty	15 • 10:30-12: NIPPV intro • 1-3: Cadwell and G3 hands on orientation
18 • 8-12: shadow in OHSU clinic • 1-2: Intro to Scoring PSG Movements • 2-3: Library overview part 1	19 • 10-11: Peds OSA • 11-12: Learning Resources at OHSU, MH/healthcare resources for trainees • 1-end of day: Read Cadwell PSG/HSAT/Self Study	20 • 9-10: Suicide Screening and MH Resources for pts • 10-11: CBTI overview • 1--end of day: Review PSG and HSAT with OHSU faculty	21 • Day time hours off • 6PM-midnight: Spend time in sleep lab participating in set up, etc. if possible, stay through initiation of CPAP in split night PSG at VA	22 • Post night self-study day • 11AM: AADSM Dental Sleep Medicine Talk
25 • 10-11am: Overview of ITE/Board expectations • 11-12: Library Overview Pt 2 • 1-End of Day: Read PSG/Self Study	26 • 8-12: shadow in VA clinic • 1-2:30: Overview of Scholarly Activity Expectations, Journal Club, Case Conference presentations • 2:30-end of day: Read PSG/Self Study	27 • 8-12: shadow in VA clinic • 1-2: How to be an Effective Consultant • 2-End of Day: Read PSGs/Self Study	28 • 8-9: Legal Elements of Sleep • 9-10: Neurophysiology of Sleep • 10-end of day Review PSGs with faculty	29 • 8-12: shadow in dental clinic • 12-1: Billing and Coding • 1-4: self study; computer modules

University Hospitals Cleveland Medical Center

Leadership Curriculum for All Critical Care Medicine Fellows

AUTHORS: Claire Irons, MD

RATIONALE:

Although leadership training in the critical care setting is not new, its critical importance became clear during the rise of the COVID-19 pandemic, where trainees needed to embrace a changing healthcare landscape, foster teamwork, and innovate in order to deliver quality patient care. In a national survey, 73% of program directors agreed that leadership education should be a mandatory part of fellowship training. However, 68% reported less than three hours of leadership training during all three years, often citing barriers such as a lack of time to develop/deliver material and lack of funding (1). The purpose of this project is to provide a formal and dedicated leadership curriculum for all fellows training in critical care medicine at our institution, recognizing that regardless of whether fellows desire leadership positions following training, all critical care physicians will be expected to lead.

METHODS:

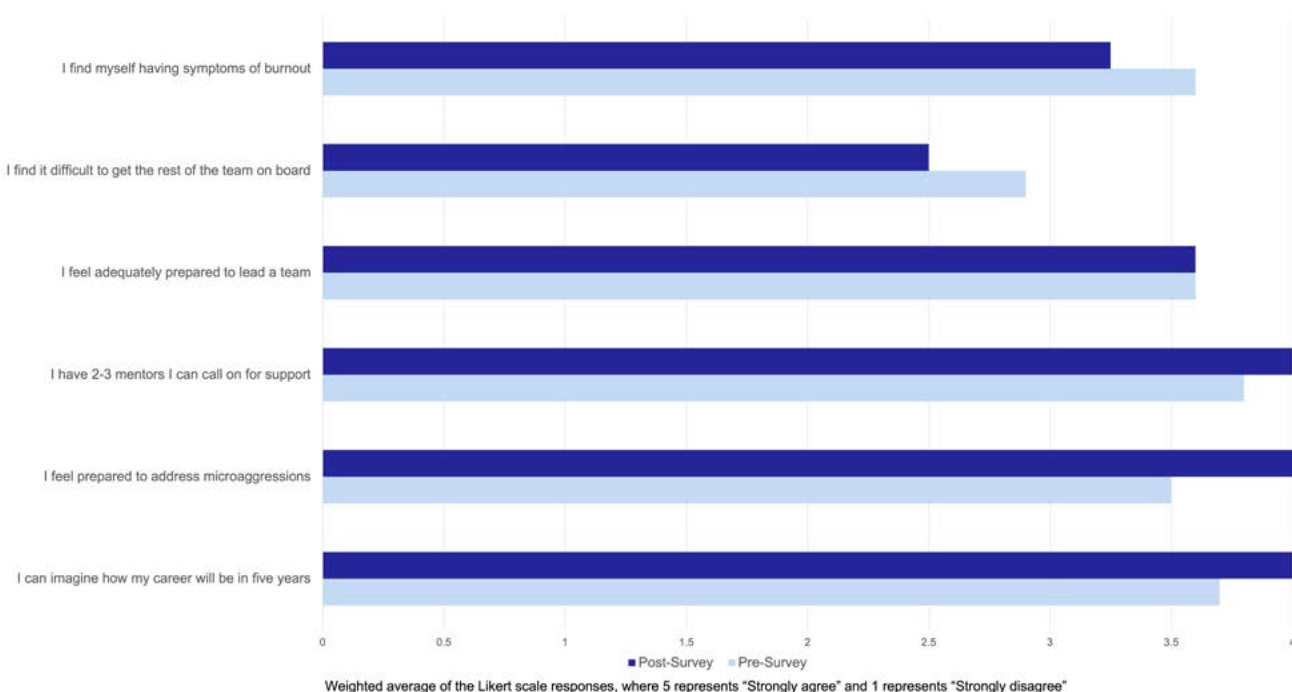
In a collaboration between our program and Weatherhead School of Management, we developed a leadership curriculum for critical care fellows.

Topics include understanding self (learning styles, career anchors, developing a 5–10-year plan), managing teams (crisis leadership), and influencing the environment (women in leadership, diversity equity and inclusion). These sessions (didactics and small group format) were each one hour in duration and delivered over a six-month time span with zoom and in-person option. Participants for this study included critical care fellows from medicine, anesthesia, emergency medicine, and neurology programs. Faculty were also encouraged to attend and participate.

A learning needs assessment, individual session assessment, and post-course survey were conducted. Long-term outcomes evaluating fellow participation in leadership positions after graduation are being collected.

RESULTS:

Fifteen fellows completed the learning needs assessment, and ten out of fifteen fellows completed the post-course survey. There was an improvement in pre and post survey questions (figure 1). Following the course, 9/10 participants reported



that they could imagine how their career would be 10 years after fellowship, and most fellows felt adequately prepared to lead a team through the next pandemic. 9/10 participants felt prepared to address microaggressions in the workplace. 100% of respondents reported the leadership curriculum was helpful to their career, and they would recommend repeating it.

CONCLUSIONS:

The intensive care unit will continue to be directly affected by the changing landscape in healthcare, and equipping fellows to become leaders in a field constantly affected by this change will benefit the healthcare system as a whole.

University Hospitals Cleveland Medical Center - 2

Mortality Rounds: Fellow-Led Multidisciplinary Intensive Care Unit Rounds Discussing of End-of-Life Care

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RATIONALE:

The medical intensive care unit (MICU) has a nearly 30% patient mortality rate. Caring for dying patients comes at an emotional cost for medical caregivers, with over 50% of physicians reporting burnout. Debriefing sessions help reduce burnout and improve resident wellness. Residents who debrief with attending physicians overwhelmingly report educational benefits and recommend continuation. To our knowledge, there is no data evaluating multidisciplinary debriefing

sessions. We initiated “Mortality Rounds” (MR) to evaluate how multidisciplinary discussions impact fellow and resident education and caregiver well-being in the MICU. We additionally evaluated the impact of a patient diagnosis of coronavirus-19 (COVID-19) on care providers.

METHODS:

A learning needs assessment was sent before the initiation of MR.

Table 1:

Question:	Strongly Agree:	Agree:	Disagree:	Strongly Disagree:
1. Compared with other teaching sessions or conferences, Mortality Rounds was very worthwhile to me:	51.56%	46.8%	1.6%	0.0%
2. My ability to take care of dying patients has improved as a result of mortality rounds:	33.1%	61.3%	5.6%	0.0%
3. My ability to cope with dying patients has improved as a result of Mortality Rounds:	37.4%	56.9%	5.7%	0.0%
4. Mortality Rounds has improved the overall ICU experience for me:	45.6%	50.4%	4.0%	0.0%
5. Mortality rounds should be incorporated into all ICU rotations for medical trainees:	56.8%	41.6%	1.6%	0.0%
6. Too much time was spent discussing end-of-life issues:	8.8%	10.4%	44.8%	36.0%
7. I found it beneficial that mortality rounds were multidisciplinary:	65.9%	34.1%	0.0%	0.0%
8. I feel that deaths from COVID-19 affects me:	More than other patients (22.4%)	The same as other patients (75.2%)	Less than other patients (2.4%)	

Questions 1-7 adapted from: Smith L, Hough CL. Using death rounds to improve end-of-life education for internal medicine residents. J Palliat Med. 2011

At biweekly multidisciplinary meetings the multidisciplinary MICU team, consisting of attending physicians, residents, fellows, palliative care, nurses, physical, occupational, and respiratory therapists discussed patients who had died during the preceding two weeks. MR was led by the MICU fellow who had received a brief 30-minute training session.

Discussions focused on the topics of patient symptom and support, ethical/moral concerns, recollections, self-application and personal fears, and self-care. A moment of silence was held, and condolence cards signed to be sent to families in conclusion. An anonymous survey was completed. At the end of the study period, the same learning needs assessment was sent to residents for evaluation.

RESULTS:

A pre-intervention survey showed among residents rotating in the MICU, 0.0% were “very satisfied,” 13.1% “satisfied,” 45.9% “neutral,” 37.7% “dissatisfied,” and 3.3% “very dissatisfied” with current debriefings after a patient death. Twenty-one MR sessions were held from January 20, 2022 through October 27, 2022 with 169 respondents. The post-MR Survey data are shown in Table 1. At the conclusion of the study period, residents answered the same satisfaction survey: 8.0% were “very satisfied,” 40.0% “satisfied,” 44.0% “neutral,” and 8.0% were “dissatisfied.” Overall, 64.0% of respondents had attended a Mortality Rounds session during their MICU rotation.

Seventy-eight percent of MICU fellows reported MR added to their educational experience, 67.0%

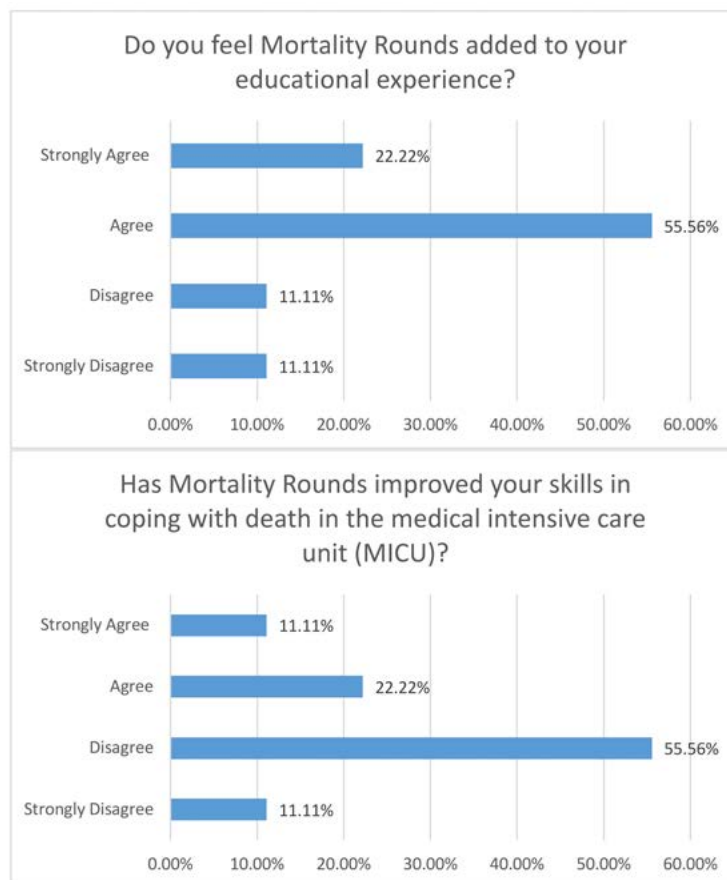


Figure 1: Evaluation of 9 fellows in pulmonary and critical care after mortality rounds was implemented

felt it improved their skills in coping with death in the MICU, and 100% felt it was beneficial for MR to be multidisciplinary (Figure 1). One-quarter of all participants reported deaths from COVID-19 affected them more than other deaths.

CONCLUSIONS:

Fellow-led multidisciplinary Mortality Rounds were perceived to enhance the MICU educational experience for both residents and fellows as well as the ability to cope with caring for the dying patient.

University Hospitals Cleveland Medical Center - 3

Swipe for Success: A Novel Platform for the Humble Fellowship Manual

Authors: Layla Al Bizri MD, Fellow, Pulmonary and Critical Care Program at University Hospitals Cleveland Medical Center; Jojo Alunilkummannil MD, Fellow, Pulmonary and Critical Care Program at University Hospitals Cleveland Medical Center; Reem Al Bizri, BS in Computer Science; Layla Sankari MD, Associate Program Director, Pulmonary and Critical Care Program at University Hospitals Cleveland Medical Center; Maroun Matta MD, Program Director, Pulmonary and Critical Care Program at University Hospitals Cleveland Medical Center

INTRODUCTION:

The Accreditation Council for Graduate Medical Education (ACGME) requires programs to distribute competency-based goals and objectives to fellows and faculty yearly. A significant amount of time and resources is diverted annually to the creation and update of these goals often in a fellowship manual form that is distributed either electronically or on paper to the trainees. The usage and impact of these manuals on fellows' education has not been fully elucidated. We hypothesized that having the manual available in a mobile application would improve its usage by the fellows and its impact on the training.

METHODS:

Our adult PCCM fellowship training includes five fellows per year of training for a total of fifteen fellows. Before the launch of the mobile application, we conducted a program wide survey to assess the use, impact, and areas of potential improvement in the existing manual. We subsequently worked to incorporate this feedback into the 2022 updated manual. In addition to the nuts and bolts of a fellowship manual such as program policies, call schedules and rotation objectives, we included the ATS reading list presented with hyperlinks to the individual articles.

We partnered with a computer science graduate who was able to transfer the data to an application form on mobile platforms like Android and iOS. Features such as: login/register account, saving notes, checklists, and push notifications were used. The mobile application was then circulated to the fellows on both android and apple devices to use (Figure 1). App

Figure 1: Application Interface

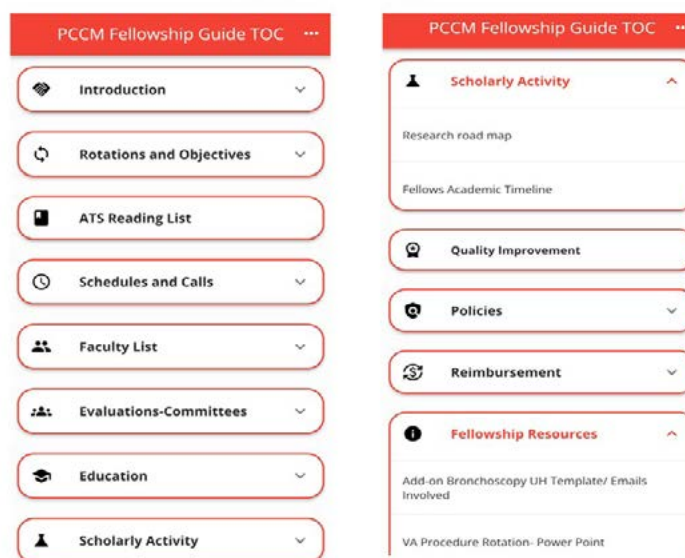


Figure 2a: Pre-Mobile Application Survey

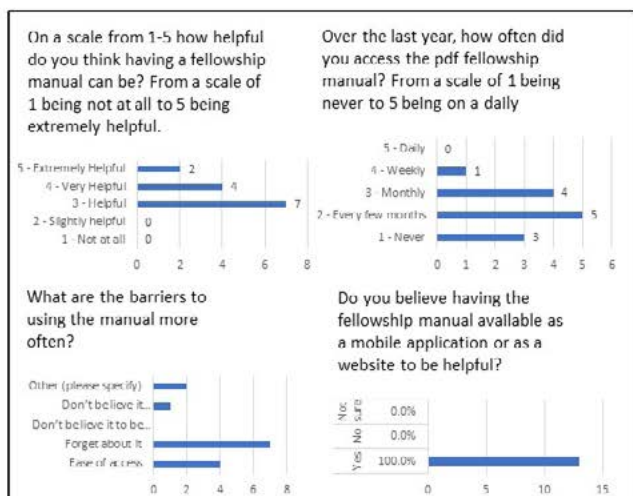
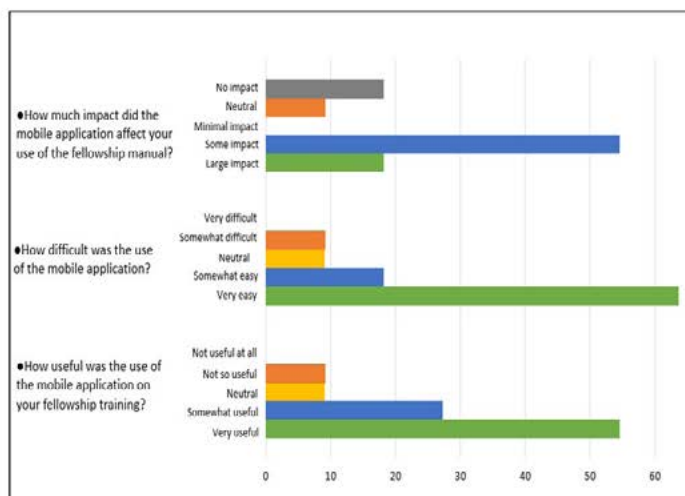


Figure 2b: Post-Mobile Application Survey



usage data was collected.

A survey was done four months post launch to evaluate fellows' perception of the usefulness of the mobile application. Long term outcomes including rotation evaluations, in-training scores, board pass rates are being collected.

RESULTS:

Thirteen out of fifteen fellows (87%) completed the initial learning needs assessment. All fellows felt that having a fellowship manual can be helpful, very helpful, or extremely helpful, however; eight fellows replied that they were using the pdf format less than monthly. The major barriers to using the manual were "forgetting about it" and "ease of access". All fellows felt that the mobile application form would improve the manual's use (Figure 2a). Usage data from the app at 4 months showed that the average number of logs by fellows was 3.6 times/month.

Eleven out of fifteen fellows (73%) completed the post-app survey. Nine of the eleven fellows (82%) found the app format very useful or somewhat useful, and nine (82%) found the app very easy or somewhat easy to use. Eight fellows (73%) believed that the app format will have a large impact or some impact on their training (Figure 2b).

DISCUSSION:

An app format can increase fellows use of the fellowship manual and possibly have an impact on the quality of their training. Although we have partnered with a computer science graduate, the above steps can be conducted on freely available application building platform that do not require coding such as Appy Pie, which would eliminate the need for a computer programmer, and can be carried out by a trainee or a program coordinator, making this a sustainable process.

University of Alabama Birmingham - 1

Implementing a Structured Multidisciplinary Critical Care Curriculum for Critical Care Fellows.

Authors: Drew Robinson, MD; Sheetal Gandotra, MD

BACKGROUND:

Critical care medicine includes many subspecialties that must function as a team in order to optimize patient care. The importance of interdisciplinary education has been increasingly recognized to improve collaboration and teamwork among disciplines. However, education in various critical care fellowships is typically siloed with limited curricular collaboration. Guidelines recommend that education in critical care should encompass all specialties that provide care in the intensive care unit. [2] Our goal was to develop a critical care curriculum incorporating various critical care specialties including medicine, anesthesia, surgery, and neurology.

METHODS:

We developed a collaborative interdisciplinary educational curriculum for fellows from anesthesia critical care, neuro critical care, pulmonary critical care, and trauma surgical critical care, called the Multidisciplinary Critical Care Curriculum (MDCCC). The curriculum was designed by the Program directors of all the critical care fellowship programs at UAB. Over the course of several meetings, using the ACGME Critical Care Common Program Requirements and the previously well-developed critical care education components of the Pulmonary Critical Care fellowship curriculum, the program directors generated a list of common topics that should be covered during MDCCC. The curriculum begins with didactics and workshops during “Introduction to Critical Care Fellowship” from July to August, including orientation lectures for the first two weeks of the year. Subsequently, the curriculum runs during a two-hour weekly timeslot from noon to 2pm, which was agreed upon by the program directors as protected education time. The remainder of the one-year curriculum is comprised of fellow-led sessions including Critical Care Case Conference, Radiology Conference, Morbidity and Mortality Conference, Journal Club and faculty presentations. We also include a monthly small group workshop, during which the fellows rotate through the sessions on the following topics: Cardiology Cases, Tracheotomy Cases, Patient Safety Cases, Ventilator Wave Forms, Point of Care Ultrasound Image Review. [Table1] The program directors agreed to aim for at least two faculty from each discipline being present for each

Week	Tuesday – MDCCC Series
Orientation + Nuts and Bolts Didactics: July 1 - August 31 • Didactic Lectures by Faculty	
1	12PM: Critical Care Case Conference 1PM: Critical Care Master Clinician*
2	12PM: Journal Club 1PM: Critical Care Master Clinician*
3	12PM: Critical Care Case Conference 1PM: Interactive CC Sessions: Group A: POCUS Image Review Group B: Ventilator Waveform Review or Trach Cases Group C: Nov/Jan/March/May = Neuro Cases; Oct/Feb/April/June = Cardiology Cases
4	12PM: M&M 1PM: Radiology Conference
5	12PM: Overflow date for Town Hall or Extra Fellow Lecture Make-up 1PM: Overflow date for Critical Care Case Conference or other Make-up
* Topics that are considered foundational to the practice of critical care medicine. Given by faculty.	

Table 1: MDCC Curriculum Layout

conference. We are also assessing fellow and faculty perception on the importance of multidisciplinary critical care education, topics that are valuable inclusions in this curriculum, and the prior critical care curricula for each of the involved fellowships, using pre and post curriculum implementation RedCap surveys. Our multidisciplinary critical care curriculum was initiated in July 2022 and will last until the end of the academic year in June 2023.

DISCUSSION:

One unique aspect of critical care is that there are several paths that can be taken to become an intensivist. Another is the importance placed on multidisciplinary involvement. Care provided by each member of the team including nurses, respiratory therapists, techs, physical therapists, occupational therapists, and pharmacists is essential to the delivery of critical care medicine. Furthermore, interprofessional education in healthcare has become increasingly important and essential in delivering patient-centered care. [3] Interprofessional education has also been shown to improve learner knowledge, skills, and attitudes. [3] However, training is classically

siloes and even work environments tend to be partitioned into neurological, medical, or surgical intensive care units. This likely results in reaching a ceiling in education that can be raised by increasing collaboration. Future additions to this curriculum include adding an interprofessional component.

CONCLUSION:

We developed a multidisciplinary critical care curriculum in the form of weekly two-hour sessions, comprised of fellow and faculty led conferences as well as small group sessions, attended by faculty and fellows in all the critical care disciplines (anesthesia, pulmonary, neuro, and surgical critical care) at UAB to increase collaboration and improve the quality and breadth of critical care education. This curriculum can be shared and used in other institutions that have multiple critical care training programs.

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University of Alabama Birmingham - 2

Developing and Implementing a Fellow Tele-ICU and eICU Rotation

Authors: Reed LaHaye, MD; Sheetal Gandotra, MD

RATIONALE:

The use of tele-critical care services increased rapidly over the last three years. However, due to rapid innovation and implementation, limited formal graduate medical education was provided on how to effectively perform tele-medicine. University of Alabama Birmingham (UAB) has a robust virtual critical care program comprised of two distinct care models: tele-critical care (tele-ICU) through which patients located at rural community hospital partners receive consultative care, and electronic intensive care unit (eICU), which provides 24-hour monitoring and care for patients in the UAB ICUs. Many of our clinical faculty provide virtual care for critically ill patients, however, none received formal training in telemedicine during fellowship, including nearly ten faculty members who joined the faculty since 2020. Now that our faculty are well-versed in the tele-medicine program, we felt it was vital to develop and implement a tele-critical care/eICU rotation experience for our pulmonary critical care (PCCM) and critical care (CCM) fellows.

METHODS:

We designed and implemented a two-week Tele-ICU/eICU rotation for PCCM and CCM fellows. The UAB tele-ICU/eICU rotation provides an excellent opportunity for fellows to gain an understanding of remote critical care management in under-resourced settings, while learning tangible skills for managing critically ill patients in the virtual setting with the supervision of a faculty member. Table 1 outlines the fellow’s rotation schedule. During eICU shifts, the fellow works with a team of nurses and a faculty member, assessing new admissions and managing acute issues for critically ill patients located at UAB, assisting the in-house teams as needed. The fellow also participates in transfer request phone calls from outside hospitals. During

Tele-ICU, the fellow provides consultative critical care services to patients admitted to the ICU at Bryan Whitfield Hospital, a community hospital with a ten bed ICU and no local critical care physicians. Fellows review the medical record, evaluating new and follow up patients in the ICU daily, rounding via a rolling camera cart with the bedside nurse, and the faculty member. Fellows address all critical care issues, communicating plans with nursing, primary team (hospitalist and/or nurse practitioners), and family. Documentation occurs in the hospital’s electronic medical record.

We also created a guided discussion curriculum to pair with the clinical experience on this rotation. Fellows and faculty are provided with two articles and discussion questions in four topic areas relevant to virtual critical care: 1) Models of Tele-Critical Care, 2) Health Care Disparities, 3) Cognitive biases and heuristics, and 4) Emergency Medical Treatment and Labor Act (EMTALA) and Transfers. The fellow and faculty receive an introductory email, including rotation documents reviewing the curriculum and the Milestones-Based Goals and Objectives. Fellows are completing pre and post surveys to further evaluate the Tele-ICU/eICU curriculum, as they complete the rotation throughout the year. Fellow feedback on the rotation has been overwhelmingly positive thus far.

DISCUSSION:

Fellowship education has not routinely included formal curriculum to teach skills necessary for providing virtual critical care. Capitalizing on our growing telemedicine program, we designed and implemented a tele-ICU/eICU rotation paired with a faculty-fellow guided discussion curriculum on important relevant topics. Given the rapid increase in the use of tele-critical care internationally, PCCM and CCM training programs have an opportunity

Table 1

Week 1						
Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
	eICU	Tele-ICU	Tele-ICU	Tele-ICU	Tele-ICU	
Week 2						
Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
eICU	eICU	Tele-ICU	Tele-ICU	Tele-ICU	Tele-ICU	

**eICU shifts occur 5:30pm-10:30pm, our eICU hub located at UAB Highlands Hospital

**Tele-ICU shifts occur from 8am-5pm.

to develop curriculum to ensure that fellows are graduating with skills to provide remote critical care services.

CONCLUSION:

To our knowledge, our institution is unique in providing a tele-critical care/eICU training opportunity during fellowship. This is a vital area of curricular growth given the ubiquitous use of virtual critical care. We provide a curricular model for this training that can be implemented by other fellowship programs, particularly those that also have robust Tele-Medicine programs.

University of Alabama Birmingham Heersink School of Medicine

A Track for Trachs: Implementation of a Formal Curriculum, Checklist, and Feedback Protocol in Trainees Performing Percutaneous Tracheostomy at a Tertiary Academic Center

Authors: Melissa Jordan, MD; Edwin Gunn MD; Jonathan Kalehoff, MD; Ross Schumacher, MD; Daniel Scullin, MD; John Patrick Simmons, MD

BACKGROUND:

The Division of Pulmonary & Critical Care at the University of Alabama at Birmingham (UAB) recently instituted a percutaneous dilational tracheostomy (PCT) team to accommodate the increasing demand for long term ventilation in our patient population. Fellows without a surgical background have been performing tracheostomies more frequently at our institution without a formalized educational pathway. Therefore, we designed and implemented an innovative formal tracheostomy curriculum and evaluation process to improve fellow educational experience and procedure feedback. To our knowledge, this is the first PCT educational curriculum that has been developed that provides educational materials regarding PCT placement and tracheostomy care as well as standardization of procedural steps and trainee evaluation.

METHODS:

We designed a tracheostomy curriculum based on literature review along with a standardized process for the evaluation of fellows shortly after PCT placement to improve fellow education, and improve procedural competency and feedback. The curriculum includes providing trainees with a comprehensive tracheostomy educational primer, procedure checklist, and a sixty-minute didactic lecture outlining fundamental aspects of PCT placement. Knowledge acquisition was assessed by comparing baseline knowledge on a pre and post-knowledge assessment. Procedure feedback and self-reported competency were assessed by comparing a pre and post-feedback/competency survey. Fellows were encouraged to use a procedure checklist to ensure procedure standardization.

RESULTS:

The curriculum piloted August 2022 through January 2023. Twelve first and second year fellows received the curriculum and completed the pre and post- test knowledge assessment and feedback/competency

Figure 1: Fellow Perception of PCT Procedure Education, Feedback, and Confidence Pre and Post-Intervention

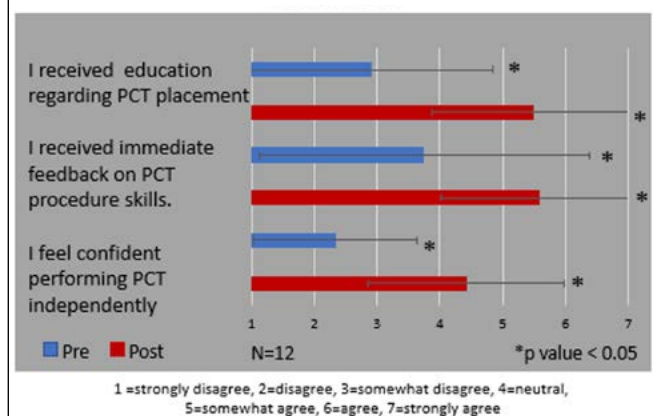
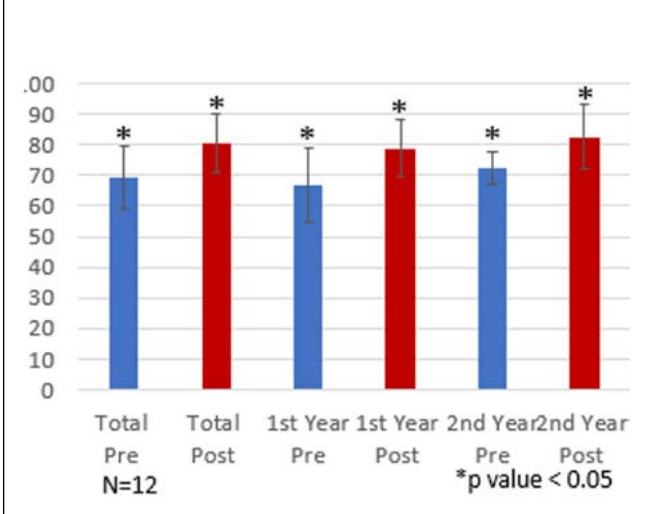


Figure 2: Percent Score Pre versus Post-Intervention



survey. Upon conclusion of the study, the fellows reported improvement in procedure education by 2.6 points, improvement in procedure feedback by 1.75 points, and improvement in self-reported competency by 2.1 points; on a 7-point Likert scale (p <0.05) (Figure 1). The first year fellows (n=7) scored 67% on

the pre-knowledge assessment compared to 78.7% on the post- knowledge assessment ($p < 0.5$). The second year fellows scored 72.6% and 82.6% on the pre and post-knowledge assessment respectively ($p < 0.05$). (Figure 2) A total of 18 PCTs were performed during the timeframe. A procedure checklist was used 77% of the time.

DISCUSSION:

PCT is a procedure that is becoming more frequently performed by pulmonary and critical care physicians. It is imperative to structure PCT education and to standardize the PCT procedure to improve patient outcomes as well as PCCM fellow training and competency. Our pilot PCT curriculum did show improvement in PCT procedure knowledge without knowledge decay at 6 months. We also demonstrated improvement in procedure education, procedure feedback, and self-reported competency. The utilization of procedure checklist was lower than expected. Limitations to this study was short –term follow –up and low PCT procedures. Next steps will be to implement curriculum with longer follow-up and improving checklist adherence.

University of Colorado

Ultrasound Guided Pleural Biopsy: Description of a Model and Trainee Preferences with Respect to Technique

Authors: Vibhu Sharma, MD, MS; Anna Neumeier, MD; Melissa New, MD; University of Colorado, Anschutz Medical Center, Aurora, CO

RATIONALE:

Ultrasound guided pleural biopsies have high diagnostic yield when thickened pleura (> 4.5 mm) nodular lesions are seen. An ultrasound-based training model for pleural biopsies has not been previously described. In plane or out of plane techniques for biopsy have been described but trainee preferences for either are unclear.

METHODS:

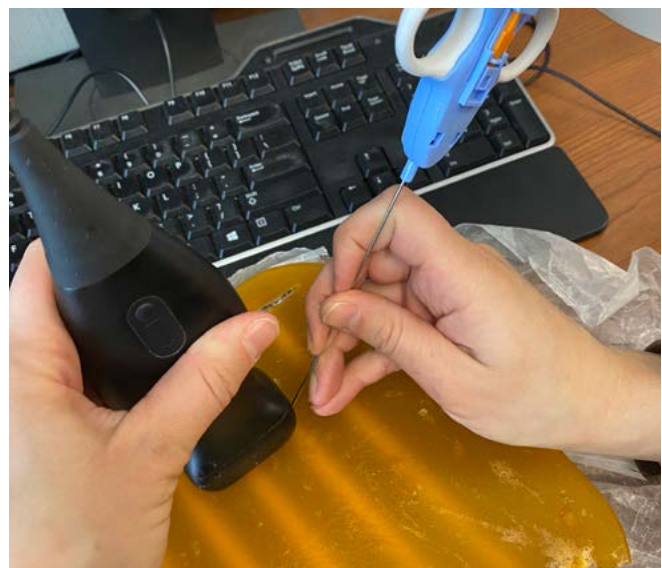
A structured curriculum using a gelatin-based model was developed with short chalk talk didactic to explain use of a Trucut cutting needle to perform pleural biopsies. Pulmonary Fellows (Year 1-3) used a training model to practice biopsy in the out of plane (linear array probe set to 4 cm depth, cephalocaudal orientation, needle introduced at right angle to the probe) and in plane technique (probe in transverse orientation, needle introduced in plane). An assessment model using wood dovels to simulate ribs and gelatin coloring to simulate skin-intercostal / muscle-pleura-pleural effusion interface was used to assess biopsy technique. Two attempts per Fellow in the in-plane technique and one in the out of plane technique were scored; 5 points scored if technique was satisfactory (needle tips visualized real time) and 0 if not satisfactory (needle tips not visualized real time). Adequate visualization of cutting needle across the pleura was similarly scored. Trainee preferences for in-plane and out of plane techniques were scored and compared, confidence in pleural biopsy technique was also assessed prior to and after training session.

RESULTS:

20 Fellows performed 40 in plane attempts and 20 out of plane attempts. The target (thickened pleura in between ribs) was visualized adequately in 92% of in-plane attempts and 85% of out of plane attempts. The needle tip was visualized in real time in 92 % of the in-plane attempts and 65% of the out of plane attempts. Biopsies were successfully performed while maintaining stable visualization of introducer needle and cutting needle in 72% of in-plane and 45% of out of plane attempts. More fellows strongly preferred the in-plane technique (p= 0.0024). 94% of trainees were confident of performing pleural biopsy after training session compared with 17% prior to session.

CONCLUSION:

A pleural biopsy model using gelatin is described. Trainees strongly preferred in plane to the out of plane technique. Real time cutting needle visualization was satisfactory in a higher proportion of in-plane than out of plane attempts despite target being visualized adequately in either plane.



University of Toronto Adult Respiriology Training Program

Pilot Virtual Pulmonary In-training Oral Exam in the Era of COVID-19

Authors: Harvey H. Wong, MD, FRCPC, MScCH Department of Medicine, Division of Respiriology, Sunnybrook Health Sciences Centre, University of Toronto, Ontario, Canada

Christopher K. Li, MD, FRCPC, DABSM Department of Medicine, Division of Respiriology, St. Michael's Hospital, University of Toronto, Ontario, Canada

BACKGROUND:

The digital world has played an important role in mitigating the impact of the COVID-19 pandemic on medical education. However, there is still a paucity of reported virtual methods for assessing postgraduate medical learners, particularly in non-surgical specialties.

OBJECTIVE:

The aim of this paper is to describe the process of conducting a virtual in-training oral exam for a training program in adult pulmonology at a large Canadian academic center during the COVID-19 pandemic, and report on its perceived effectiveness at assessing resident performance.

METHODS:

Eleven residents and 3 experienced examiners completed the in-training examination. The examination was conducted entirely on Zoom. A voluntary post-exam survey was conducted anonymously.

RESULTS:

All respondents of the survey felt that the virtual oral in-training exam was able to accurately assess a resident's knowledge and identify gaps in knowledge. Eight out of 11 respondents felt that the educational value of the exam was not affected by the virtual format. The pass rate of the virtual examination was significantly higher than previous in-person in-training exams.

CONCLUSION:

Conducting virtual examinations to assess learners in pulmonary medicine is feasible, with high face validity. Including adequate information to exam participants in an orientation session such as ground rules on how to navigate the clinical cases virtually is essential to ensuring an optimal virtual exam experience.

Wayne State School of Medicine

An Innovative Interactive E-Learning Based Curriculum in Non-Invasive Ventilation For Pulmonary And Critical Care Fellows.

Authors: 1-Asil Daoud, MD, Division of Pulmonary & Critical Care, Detroit Medical Center-Wayne State University School of Medicine, Detroit, MI, USA.; 2-Divya Venkat, MD, Department of Education, John D. Dingell VA Medical Center, Detroit MI, USA , Division of Pulmonary & Critical Care, John D. Dingell VA Medical Center, Detroit MI, USA ; 3-Abdulghani Sankari, MD, PHD, Department of Medical Education, Ascension Providence Hospital, Southfield MI, USA, Division of Pulmonary & Critical Care, John D. Dingell VA Medical Center, Detroit MI, USA

INTRODUCTION:

The ongoing evidence on the importance of Non-invasive ventilation (NIV) use in acute and chronic respiratory failure has highlighted the genuine need to develop a structured, standardized NIV education and training to develop advanced operator skills. However, of what we know, there is no standardized NIV curriculum for rapid mastery. Our objective is to create a standardized NIV curriculum using E-Learning modules and evidence based bedside practices for PCCM fellows.

METHODS:

The curriculum targeted new PCCM fellows (N=8) to assess competency and knowledge in the key topics of NIV management which was divided into two parts. The first part focused on NIV use in acute respiratory failure and the second part focused on NIV use in chronic respiratory failure.

The NIV E-curriculum consisted of the following sequential steps: 1) A baseline written knowledge test consisting of twenty-five multiple choice questions (MCQs), including NIV topics and the latest evidence-based practices in both settings of acute and chronic respiratory failure in the ICU and the pulmonary clinic. Discrimination and difficulty indices were used to narrow to the final 25 MCQs from a pool of 45 questions tested on 4 PCCM attendings and 5 PCCM fellows. 2) A pre- training confidence survey using a 5 points Likert scale for subjective evaluation.

3) Four E-learning evidence-based modules were developed using animated characters for patients and providers, created using two different online platforms.

The first module, 17:30 minute-long, included an introduction to NIV with detailed explanation of the pathophysiology behind using NIV in respiratory

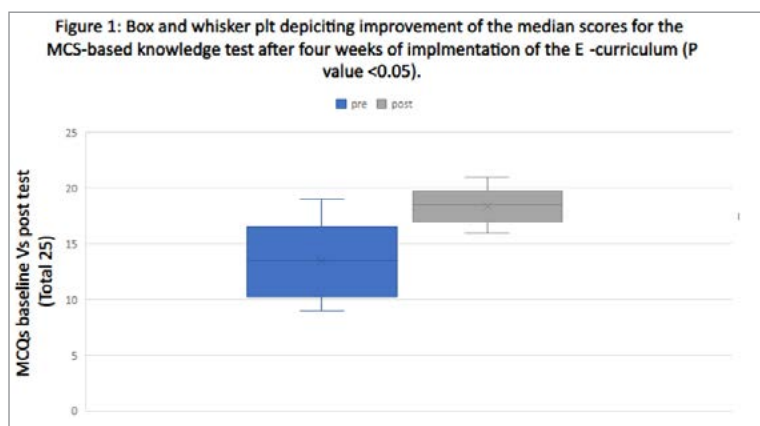
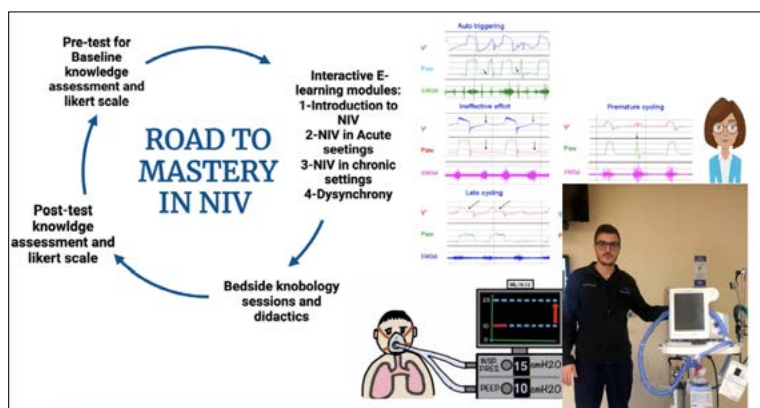


Figure 1

failure. It also included recommendations on initial settings, clinical parameters monitoring, titration, contraindications, and liberation based on most recent guidelines published in ERS and ATS. This first E-learning module had an embedded video with one of the PCCM fellows at WSU (Wayne State University) explaining equipment and knobology.

The second and third modules, 22:15 minute-long, were interactive E-learning modules with two clinical scenarios. The modules start with history and physical examination of two patients; one presenting to the hospital for acute hypercapnic respiratory failure requiring NIV in ICU and the second coming to the pulmonary clinic for follow up on long term home

NIV. These modules have embedded quizzes on next steps in management and evidence-based explanation of incorrect answers. They focused on making decisions to start NIV, initial settings, titration of settings, liberation for NIV in ICU and outpatient follow up.

The fourth module, 6 minutes, included a detailed explanation of the clinical approach to different types of desynchrony.

4) One-hour didactics were conducted, focusing on indications of NIV other than the two clinical scenarios discussed in the E modules. 5) 30-minute knobology session and bedside clinical application of NIV settings. 6) A written knowledge post-test done 4 weeks from baseline testing. 7) A post training confidence survey using a 5 points Likert scale for subjective evaluation.

RESULTS:

In July 2022, 8 first year PCCM fellows completed the training of a total duration of 166 minutes (about 3 hours). The average MCQ score increased from 13.5 ± 3.2 to 18.37 ± 1.6 (Maximum of 25), which equated to about 36% improvement ($P < 0.05$) (figure 1). The confidence survey also revealed improved learner confidence in all competencies with statistical significance ($P < 0.05$). (Table 1).

DISCUSSION AND CONCLUSION:

E-learning is one of the new methods of education which is easily accessible and reproducible over the years. This Internet based curriculum that focused on the NIV use for PCCM trainees and included videos of clinical case scenarios with animated characters, didactics, and bedside small group and knobology sessions, showed improvement in the knowledge and confidence in NIV use for the PCCM fellows.

Table 1: Mean and standard deviation of Pre and post training survey using 5-point Likert scale, with 5 as extremely comfortable. It showed self-reported improvement of in competencies related to the management of NIV in the different clinical settings, chronic and acute respiratory failure. *P value <0.05

NIV competency subjects	Pre-training Mean \pm SD	Post-training Mean \pm SD
NIV management in COPD exacerbation	3.1 \pm 0.8	4.4 \pm 0.5*
NIV management in pulmonary edema	3.3 \pm 0.7	4.1 \pm 0.6*
Patient's selection for NIV initiation in ICU	3.4 \pm 1.1	4.6 \pm 0.5*
Choosing appropriate NIV mode for different clinical scenarios in ICU	2.5 \pm 0.9	4.1 \pm 0.6*
Titration of NIV settings in ICU	2.3 \pm 0.9	4.5 \pm 0.5*
Liberation from NIV in ICU	3.1 \pm 1.1	3.6 \pm 1.2
Management of NIV in chronic hypercapnic respiratory failure in COPD	2.8 \pm 1.0	4.1 \pm 0.6*
Patients' selection for long term home NIV	2.6 \pm 1.1	4.0 \pm 0.5*
Choosing appropriate NIV mode for different clinical scenarios for long term home NIV	2.5 \pm 1.1	4.0 \pm 0.5*
Titration of NIV settings and follow up in outpatient settings	2.3 \pm 0.9	4.3 \pm 0.4
Troubleshooting of NIV issues, such as leak and mask discomfort	2.3 \pm 1.0	4.3 \pm 0.9*



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