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EDUCATION



# INNOVATIONS IN **Fellowship Education**

*2020 Highlights Book*

2020 Highlights Book

EDUCATION

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The following programs were selected by the ATS Training Committee as the standout programs in educational excellence this year. **NYU Grossman School of Medicine** submitted the top innovations abstract for 2020.

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The ATS would like to showcase the additional institutions who submitted an abstract to the 2020 Innovations in Fellowship Education program.

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## PROGRAM DETAILS

The American Thoracic Society greatly values a strong fellowship program as a means of academic and clinical success. In an effort 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) were invited to submit abstracts showcasing a novel and innovative best practice. Abstracts were reviewed and ranked by the ATS Training Committee based on the following criteria:

1. Innovation: How unique is the educational program? What is new and different?
2. Implementation/Sustainability: How was the program implemented and how effective was such implementation? Is this program sustainable?
3. Transferability: How easily might this educational program be adopted by other fellowship programs?
4. 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.

The committee is pleased to honor the following top programs:

### **NYU Grossman School of Medicine**

**SIM-plifying Palliative Extubations: A Two-Part Interdisciplinary OSCE in a Simulation Center to Assess Entrustable Professional Activities**

### **University of Colorado**

**Fellow as Educator: Educational Skills Development During Pulmonary and Critical Care Fellowship Training Through Deliberate Practice and Coaching**

### **University of Washington**

**Fluoroscopy with Bronchoscopy: A Just-in-time Training Video to Fill an Education Gap**

## TOP INNOVATION ABSTRACT OF 2020!

## NYU Grossman School of Medicine

### SIM-plifying Palliative Extubations: A Two-Part Interdisciplinary OSCE in a Simulation Center to Assess Entrustable Professional Activities

**Authors:** Mark H. Adelman, MD; Megan E. Rau, MD, MPH; Brian Kaufman, MD; Joseph Lowy, MD; Susan E. Cohen, MD

**Program Director:** Doreen Addrizzo-Harris, MD

**Associate Program Director:** Deepak Pradhan, MD

#### PROGRAM DESCRIPTION:

Our fellows rotate through four tertiary referral centers and see a wide range of routine and advanced pulmonary diseases, as well as complex critical illnesses. All fellows participate in longitudinal quality improvement and research methods curricula, culminating in a scholarly activity in the third year suitable for peer-reviewed publication. Fellows interested in medical education benefit from a close working relationship between our division and multiple institutional med ed resources hosted by other departments.

#### RATIONALE:

Healthcare professionals require education and practice to master communication and procedure skills, especially in potentially distressing circumstances like palliative extubations. Palliative extubation refers to the withdrawal of invasive mechanical ventilation when, based on a patient's goals of care, it is thought to be prolonging the dying process rather than supporting a reversible critical illness. In order to provide competent and compassionate care for patients and family members, clinical trainees must provide a clear explanation of this complex procedure, show proficiency in its performance, and demonstrate leadership skills when working with an interdisciplinary team.

The objective structured clinical exam (OSCE) is a type of simulated patient encounter that can effectively teach theoretical knowledge, improve hands-on skills, and assess clinical competencies while reducing the risk of harm to patients and providers in high-stakes clinical situations. An OSCE provides a reproducible assessment of clinical skills well-suited for the evaluation of a healthcare provider's competency to perform the multiple domains of a palliative extubation. Our goal was to create a curriculum culminating in an OSCE to teach palliative extubation to our trainees.

#### METHODS:

We held a joint lecture with pulmonary-critical care medicine (PCCM) and palliative care (PC) fellows on the communication and procedural steps of a palliative extubation. An OSCE was scheduled several months later, allowing time for clinical experience. Prior to the OSCE, we emailed educational resources on palliative extubation, the simulated scenario, and an online pre-OSCE survey to participants. The simulated patients were high-fidelity mannequins. Standardized patients (SPs) acted as the patient's family member. PCCM and PC faculty volunteered as observers, mannequin operators, and confederates (acting as the bedside nurse and respiratory therapist). SPs and faculty attended a debriefing to give verbal feedback to fellows, and provided written feedback with a standardized behavioral checklist. Fellows also wrote a narrative reflection. We subsequently emailed a post-OSCE survey to the fellows.

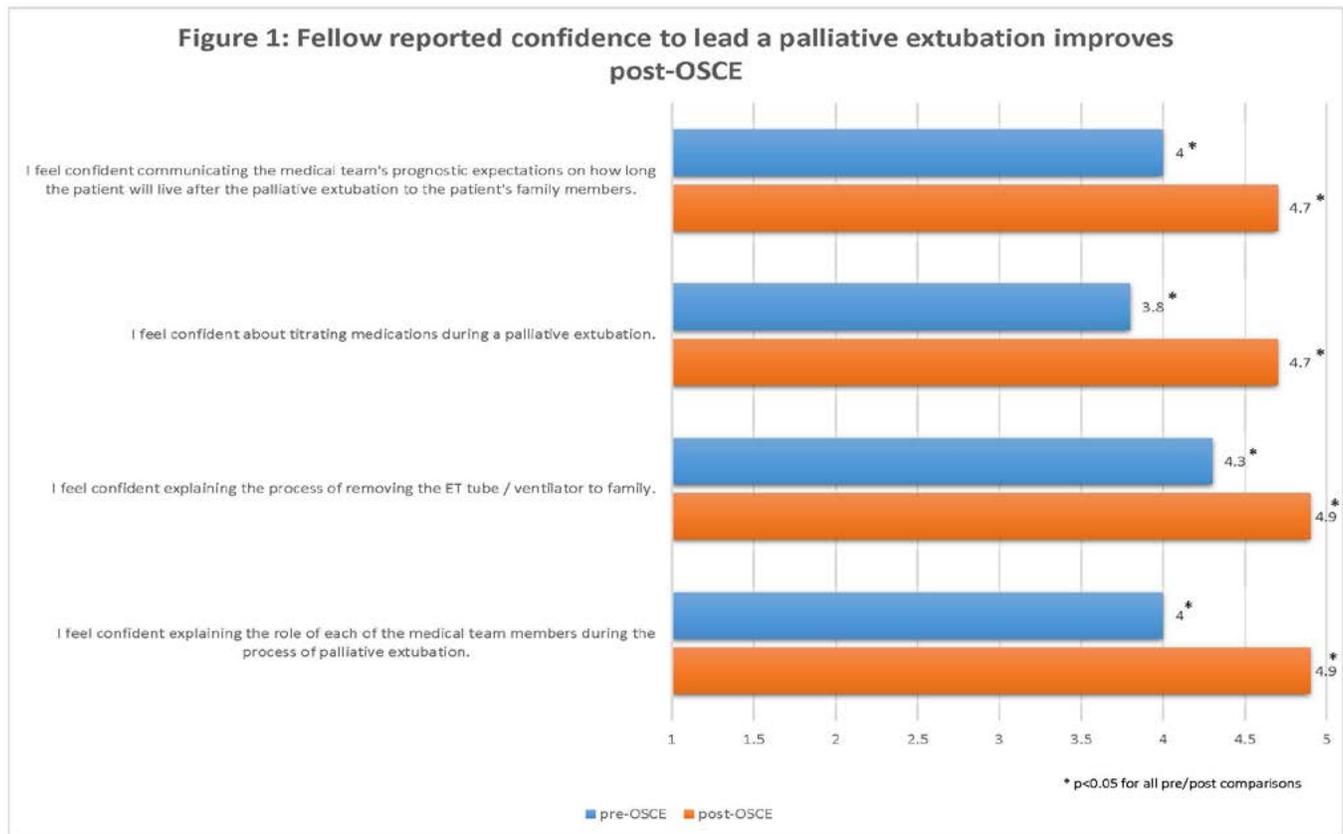
#### RESULTS:

Six PCCM and three PC fellows completed all curricular components, and seven fellows responded to the surveys. At baseline, 100% of survey respondents had participated in a palliative extubation, but only a minority had ever led the entire procedure (n=3, 33%). SP checklists consisted of 29 specific behavioral objectives; fellows were rated as well-done in 77% of total behavioral assessments, and only 3% of behavioral goals were rated as not-done. SP global ratings of professionalism were high, with 78% (n=7) of fellows rated as "completely professional" and 100% of fellows (n=9) recommended or highly recommended as a physician for a family member or friend. After the OSCE, fellows reported significantly higher levels of agreement in their confidence to lead multiple elements of a palliative extubation on a 5-point Likert scale (Fig. 1). 86% of respondents stated they would use elements of our discussion framework frequently or very frequently in clinical practice.

**CONCLUSION:**

We developed a curriculum to teach palliative extubation to PCCM and PC trainees that combined classroom learning, online reading and an OSCE with structured behavioral assessment and time for debriefing with verbal feedback and narrative self-reflection. Actors trained in giving standardized written assessments rated participants highly, and participants reported improved confidence to perform the procedure, with most agreeing they would change their practice in the future. We incorporated lessons learned and feedback from participants and faculty to

develop an educator toolkit for other training programs in PCCM and PC to adapt to their local needs. Future goals include: offer this session biannually to fellows; expand the number of PCCM fellows that participate; develop additional checklist items re: ventilator setting titration; further training for faculty observers to enhance our ability to give learners objective and reproducible written feedback.



# University of Colorado

## Fellow as Educator: Educational Skills Development During Pulmonary and Critical Care Fellowship Training Through Deliberate Practice and Coaching

**Authors:** Katie McPherson, MD; Tristan Huie, MD; Anna Neumeier, MD

**Program Director:** Tristan Huie, MD

**Associate Program Director:** Anna Neumeier, MD

### PROGRAM DESCRIPTION:

The University of Colorado Pulmonary and Critical Care Medicine Fellowship program has a mission of training leaders in academic medicine. There are currently 23 fellows.

### RATIONALE:

Effective teaching is an important skill for a career in academic medicine. Educational skills curricula for fellows are often only provided as an elective, and as a result, many trainees miss the opportunity to cultivate these competencies. Within our program, fellows historically have received variable instruction and directive feedback about their skills as an educator. We developed a longitudinal curriculum using the theoretical framework of deliberate practice to provide a foundation for educating the adult learner. This curriculum incorporates self-reflective feedback and coaching to complement existing educational opportunities promoting teaching skills development.

### METHODS:

Commonly identified educational skills were extracted from a review of the literature and used to develop the framework for the fellows as educators curriculum. The curriculum was implemented in July 2019. Fellows participated in experiential workshops focusing on skills relative to their educational level of training including leading clinical problem-solving cases, teaching through consultation, procedural teaching skills, leading bedside rounds, delivering a research talk and small group teaching. These workshops preceded paired teaching opportunities

within the fellowship allowing application of learned skill. Teaching opportunities (Figure 1) were paired with direct observation with feedback through self-reflection and direct observation by faculty. Curricular impact was assessed via survey.

### RESULTS:

85% (17/20) of fellows responded to the survey. The majority of respondents, 94% (16/17) agreed or strongly agreed that developing effective teaching skills is important for their career. Since completing the seminars, the majority of fellows applied their learned skills in: bedside procedure teaching 88% (15/17), bedside rounding 76% (13/17), and giving a chalk talk 82% (14/17). Comparing the fellowship cohorts, 100% of (7/7) of first year fellow respondents reported receiving directly observed feedback presentations and coaching on their large group compared to baseline (pre-intervention rate) reported by upper level fellow respondents of 50% (5/10).

### CONCLUSION:

Effective educational skills are a desired competency for a career in academic medicine and should be taught to all fellowship trainees. A curriculum aimed at developing these skills comprising experiential workshops and teaching experiences paired with direct observation and feedback can be integrated into Pulmonary and Critical Care training programs. Future work will assess the programmatic impact on fellow teaching skills through objective measure of learner evaluations.

**Figure 1:**

	Orientation	Summer			Fall	Winter	Spring		
Year of Training	Workshops				Teaching Opportunities with Direct Observation				
					Pulmonary Grand Rounds (lecture)				
F1	How to lead a clinical problem solving case (lecture)	Teaching procedures at the bedside (beside teaching)			Bedside Procedural Teaching (bedside teaching)				
	Teaching through consultation (bedside teaching)				Internal Medicine Resident Critical Care Curriculum (small group teaching)				
F2		How to give a research talk (lecture)	How to give a chalk talk (small group teaching)	Leading bedside rounds (bedside teaching)	Research In Progress (lecture)		Pulmonary Physiology medical Student Small Groups (small group teaching)	Central Line workshop for residents (small group teaching)	
					Leading bedside rounds (bedside teaching)				
F3		Facilitating a case review conference (lecture)		Leading bedside rounds (bedside teaching)	M&M Conference and ICU Outcomes Conference (lecture)				
					Internal Medicine Resident Critical Care Curriculum (small group teaching)				
					leading bedside rounds (bedside teaching)				
					Research in Progress (lecture)	Pulmonary Physiology medical Student Small Groups (small group teaching)	Central Line workshop for residents (small group teaching)		

# University of Washington

## Fluoroscopy with Bronchoscopy: A Just-In-Time Training Video to Fill an Education Gap

**Authors:** Ilana R. Krumm, MD,<sup>1</sup> Stephen K. Allison, MD<sup>2,3</sup>, Rosemary Adamson, MBBS<sup>3,4</sup>

<sup>1</sup>Department of Internal Medicine, University of Washington; <sup>2</sup>Department of Interventional Radiology, University of Washington; <sup>3</sup>Veterans Affairs Puget Sound Healthcare System; <sup>4</sup>Division of Pulmonary, Critical Care and Sleep Medicine, University of Washington

**Program Director:** Basak Coruh, MD

**Associate Program Director:** Rosemary Adamson, MBBS

### PROGRAM DESCRIPTION:

The UW PCCM fellowship program is committed to creating excellent clinicians, academic leaders, scientists, and scholars in PCCM. Fellows complete clinical rotations at three sites (county, state and VA hospitals) and typically spend 12-18 months of the first three years of fellowship on scholarly endeavors. Fellows are also strongly involved in teaching residents and medical students. Many fellows complete more than three years of fellowship pursuing research.

### RATIONALE:

Fluoroscopy is commonly used when performing transbronchial biopsies during bronchoscopy. Fluoroscopy can increase the diagnostic yield for biopsy of masses and make the procedure technically easier for bronchoscopists (Roth *et al.*, 2008, Milman *et al.*, 1994). However, pulmonologists, like cardiologists who also use fluoroscopy frequently (Jacob, *et al.*, 2004), typically receive very little fluoroscopy-specific training. As a result, trainees' learning is often dependent upon the knowledge of their supervisors rather than a standardized curriculum. To address this, we developed a video module designed to be introductory material for the novice bronchoscopist and 'Just-in-Time' training for those with more experience.

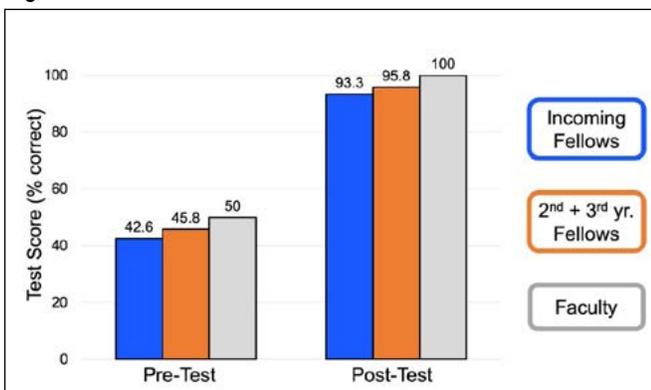
### METHODS:

The material for the video module and knowledge assessment was drafted using the available literature, with input from a pulmonologist with experience teaching bronchoscopy and an interventional radiologist. The video material, consisting of diagrams, clinical examples, and audio narration, was revised by a wider group of pulmonologists. Cognitive interviewing was then used to revise the knowledge assessment questions. The video was hosted on an open access website and shared with other pulmonary fellowship programs, with a request that learners complete the accompanying pre- and post-test assessment.

The educational objectives are that, by the end of the video module, learners will be able to:

1. Identify the three major components of the C-arm
2. Position patients to minimize radiation exposure
3. Describe the protective equipment worn by staff to minimize radiation exposure
4. Demonstrate correct positioning of the dosimeter
5. List fluoroscopy settings that will minimize radiation
6. Determine when to turn off the fluoroscopic X-ray beam when taking a transbronchial biopsy

**Figure 1:**



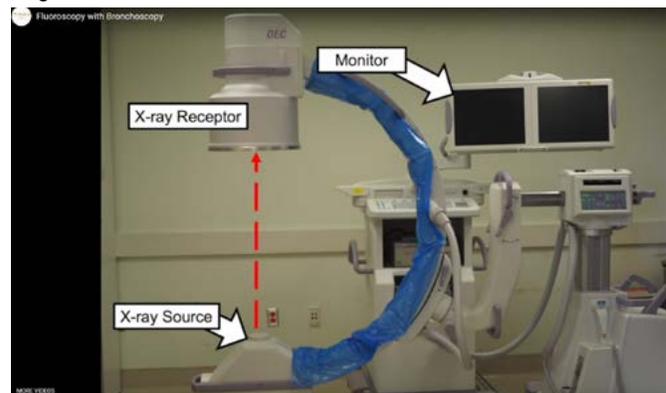
**Percent (%) correct pre- and post-test scores by year of training**

### RESULTS:

We had participants from Pulmonary/Critical Care fellowship programs at seven different institutions. Participants included first-year fellows in their first months of fellowship, second- and third-year fellows, and faculty. 15 participants completed the test prior to watching the module with a mean score of 46.1% (42.6% for first year fellows, 45.8% for senior fellows and 50% for faculty). 11 participants completed the test after watching the module with a mean score of 96.4% (93.3% for first year fellows, 95.8% for senior fellows and 100% for faculty).

**CONCLUSION:**

Initial data shows that this video module successfully improved understanding of safety for use of fluoroscopy with bronchoscopy. Notably, the mean pre-test score for faculty was 50%, demonstrating the need for education focused on the use of fluoroscopy across all levels of clinical experience. In the future, we plan to further evaluate the faculty knowledge gap regarding fluoroscopy use and aim to increase the number of participants – particularly faculty. Additional bronchoscopy education modules are in production, including “Management of Pneumothorax” and “Overview of Common Adverse Effects of Bronchoscopy”. Following production of these modules, we plan to survey pulmonary fellows to explore if additional aspects of bronchoscopy may benefit from ‘Just-in Time’ training material.

**Figure 2:**

**The video module included diagrams and video clips to provide practical, applied knowledge about fluoroscopy basics.**

# Boston Children's Hospital, Harvard Medical School

## Easing Transition Through Innovation – A Revamp of Our Pediatric Pulmonary Fellowship Program's Orientation

**Authors:** Marina Martinez-Garri, MD<sup>1</sup>, Katie Krone, MD<sup>1</sup>, Dan Schwartz, Ed.M.<sup>2</sup>, Debra Boyer, MD, MHPE<sup>1</sup>

<sup>1</sup>Division of Pulmonary Medicine, Boston Children's Hospital, Harvard Medical School, <sup>2</sup>Department of Medical Education, Boston Children's Hospital, Harvard Medical School

**Program Director:** Debra Boyer, MD, MHPE

### PROGRAM DESCRIPTION:

Our program trains 12 fellows and takes place in a busy hospital with complex care patients. The clinical training is divided in 4 rotations: inpatient service, consultation service, pulmonary transplant service and bronchoscopies+PFTs interpretation. In addition, fellows also develop their research skills with dedicated time for this during the training. Our program consists of a big faculty (+15) dedicated to teaching.

### BACKGROUND:

Our program's orientation for incoming fellows has varied significantly over the years. More recent components have included a welcoming breakfast, clinically shadowing senior fellows, didactics by faculty, amongst others.

Taking into consideration the results of a needs assessment evaluating the first year fellows' perception of the usefulness of their orientation week in preparing them for their roles, we restructured orientation for the academic year 2019-2020 with the goal being making it innovative, high-yield, and most importantly, fun.

### METHODS:

Orientation was one week long and consisted of high-yield activities taught via mixed-methods approach (self-study, flipped classroom, case-based discussions, online modules, simulation and deliberate practice).

One of the main innovations was the addition of an online component via creation of a website dedicated to our program's orientation designed by our hospital's educational technology department(image-A). Content included self-study material, original 'how-to-videos' on how to do specific tasks encountered during fellowship, recorded talks by faculty of our division on core pulmonary topics, a flexible bronchoscopy course and reference material. Incoming fellows were provided access to this website a week before orientation.

Instead of traditional didactics, we conducted two high-yield, senior fellows-led workshops using a flipped

classroom, case-based approach. Self-study material for these sessions was available on the website and expected to be studied beforehand. One workshop was on Pulmonary Function Test (PFTs) interpretation during which a short didactic was followed by hands-on practice using real patients' PFTs. The second workshop was on the Top-5 Most Common Pulmonary Consult Questions in our program during which fellows were taught how to tackle these consults from medical, administrative and system-based standpoints.

A flexible bronchoscopy simulation course was conducted by one of our faculty members utilizing a novel 3-D printed trainer (image-B). Prior to it, fellows completed web-based bronchoscopy modules. Subsequent one-on-one teaching sessions were conducted focused on deliberate practice to achieve proficiency manipulating the scope and identifying anatomic landmarks. Assessments were performed using validated tools to identify targets for improvement.

A *Pulmonary Punch Card* (PPC)(image-C) initiative was created to ensure fellows learned how to perform crucial tasks (clinical and administrative) they were going to encounter during training (navigating the electronic medical record, scheduling admissions, composing medical notes, routing prescriptions, among many others). For many of these they received one-on-one guidance from a senior fellow. It was recommended to complete all the tasks before the end of orientation week and if so, they received a gift card as an incentive.

Fellows were provided with an informative binder(image-D) on the first day of orientation. In it they could find a copy of the week's schedule, a document detailing each clinical rotation, a USB with study materials (clinical guidelines, important pulmonary scientific articles, etc.), the PPC, and other helpful documents.

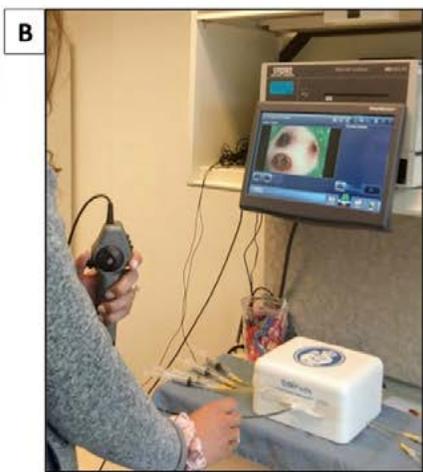
Some activities from previous years were conducted again this year including a welcoming breakfast with

all fellows, shadowing a senior fellow in each of the clinical services for day and a social event at the end of the week.

Finally, for the first week of service, we instituted a *Buddy System* in which each first-year fellow was paired with a senior fellow who was available in-house to answer questions and provide guidance.

**DISCUSSION:**

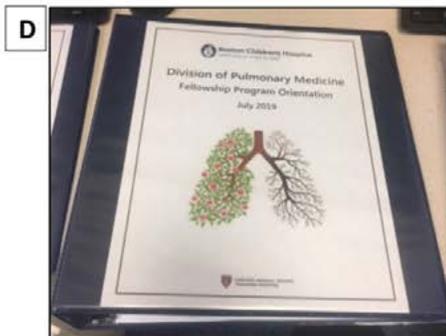
A survey conducted 2.5 months after starting fellowship showed that fellows rated orientation as very useful in preparing them for their roles. We think our approach to orientation week is innovative and could be adapted for implementation in other training programs. We were able to achieve our goal of not only welcoming incoming fellows but also empowering them by providing the tools and skills necessary to ease their transition into a busy training program.



**Pulmonary Punch Card**

Name: \_\_\_\_\_

<input type="radio"/> <b>Inpatient Service</b> Establish treatment plan for a planned CP admission <sup>1,2</sup> Coordinate a non-urgent admission to pulmonary service <sup>1</sup>	<input type="radio"/> <b>Consult Service</b> Compose a new consult note <sup>1</sup> Compose a follow-up consult note <sup>1</sup> Practice ordering an equipment overnight continuity study <sup>1,2,3</sup> Practice ordering a sleep study <sup>1,2</sup>
<input type="radio"/> <b>Bronchoscopy Service</b> Schedule a bronchoscopy <sup>1</sup> Practice one bronchoscopy consent with a real patient <sup>1</sup> Set up for a bronchoscopy <sup>1</sup> #1 & bronchoscopy supply bag <sup>1</sup> (DR and Foley) Compose a bronchoscopy procedure note <sup>1</sup>	<input type="radio"/> <b>PFTs</b> Practice ordering PFTs <sup>1,2</sup> Observe performance of spirometry, lung volumes and DLCO <sup>1</sup> Compose one PFT interpretation in computer <sup>1</sup> Interpret at least five PFTs <sup>1</sup>
<input type="radio"/> <b>Transplant Service</b> Coordinate morning rounds for transplant service <sup>1</sup> Ask Dawn Fralinger to explain Post-transplant order set <sup>1</sup>	<input type="radio"/> <b>Fellow's Clinic</b> Shadow a fellow in clinic for one patient <sup>1</sup> Observe one ribular teaching session <sup>1</sup> Practice doing a prescription in power chair <sup>1,2</sup> Practice doing an asthma action plan <sup>1,2</sup>
<input type="radio"/> <b>Miscellaneous</b> Practice using the engine (from sign) shared Practice messaging through power chart (passage the pulmonary nurse and enjoy Marisa) Download (per) her app and message Marisa	<input type="radio"/> <b>Legal</b> Discuss with Marisa Not case sensitive Power chart trainer Coordinate with bronch/PFT fellow Coordinate with PFT techs PFT workshop Coordinate with clinic nurses



# Boston University School of Medicine

## Implementation of a Low-Cost Pilot Intervention to Improve Fellows' Ultrasound Ability

**Authors:** Samuel H. Belok, MD<sup>1</sup>, Priya Soni, MD<sup>2</sup>, Christine C. Reardon, MD<sup>1</sup>

<sup>1</sup>Section of Pulmonary, Allergy and Critical Care Medicine, Boston University School of Medicine, Boston MA;

<sup>2</sup>Department of Medicine, Boston University School of Medicine, Boston MA

**Program Director:** Christine C. Reardon, MD

### PROGRAM DESCRIPTION:

A flagship of the pulmonary/critical care section is our post-doctoral training program in Pulmonary and Critical Care Medicine. We train specialists for careers in academic medicine tailored to the diverse interest of our trainees. Our division is committed to mentoring and teaching clinical care and state of the art investigation in basic science and translational-clinical research.

### RATIONALE:

Pulmonary/critical care fellows are now required by the ACGME to demonstrate knowledge of “imaging techniques commonly employed in the evaluation of patients...including the use of ultrasound”. (1) At our institution we provide first year fellows with a robust didactic and practical orientation to learn POCUS (Point-of-Care Ultrasound). After this orientation the fellows continue to learn ultrasound through “on-the-job” training. However, instituting longitudinal training can be challenging given resource and faculty limitations in already busy pulmonary/critical care departments. Sternschein et. al suggest near-peer teaching as a method to build collective expertise in ultrasound.(2) Many teaching institutions already rely on fellows as de facto instructors to help train learners with ultrasound. We sought to examine what effect assigning formal teaching roles to fellows might have on fellows' own POCUS knowledge, ability and confidence.

### METHODS:

A pre-test was administered to all first year fellows on arrival to fellowship to assess their ultrasound knowledge, interpretation ability, image acquisition ability and confidence with POCUS. The test included a 32-question knowledge/skills (KS) assessment and a Likert-scale confidence self-assessment (CA). This

same test was administered to senior fellows. The first year fellows participated in the routine POCUS orientation that had been offered to the prior classes. Then, they were assigned several 30-minute blocks of bedside teaching to trainees over the next 3 months. An identical post-test was administered to all first year fellows 3 months into fellowship. Four first year fellows completed the pretest, five first year fellows completed the post-test and thirteen senior fellows completed the test. (Fig 2). Descriptive statistics, paired t-tests and unpaired t-tests were used to assess ultrasound ability and self-measured confidence.

### RESULTS:

(Fig 2). The mean KS score of the first year fellows (who took both the pre and post-test) increased from  $20.5 \pm 3.11$  to  $25.0 \pm 2.07$  ( $p = 0.01$ ) following intervention. The senior fellows mean was  $24.5 \pm 4.1$ . There was no significant difference in the post-intervention first years' scores compared to the senior fellows ( $p = 0.53$ ). The first years pre-intervention mean CA score was  $2.5 \pm 0.58$  compared to the post-intervention mean CA score of  $3.3 \pm 0.5$  ( $p = 0.22$ ). The mean CA score of the first year fellows post-intervention was not significantly different compared to the senior fellows who had a mean CA score of  $2.8 \pm 0.8$  ( $p=0.26$ ).

### CONCLUSIONS:

This pilot study shows that first year fellows who were assigned teaching roles in addition to routine orientation training significantly improved their knowledge and acquisition skill of POCUS to at least the level of senior fellows at an extremely early point in training. Longitudinal follow-up is required to see if participants who underwent the intervention continue to improve in knowledge, skills and confidence and have less knowledge degradation than prior fellows.

CITATIONS:

1. Requirements, O.C.P. and Effective, B. (2001) ACGME Program Requirements for Graduate Medical Education in Pulmonary Disease and Critical Care Medicine.

2. Sternschein, R.M., Gay, E.B., Palmer, L.J. and Hayes, M.M. (2019) Scanning for Experts: Practical Approaches to Incorporate Ultrasound Use in the ICU and Enhance an Ultrasound Educational Program. *Ann. Am. Thorac. Soc.*, 10:1513/AnnalsATS.201904-334PS. <https://doi.org/10.1513/AnnalsATS.201904-334PS> <http://www.ncbi.nlm.nih.gov/pubmed/31453708>

Figure 1:

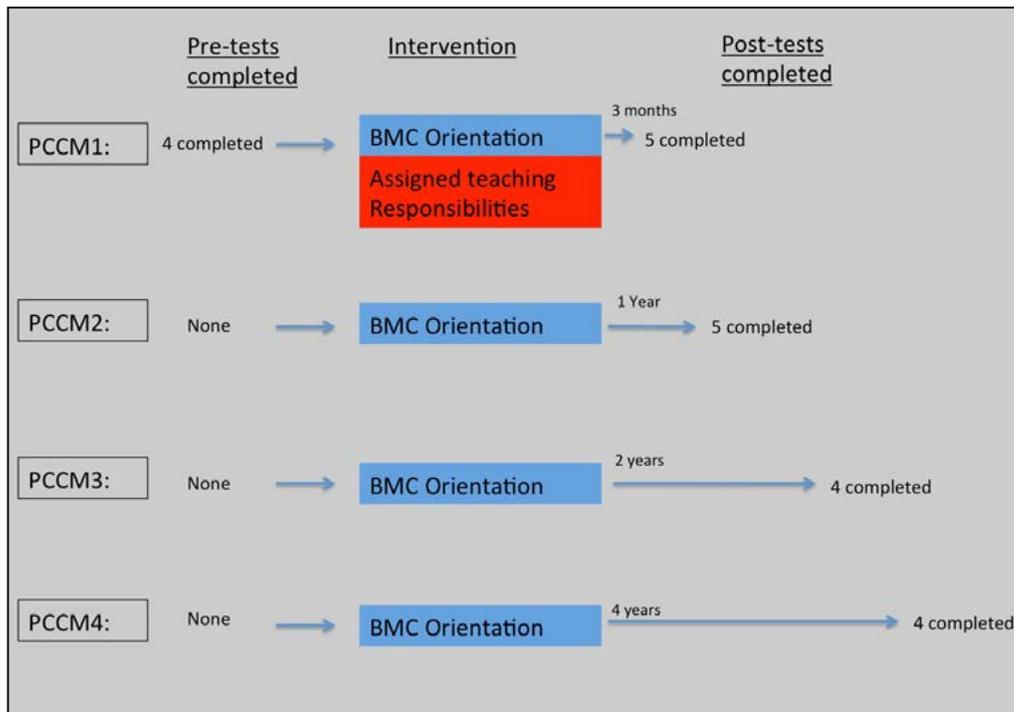
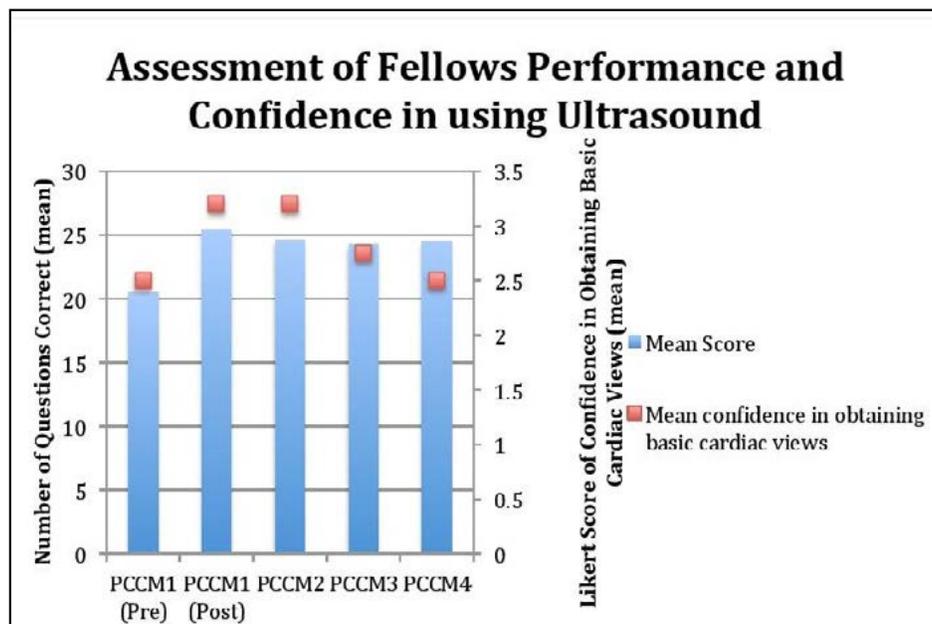


Figure 2:



# Children’s Hospital Colorado

## Initiation of a Structured Research Timeline to Improve Pediatric Pulmonary Fellows’ Research Training

**Authors:** Erin Khan, MD; Heather De Keyser, MD; Ricky Mohon, MD; Robin Deterding, MD; Stanley Szeffler, MD

**Program Director:** Ricky Mohon, MD

**Associate Program Director:** Stanley Szeffler, MD

### PROGRAM DESCRIPTION:

The Pediatric Pulmonology Fellowship Program at the University of Colorado School of Medicine is one of the oldest and most respected programs in the United States, training over 64 pediatric pulmonologists. Our graduates practice around the country in a variety of leadership and clinical roles. During this 3-year fellowship, faculty guide fellows through numerous clinical and research opportunities customized to generate the knowledge, skill and technical expertise necessary to become an excellent academic pediatric pulmonologist.

### BACKGROUND:

A scholarly work product is required for certification by the American Board of Pediatrics for pediatric subspecialty fellows. There is no widely used framework for scholarship or research development training for pediatric pulmonology fellows. Scholarly productivity during fellowship is often dependent on the individual fellow in conjunction with their primary research mentor, leading to a mentor-centric model that provides a

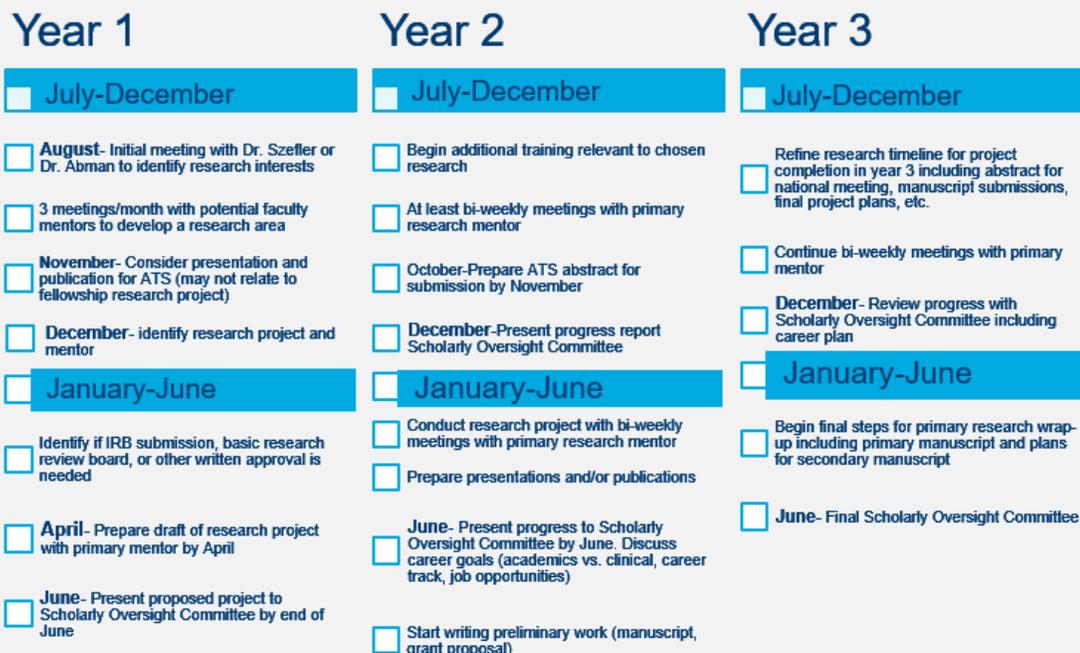
varied experience for each fellow. To address this gap in training, our program developed and implemented a structured research timeline for pediatric pulmonology fellows to help enhance early scholarly productivity and improve the research educational experience of fellows.

### METHODS:

Informal individual interviews were conducted with fellows, recent fellow graduates, and faculty members at our center in 2014 to identify common themes and pitfalls in fellowship scholarly success. Based on this feedback and a review of the literature, a multi-tiered structured research curriculum was developed, including a structured research timeline for fellows to track their progress toward graduation (Figure 1). The structured timeline was implemented in 2014 and was initially revised based on fellow and faculty mentor feedback. Progress was monitored by fellowship leadership and at scholarly oversight committee meetings. To assess utility of the final structured timeline, formal interviews were held with all current fellows in 2019.

Figure 1:

## Fellowship Research Timeline



**RESULTS:**

Common themes and pitfalls emerged during initial informal interviews of fellows and faculty (Figure 2). Faculty reported fellows often “floundered” in the early stages of fellowship, lacking a clear direction toward developing a scholarly interest. Fellows commonly changed interest and/or research mentors partially through projects, leading to delays in getting projects off the ground and delays in publications.

Fifteen fellows have used the structured research timeline since its initiation. All current fellows, excluding this author, were interviewed on utility of the fellowship timeline. Fellows found the timeline simple and easy to use. The timeline was most beneficial in the first year of fellowship, allowing junior fellows to set early expectations of important tasks to allow success in their research interest development. One junior fellow commented, “I appreciate the structured approach. It’s very helpful, especially if you are not clear on your research interests.” Senior fellows found that the timeline aided in early productivity and project development, but reported using the timeline less after establishing mentorship with active ongoing research projects. A senior fellow stated, “For me, doing a basic science project, it was especially helpful having decided a project halfway through my first year. I was able to get in the lab and start being productive with research experiments in early February. If there was no structured timeline, it easily could’ve extended my decision to later in the Spring.”

Fellowship leadership has found similar benefit to the structured approach. The Research Medical Director stated: “Fellows have had an early start with their projects. There has been less switching of research projects and career directions as a result of this process, as reflected in the timeline and improved oversight of fellow progress.”

**CONCLUSIONS:**

Implementation of a structured fellowship research timeline with appropriate research infrastructure is a simple way to support pediatric pulmonary fellows in early research productivity. The fellowship research timeline gives fellows a structured approach to developing and enhancing research interests, beginning in the first month of the first year of fellowship. The timeline gives fellows and their mentor team clear and manageable expectations for each stage of their fellowship. Fellows appreciated the structured approach to research development and found the timeline easy to use and adapt to their specific research interest. The timeline has been most useful for junior fellows, allowing for earlier project selection and early productivity.

# Detroit Medical Center-Wayne State University

## Simulation-Based Curriculum for Ultrasound Training and Shock Management in a Pulmonary & Critical Care Medicine (PCCM) Fellowship Training Program: Effectiveness and Retention

**Authors:** Navin Durairajan, MD; Shyam Ganti, MD; Sammar Alsunaid, MD; Sarah Lee, MD; Maryjean Schenk, MD; Abdulghani Sankari, MD, PhD

**Program Director:** Abdulghani Sankari, MD, PhD

### PROGRAM DESCRIPTION:

Detroit Medical Center-Wayne State University is a tertiary care academic program serving an urban population, training both pulmonary-critical care and critical care fellows.

### BACKGROUND:

Bedside critical care ultrasound (US) plays a major role in the early detection and management of shock in the intensive care unit (ICU); however, it is an emerging skill such that incoming trainees into a Pulmonary and Critical Care (PCCM) fellowship have vastly differing competencies and prior experiences. We created a standardized curriculum for orientation Bootcamp that aims to improve knowledge and skills in shock management using US simulation and bedside assessment.

### METHODS:

All participants were PCCM fellows during their first year of training. The US and shock curriculum included a baseline knowledge test consisting of internally validated 15 multiple-choice questions, a high-fidelity simulation manikin [SimMan 3G®], a 29-item checklist to assess clinical competence in shock diagnosis and management, a Symbionix U/S Mentor ultrasound simulator, a 15-item checklist for the US use competency, and a post-simulation knowledge test. The training team consisted of Clinical Educator (CE) PCCM fellows and two teaching faculty attendings.

Each learner underwent the following chronological steps: 1) Baseline knowledge test. 2) A two-part baseline simulation session with a standardized case scenario utilizing a high-fidelity manikin to assess adherence to best practices in medical decision-making and communication in shock management and using an US simulator to assess motor skills and knowledge of visualized anatomy. The learner's

performance was measured via a standardized competency checklist. All simulations were conducted over 30-minute sessions followed by structured 10-minute debriefings. 3) A 60-minute didactic lecture. 4) Bedside US/shock teaching rounds in an ICU. 6) Post-course simulation sessions conducted 1 to 2 weeks later. The primary outcome was the comparison of learners' competency pre- and post-course. In addition, retention assessments were completed both in the simulation center and at the bedside. This study was granted exemption from IRB. Results are expressed as mean  $\pm$ SD or median (25-75%) as appropriate.

### RESULTS:

A total of 16 first-year fellows completed the US and shock curriculum (8 fellows in 2018 and 8 in 2019). The median (25-75%) post-course shock simulation competencies increased significantly from a baseline of 12 (10.3-14.8) which is 41.4% to 23 (21.3-24.0) which is 79.3% ( $p < 0.001$ ). The mean (SD) post-course competency on US simulator (maximum score is 15) increased significantly from  $8.9 \pm 3.6$  (59%) to  $13.4 \pm 1.3$  (89.3%),  $p < 0.001$ .

Retention assessment of US competencies at bedside showed a mean competency score (maximum score is 13) of  $12.3 \pm 0.7$  (92.3%) at a 2-week post-test in the 2019 fellows compared to baseline  $6.8 \pm 3.6$  (52.3%) ( $p = 0.003$ ).

### DISCUSSION:

Our study results suggest that a standardized curriculum using simulation is an effective teaching method and can improve new learners' competencies in ultrasound and shock management during orientation Bootcamp with excellent retention at the bedside. Future studies are needed to assess the impact on clinical outcomes.

## Detroit Medical Center- Wayne State University

### Improving Endobronchial Ultrasound (EBUS) Competency in Pulmonary Fellows with a Novel Hands-on Simulation-based Curriculum

**Authors:** Navin Durairajan, MD; Ayman Soubani, MD; Chetna Jinjuvadia, MD; Divya Venkat, MD; Zubin Mukadam, MD; Maryjean Schenk, MD, MPH, MS; Abdulghani Sankari, MD, PhD

**Program Director:** Abdulghani Sankari, MD, PhD

#### PROGRAM DESCRIPTION:

Detroit Medical Center-Wayne State University is a tertiary care academic program serving an urban population, training both pulmonary-critical care and critical care fellows.

#### BACKGROUND:

Simulation techniques have been increasingly used to train physicians and trainees on specific procedure skills to lower the risk of patient complications while improving their learning skills. We hypothesized that the implementation of a novel hands-on simulation-based curriculum for Endobronchial ultrasound (EBUS) will improve medical knowledge, technical skill and satisfaction of Pulmonary and Critical Care (PCCM) fellows. Previously, EBUS Skills and Tasks Assessment Tool (EBUS-STAT) has been validated as a tool to assess operator competency in knowledge and technical skills to perform EBUS, however this tool has not been used as a training curriculum for PCCM fellows.

#### METHODS:

The study targeted second and third-year PCCM fellows (n=6) in an urban academic center. Symbionix BRONCH Express™ simulator was used in this curriculum, to assess competency and to train fellows. Competency pre- and post- curriculum was assessed using a modified version of EBUS-STAT and Multiple-Choice Questions (MCQs) after confirming their internal validity. Subjective confidence scores of fellows in EBUS skills were also assessed using

a previously validated assessment tool, EBUS Subjective Assessment Tool (EBUS-SAT). After baseline testing, all 6 trainees were included in the EBUS curriculum including hands-on learning on the simulator, educational lectures, and small group-interactive case-based learning modules. The fellows' baseline and 2-month post- EBUS curriculum performances were compared.

#### RESULTS:

The mean modified EBUS-STAT scores of the 6 PCCM fellows improved from baseline score (maximum score is 105) of  $43.5 \pm 8.2$  (41.4%, range 30-46) to  $61.0 \pm 10.2$  (58.1%, range 48-58) at 2-month post-curriculum ( $p=0.005$ ). This improvement was mainly contributed by the improvement in the bronchoscopic technical skills part (maximum score is 80) of the assessment tool [ $29 \pm 7.7$  (36.2%) to  $47 \pm 10.9$  (58.7%),  $p=0.004$ ]. The mean EBUS-SAT confidence scores (maximum score is 50) of the 6 PCCM fellows improved from  $23.8 \pm 7.8$  at baseline to  $34 \pm 6.1$  at 2-month retention testing ( $p=0.005$ ).

#### CONCLUSION:

A hands-on simulation-based EBUS curriculum may improve PCCM fellows' technical skills and confidence in performing EBUS. It allows direct observation of trainees in a controlled environment without compromising patient safety. Assessment of retention for EBUS procedure knowledge and competencies in a larger sample and longitudinal monitoring is needed.

# Massachusetts General Hospital for Children

## Implementing a Professional Development Coaching Program in a Pediatric Residency and Fellowship Program

**Authors:** Benjamin Nelson, MD<sup>1,2</sup>, Jacqueline Chu, MD<sup>1,3</sup>, Liyang Yu, MS<sup>1,3</sup>, Karen Donelan, ScD, EdM<sup>1,4</sup>, Kerri Palamara, MD<sup>1,3</sup>

<sup>1</sup>Harvard Medical School, Boston, MA, <sup>2</sup>Massachusetts General Hospital for Children, Boston, MA, <sup>3</sup>Department of Medicine, Massachusetts General Hospital, Boston, MA, <sup>4</sup>Mongan Institute Health Policy Center, Massachusetts General Hospital, Boston, MA

**Program Director:** Benjamin Nelson, MD

### PROGRAM DESCRIPTION:

Our fellowship program is based at an academic medical center in Boston. We currently have 4 fellows, one of which is doing a fast track fellowship. This abstract describes an innovative coaching program that includes all pediatric fellows at our institution including those in GI, endocrine, and critical care fellowships.

### RATIONALE:

Medical trainees are more likely to suffer from burnout than their age-matched peers. Therefore, the Accreditation Council of Graduate Medical Education has placed an emphasis on implementing programs to combat burnout. Positive psychology coaching uses a strengths-based approach emphasizing engagement, meaning, and accomplishment. This approach enhances self-efficacy of physicians, combats burnout, and improves quality of life. The Massachusetts General Hospital Professional Development Coaching Program (PDCP) was implemented using positive psychology to allow trainees to reflect on their performance, openly discuss their professional development, and understand how to optimize their strengths to overcome challenges and stressors.

### METHODS:

Each pediatric resident and fellow was assigned a Professional Development Coach. Volunteer faculty coaches participated in 3 hours of hands-on training, were introduced to core concepts of coaching and positive psychology, and assigned trainees in different career tracks to allow honest discussion without concern for future career impact. Coaches were assigned 1-2 trainees and were advised to meet quarterly to encourage reflection, provide guidance, and motivate trainees to set learning goals for upcoming rotations. Sessions followed a specific

curriculum focused on active listening, using questions to promote self-reflection, and articulating positive emotions and strengths as opposed to emphasizing negative emotions and weaknesses. Quantitative data were collected in the first and fourth quarters of the program and included program outcomes and two measures of burnout and well-being: The Professional Fulfillment Index (PFI), a validated instrument for assessing physicians' professional fulfillment and burnout, and the PERMA score (measuring positive emotion, engagement, relationships, meaning, and accomplishment).

### RESULTS:

29 fellows across 4 subspecialties, 38 residents and 34 coaches participated over a 2-year period. 82.6% of trainees attended at least 3 sessions each year. Trainees reported improved goal setting, an opportunity to learn new skills, a higher professional fulfillment, and a higher sense of accomplishment. If they attended all 4 sessions, they also reported less burnout. Pre and post intervention results are listed in table 1.

### CONCLUSIONS:

The PDCP included all pediatric residents and fellows regardless of performance. A coaching program separate from performance evaluation and career advising was feasible, cost effective, and highly rewarding to pediatric trainees. Positive psychology coaching, using a strengths-based approach, provided participants with additional tools to cope with personal and professional stressors faced during training. Given that similar findings have been seen in internal medicine programs, this provides further evidence to support the use of a positive psychology coaching model globally across specialties.

Table 1

Response	Pre		Post		P value	
	N	%	N	%		
<b>Goal Setting</b>					<b>0.021</b>	
Never/Rarely	11	47.8	3	13		
Sometimes/Frequently	12	52.2	20	87		
<b>Understanding role in care team</b>					<b>0.17</b>	
Poor/Fair/Good	15	65.2	10	43.5		
Excellent	8	34.8	13	56.5		
<b>Opportunity to learn new skills</b>					<b>0.059</b>	
Poor/Fair/Good	14	60.9	9	39.1		
Excellent	9	39.1	14	60.9		
<b>Opportunity to reflect</b>					<b>0.32</b>	
Poor/Fair/Good	17	73.9	14	60.9		
Excellent	6	26.1	9	39.1		
<b>Working relationship with nurses</b>					<b>0.32</b>	
Poor/Fair/Good	18	78.3	15	65.2		
Excellent	5	21.7	8	34.8		
<b>Personal Fulfillment</b>					<b>0.1</b>	
Not high	17	73.9	12	54.5		
High	6	26.1	10	45.5		
<b>PERMA</b>						
<b>Accomplishment score</b>					<b>0.059</b>	
Low score	10	45.5	6	26.1		
High score	12	54.5	17	73.9		
<b>Overall PERMA score</b>					<b>0.16</b>	
Low score	11	50	9	40.9		
High score	11	50	13	59.1		
		<b>&lt; 4 meetings</b>		<b>4 meetings</b>		<b>P value</b>
<b>Burnout</b>						<b>0.038</b>
		<b>Pre</b>	<b>Post</b>	<b>Pre</b>	<b>Post</b>	
	<b>N</b>	14	14	9	9	
	<b>Mean</b>	1.16	1.39	1.04	0.81	
	<b>SD</b>	0.67	0.59	0.49	0.65	

# Mayo Clinic

## Novel Research and Career Development Curriculum for Pulmonary and Critical Care Medicine Fellows

**Authors:** Timothy Dempsey, MD, MPH; Kelly Pennington, MD; Kannan Ramar, MD; Robert Vassallo, MD; Darlene Nelson, MD

**Program Director:** Darlene Nelson, MD

### PROGRAM DESCRIPTION:

The Mayo Clinic Pulmonary and Critical Care Fellowship in Rochester, Minnesota is a large academic fellowship program with a focus on clinical, educational, and research excellence. Our fellowship is structured so that the first and third year of fellowship are clinical and the second year is dedicated to research.

### BACKGROUND:

During the second-year of fellowship at our institution, fellows have dedicated research time to work with their mentors on individual research initiatives. The research year comes at a time of pivotal career development, as fellows work toward identifying an academic niche, search for jobs, and decide on a career path. Traditionally the year has been focused on exposure to a single path of research with no formal research or career development curriculum. Importantly fellows have had limited opportunities to learn from each other's research experience, relying on the experience and guidance of their individual mentor. In order to rectify these issues, we designed a research and career development curriculum to standardize the research experience for all fellows in our program and increase the breadth of exposure to career development opportunities.

### ABSTRACT PRESENTATION:

We surveyed second and third year fellows to determine areas of research and career development that needed improvement within our fellowship program. The survey response rate was 94.4% (17 of 18). Most fellows (76.5%) envisioned themselves working at an academic medical center upon completion of fellowship training. We found that only 41.2% of fellows were "satisfied" with our current research curriculum, and no fellows were "very satisfied". Likewise, only 47.1% fellows reported being "somewhat satisfied" with our career development programs. Most respondents were "somewhat comfortable" or "uncomfortable" when asked about various research topics, including the ability to write "fundable" grant applications, navigate

resources available to conduct successful research, and deliver effective presentations.

After collecting this information, we designed our enhanced research and career development curriculum with several principle goals: 1) Introduce monthly, semi-structured group sessions focused on core fundamental topics in biomedical research. These are led by content experts. Topics include manuscript writing, grantsmanship, effective peer review, clinical study design (prospective and retrospective), basic science/ translational study design, and academic promotion. In addition to these sessions, we also host a panel dinner on curricula vitae development, job searching, and contract negotiation. 2) Provide a venue for fellows to learn from each other's research experience through open discussion during the monthly group sessions; 3) Augment mentorship and career development of fellows by faculty in research pathways by setting up "mentorship committees" for each fellow to help oversee their professional development, provide career counseling, and facilitate job placement. These committees will consist of the fellow's primary research mentor, secondary mentor (if applicable), an assistant program director or program director, and one to two other faculty members (as selected by the fellow). The committee will meet twice per year to review and update all elements of a specially-designed "mentoring plan".

Following the initial implementation of this program, we re-surveyed fellows with a response rate of 70.6% (12 of 17). All fellows indicated that they were either satisfied (41.7%) or very satisfied (58.3%) with the new research/ career development curriculum, and the majority of fellows were either satisfied or very satisfied with the program's focus on career development (58.3%). In addition to periodic surveys (including a modified version of the "Mentorship Profile Questionnaire" developed by Berk et al.), we will use academic productivity (e.g. quality and quantity of peer reviewed publications, academic rank, leadership positions within national societies, and grant awards) as well as job placement as outcome measures.

**DISCUSSION:**

Career development and research training are key components of fellowship training and academic growth. Unfortunately, these are often overlooked and not part of the standardized fellowship curriculum.

**CONCLUSION:**

We developed a novel research and career development curriculum that improved satisfaction among fellows. Future outcome measures, such as academic productivity and job placement, will further delineate the value of this novel curriculum.

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# National Jewish Health/University of Colorado

## Understanding Pulmonary Management of Neuromuscular Weakness

**Authors:** Amen Sergew, MD; Damian Solorzano, RRT-NPS; Ute Epstein, MA, ALS Navigator; Byron Greene, MSA, RRT; National Jewish Health; Chronic Respiratory Failure Program, Denver CO

**Program Director:** Tristan Huie, MD

**Associate Program Director:** Anna Neumeier, MD

### PROGRAM DESCRIPTION:

A pulmonary and critical care medicine fellowship program with a mission of training leaders in academic medicine.

### BACKGROUND:

Although patients with neuromuscular weakness typically die from respiratory failure, the care of neuromuscular patients is rarely covered in pulmonary fellowship training programs and remains a black-box even for many practicing pulmonologists. Understanding the work up and management of neuromuscular weakness required a comprehensive skill set: recognizing symptoms of neuromuscular weakness, understanding the impact of hypoventilation on sleep, focused exam to evaluate for diaphragmatic weakness, and pulmonary physiology to help assess neuromuscular weakness.<sup>1</sup> The management of these patients requires a comfort with tools such as non-invasive ventilation (NIV) and mechanical in-exsufflator.<sup>2</sup> Additionally, these skills and tools can be applied in the intensive care setting where intensive care acquired weakness is common. Weakness in patients mechanically ventilated for 5-6 days can be seen in 26-65% on awakening.<sup>3</sup> This number increases to 67% in patients ventilated for  $\geq$  10 days. The same concepts can be applied in this patient population to improve extubation success.

### METHODS:

To address this knowledge gap, we developed a 2.5-hour introductory learning session on neuromuscular weakness. The initial 60-minute lecture utilized a case-based approach and questions to assess knowledge base and then provide the foundations including the identification and assessment of neuromuscular weakness on examination and testing, understanding the indications for non-invasive ventilation (NIV) and mechanical in-exsufflator as well as how to initiate and titrate these machines. Following this foundational lecture there was three hands-on small-group

sessions each 30-minutes long. The stations were: 1) learning about the various modes of NIV and how to set the modes on the machines. Fellows were all given settings to put into the NIV machines and each tried the settings on themselves to further understand the different modes. 2) The next station set up to do

**Figure 1**

AVAPS modes

Spontaneous-Timed (S/T)      AVAPS feature  On  Off

Pressure-Control (PC)

**AVAPS settings**

Target $V_T$	460	mL (50 to 2000)
AVAPS rate of change	5	cm H <sub>2</sub> O/min (1 to 5)
Max IPAP pressure	20	cm H <sub>2</sub> O (4 to 44)
Min IPAP pressure	10	cm H <sub>2</sub> O (4 to 44)
EPAP pressure	5	cm H <sub>2</sub> O (4 to 25)
Inspiratory time (S/T, T, PC modes only)	1	sec (0.3 to 5.0)
Back up rate	12	bpm (1 to 60)
Rise Time	3	1-6

**Figure 2**

AVAPS modes

Spontaneous-Timed (S/T)      AVAPS feature  On  Off

Pressure-Control (PC)

**AVAPS settings**

Target $V_T$	480	mL (50 to 2000)
AVAPS rate of change	5	cm H <sub>2</sub> O/min (1 to 5)
Max IPAP pressure	25	cm H <sub>2</sub> O (4 to 44)
Min IPAP pressure	18	cm H <sub>2</sub> O (4 to 44)
EPAP pressure	6	cm H <sub>2</sub> O (4 to 25)
Inspiratory time (S/T, T, PC modes only)	1	sec (0.3 to 5.0)
Back up rate	12	bpm (1 to 60)
Rise Time	3	1-6

the same with a mechanical in-exsufflator. 3) The final station was set up to understand the various masks for NIV and troubleshooting some of the more common issues that patients are faced with.

### RESULTS:

Ten PGY1-4 trainees completed this education session. The fellows filled out surveys following the session asking if the session was: engaging, relevant to them and their practice, supported with the most recent/relevant literature, high quality visual aids, clear and organized flow. The score was 0-5 on the Likert scale and the mean scores were 4.8, 4.8, 4.9, 4.9 and 4.9. Overall, the session was perceived as an effective and interactive method to understanding pulmonary management of neuromuscular weakness.

### DISCUSSION:

This session is an efficient method to teaching an important topic. Helping fellows feel more comfortable with neuromuscular weakness will translate into better care both in the out-patient and in-patient setting. Their comfort with non-invasive ventilation and mechanical in-exsufflator will translate into higher use in the appropriate settings. We are planning further sessions to expand on this foundational knowledge on these topics especially on troubleshooting these machines based on feedback from patients and how to tailor the settings to comfort. Additionally, including other technology such as use of heated-high flow with NIV in the in-patient settings<sup>4</sup> and tracheostomy indications and management for chronic respiratory failure would continue to enhance their knowledge base.

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Figure 3

**AVAPS-AE mode**

**AVAPS-AE settings**

Target $V_T$	500	mL (50 to 2000)
AVAPS rate of change	5	cm H <sub>2</sub> O/min (1 to 5)
Max pressure	30	cm H <sub>2</sub> O (6 to 50)
Max pressure support	20	cm H <sub>2</sub> O (2 to 40)
Min pressure support	5	cm H <sub>2</sub> O (2 to 40)
EPAP max	10	cm H <sub>2</sub> O (4 to 25)
EPAP min	5	cm H <sub>2</sub> O (4 to 25)
Inspiratory time	NA	sec (0.3 to 5.0)

(only available with fixed back up rate)

Back up rate

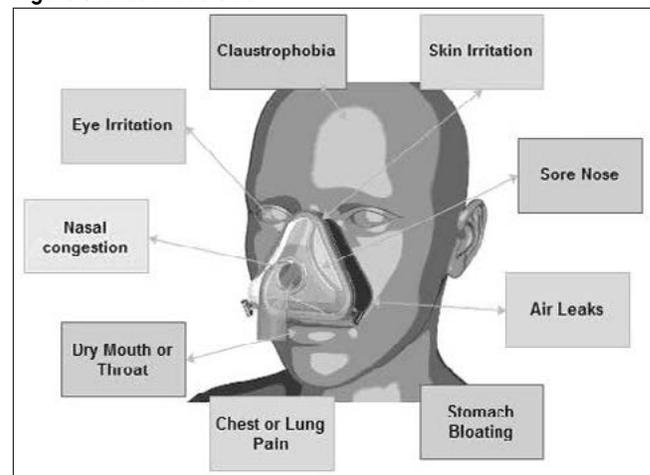
Auto    Fixed    bpm (0 to 60)

Rise time      1-5

Figure 4: Interface considerations



Figure 5: Mask Problems



# Stony Brook Medical Center

## A Blended Learning Paradigm for Pulmonary and Critical Care Fellowship Ultrasound Education

**Authors:** Sahar Ahmad, MD; Anita Fei, MD; Kazi Ullah, MD; Rajeev Patel, MD

**Program Director:** Rajeev Patel, MD

**Associate Program Director:** Sahar Ahmad, MD

### PROGRAM DESCRIPTION:

The Pulmonary and Critical Care fellowship training program at Stony Brook Medical Center in Stony Brook, NY offers three years of comprehensive training at a university based tertiary center and with an emphasis on procedural and research experiences. Stony Brook is a center of excellence in clinical ultrasound and the fellowship offers an expansive training program in bedside (point-of-care) ultrasound and echocardiography.

### BACKGROUND:

Currently no standardized training paradigm exists for ultrasound (US) training at the fellowship education level. There are many barriers to US training including a lack of faculty proficient in ultrasound (1). Blended Learning is an educational model that integrates multimedia technology-based learning with live instructor-led learning. This approach has been shown to be effective in limited medical education studies, however no existing Blended Learning model exists for Ultrasound (US) education at the level of Pulmonary and Critical Care Medicine (PCCM) Fellowship.

Given that this model incorporates asynchronous simulation based learning, we foresee this educational paradigm to overcome the barriers of teaching US knowledge and skills by a paucity of instructors. We aim to evaluate the efficacy of a Blended Learning US education program and to compare this method's efficacy to that of a Traditional faculty-led education model.

### METHODS:

Subjects were 11 first-year PCCM fellows, having matriculated in 2017 and 2018. The 2017 class of fellows underwent US training by Traditional course and the 2018 class by a Blended Learning Course. In both versions of the course, content, time devoted to each specified content, and instructor-supervised hands-on experience with normal and abnormal

models was matched. In the Traditional course, all didactics were delivered by a US educator faculty whereas the didactics were replaced by simulation video assignments for the Blended course.

Evaluation tools were: Medical knowledge testing by multiple-choice exam and hands-on skills testing by practical exam. Testing took place pre-, immediately post-, and at 6 months post- introductory course. Scores are reported as averages of the learner group. Standard statistical analysis was utilized.

### RESULTS:

Pre- versus Post- Course evaluations related to the Traditional Course (n=6) showed an increase of class average medical knowledge scores from 34.31% to 81.39% (p= 0.00058) and an increase of skills scores from 23.10% to 88.28% (p= 0.0017). When compared to immediate post- course testing, retention testing showed no significant knowledge decay (74%, p>0.05) nor skills decay (88.36%, p>0.05).

The Blended Learning Course (n=5) assessments yielded a significant increase from pre- to post- course testing scores of both medical knowledge (24.70% vs 56.47%, p=0.0085) and skills (39.32% vs 80.39%, p= 0.02), with retention testing showing no significant difference when medical knowledge (76.5%) or skills (88.84%).

When the Blended Course was compared against the traditional course, pre- course knowledge testing (24.70% vs 34.31%) post- course skills testing (39.32% vs 23.10%) were found to be similar (p=0.53 and p=0.42 respectively). Post- course knowledge testing average was significantly lower in the blended course (56.47%) than in the traditional course (80.39%, p=0.13) while post course skills average was similar (80.39% vs 88.29%, p=0.19). At the 6 month retention testing mark, both knowledge and skills scores were similar between the courses.

**DISCUSSION:**

The Blended Learning Course is found to be effective, with an increase in immediate post- course knowledge and skills scores and without significant decay in knowledge or skills at the 6 month mark. When compared to the traditional course, the blended course had overall lower scores in immediate post- course knowledge and skills despite pre- course testing being equivocal, and with the difference in knowledge base being statistically lower. This suggests that the Blended course, while effective on its own, may not be as effective as is the Traditional paradigm of US education in the immediate post- course period. At

the time of retention testing, knowledge and skills scores of the courses were equivocal, suggesting that Blended Learning is an effective alternative to traditional means of US education, while allowing for a significant decrease in time commitment by educator faculty.

**REFERENCE:**

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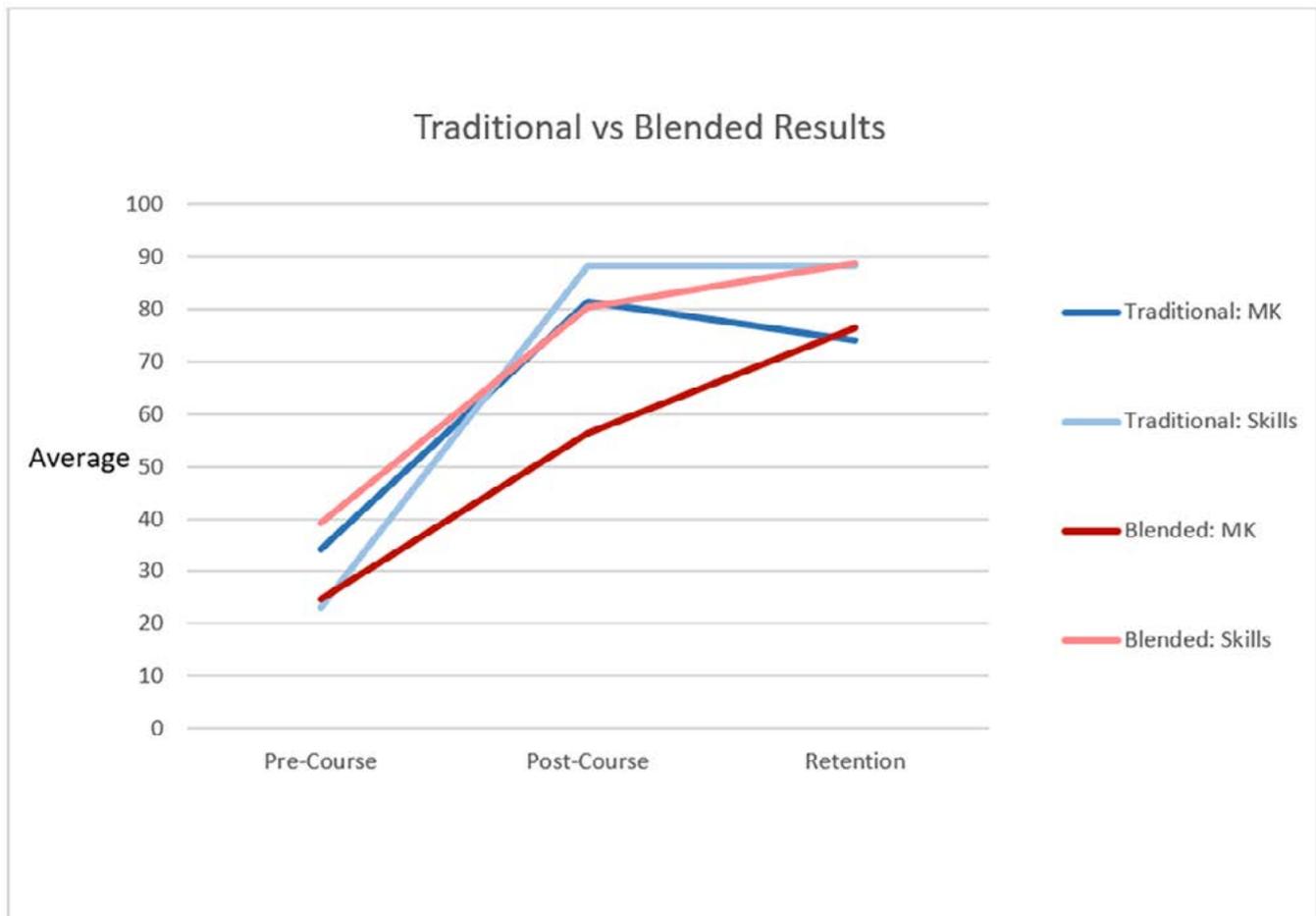


Figure 1. Blended Course was compared against the traditional course...  
*MK= Medical Knowledge*

# University of California – Los Angeles

## Implementation of Continuous Constructive Feedback Process to Improve Bronchoscopy Competency

**Authors:** Omar Awan, MD; Kathryn Melamed, MD; Scott Oh, DO; Tisha Wang, MD

**Program Director:** Tisha Wang, MD

### PROGRAM DESCRIPTION:

Academic pulmonary and critical care program with multiple training sites including community-based hospital, county hospital, Veterans Affairs hospital, and quaternary care hospital - with exposure to multiple pulmonary subspecialties including interstitial lung disease, pulmonary hypertension, interventional pulmonology and lung transplantation. There are both research-scientist track and clinician-educator track options for fellows.

### BACKGROUND:

There is growing interest in using deliberate practice to understand, evaluate, and ensure procedural competency amongst learners in post-graduate medical education training programs. While constructive feedback using clear measurements with defined outcomes is considered best practice, the implementation process has not been well-described and is likely individualized to each practitioner or institution. In this project, we aim to examine the efficacy of, attitudes towards, and obstacles observed with use of a standard evaluation and feedback tool for flexible bronchoscopy in a large academic pulmonary and critical care fellowship program.

### INNOVATION:

We have multiple training sites with significant heterogeneity in faculty sizes, workflows, and electronic healthcare records, making global implementation challenging. Thus, we felt the training and implementation strategies were best tested at a single site first. We implemented a constructive feedback process for bronchoscopy, guided by the validated Ontario Bronchoscopy Assessment Tool (OBAT, figure 1) at one of our program's training sites with a group of core faculty. Faculty and fellows were

both trained in how to use the tool. Prior to each non-emergent bronchoscopy, the fellow and attending both review the components of the tool ensuring that expectations are clear and that the critical steps of the procedure are known. Immediately following each bronchoscopy, the fellow and supervisor then review the evaluation form by actively discussing the learner's strengths and areas for improvement. This structure allows for direct and guided feedback after each procedure. As compared to periodic evaluation to monitor growth and development, this allows each bronchoscopy procedure to be a forum for improvement with the knowledge that deliberate practice is best performed continually.

We plan to track fellows' procedural skills quantitatively using the OBAT, comparing growth across levels of training, and will examine whether this approach helps fellows achieve OBAT-based competency without adding excess stress from constant evaluation as well as extra documentation and critique of each bronchoscopy. Given these considerations, we have also developed a survey for both attendings and fellows to assess their overall impressions of this approach and how the process could be improved and implemented at our other training sites.

### CONCLUSION:

Although the initial implementation may require adjustments to the procedural workflow, our hope is that the faculty and fellows will find it a positive experience that ultimately leads to performance improvements. Knowledge from this implementation project will lay the groundwork for applying deliberate practice methodology to other pulmonary/critical care procedures and ultimately implementation across all training sites in our fellowship program as well as other academic institutions.

Figure 1:

Ontario Bronchoscopy Assessment Tool					
Staff: (study number)		Date:			
Trainee: (study number)					
Relative complexity of procedure:		Low	Medium	High	Intubated Patient: Yes No
Samples Obtained / Interventions Performed					

**Scale**

- 1- "I had to take over"
- 2- "I had to talk the trainee through"
- 3- "I had to prompt the trainee from time to time"
- 4- "I needed to be in the room just in case"
- 5- "I did not need to be there"

The purpose of this scale is to evaluate the trainee's ability to perform all activities related to bronchoscopy safely and independently. The scores provided should reflect the trainee's *ability to competently perform tasks relevant to bronchoscopy* and not be based on expectations related to level of training.  
 For intubated patients, omit questions 2 and 3.  
 If an item was not assessed because the supervisor had assumed control, "1" should be selected.

**Pre-procedure planning**

1. Performs appropriate pre-procedure evaluation of patient, including review of pertinent investigations; discusses procedure with patient, obtains consent; communicates plans with bronchoscopy team	1	2	3	4	5
---	---	---	---	---	---

**Sedation and Monitoring**

2. Selects and administers (or directs administration of) appropriate sedation and local anesthesia; attentive to patient's vitals and comfort during the procedure, modifies procedure and sedation appropriately	1	2	3	4	5
--	---	---	---	---	---

**Technical**

3. Localizes / visualizes vocal cords / intubates trachea	1	2	3	4	5
4. Maintains good orientation /localization during procedure; correctly identifies bronchial anatomy and performs inspection in an orderly manner	1	2	3	4	5
5. Maintains good visualization of bronchi during procedure while avoiding excessive trauma to mucosa	1	2	3	4	5
6. Demonstrates good body and bronchoscopy mechanics	1	2	3	4	5
7. Able to obtain appropriate samples and/or perform appropriate intervention	1	2	3	4	5
8. Avoids complications if possible or recognizes and manages complications during procedure if they arise	1	2	3	4	5
9. Performs procedure efficiently (completes procedure in a timely manner without degradation in quality)	1	2	3	4	5

**Diagnosis**

10. Recognizes abnormalities and appropriately describes bronchoscopy findings	1	2	3	4	5
--	---	---	---	---	---

**Post-Procedure**

11. Develops post-procedure plan (provides appropriate verbal and written orders as appropriate); Ensures appropriate processing of samples (labels, samples, completes requisitions); Assesses for and manages post-procedure complications	1	2	3	4	5
12. Communicates bronchoscopic findings to patient and/or caregiver as appropriate; Documents procedure	1	2	3	4	5

Suggestions for improvement:

# University of Colorado

## Development of a Medical Intensive Care Unit Curriculum Following a Targeted Needs Assessment

**Authors:** Katie McPherson, MD; Tristan Huie, MD; Arun Kannappan, MD

**Program Director:** Tristan Huie, MD

### PROGRAM DESCRIPTION:

A pulmonary and critical care medicine fellowship program with a mission of training leaders in academic medicine.

### BACKGROUND:

The University of Colorado Medical Intensive Care Unit (ICU) has a thirty-minute, case-based teaching conference daily with teaching focused on cases admitted overnight. This results in heterogeneity of topics covered in any given rotation. We performed a targeted needs assessment to improve the educational content for the spectrum of learners in our MICU.

### METHODS:

Literature review revealed a paucity of published MICU curricula. A single curriculum focused on residents in an academic medical center using topics selected by the authors.<sup>1</sup> We performed surveys to evaluate perceived value of our current practice, to evaluate preferred presentation styles, and to solicit topics for a regular MICU curriculum from a multidisciplinary group of learners (residents, medical students, and advanced practice provider trainees) and experts (PCCM faculty and fellows).

### RESULTS:

Twenty two experts responded and twenty six solicited trainees solicited responded. Experts had a mean satisfaction score of 2.6 (Likert scale of 1-5 with 5 indicating highest satisfaction) with current practice. The majority 75% reported they were “very interested or extremely interested in teaching.” Learners reported a mean satisfaction of 3.12 (Likert scale 1-5) with the current format. Experts and learners agreed

a structure covering core topics would enhance comprehensiveness of current practice, but valued maintaining flexibility of using current cases as a focus of morning teaching. Learners and experts ranked potential critical care topics. The following topics were ranked highest: introduction to the ventilator; pain, agitation and delirium; pneumonia and ARDS; sepsis; ventilator management and troubleshooting; vasopressors and inotropes; and shock.

### DISCUSSION:

This targeted needs assessment demonstrated the need for a set of core critical care topics to be covered regularly. Seven core topics were selected based on survey preference and expert opinion to augment the traditional case based discussion. Facilitator guides for chalk talks with integrated active learning techniques have been developed as a teaching tool. Fellows are given these facilitator guides at the beginning of the month and expected to develop their own chalk talks on these core critical care topics as a means to develop their skills as an educator. Feedback is provided by core medical education faculty during their rotation. This project explores one method of implementing a standardized curriculum while allowing for flexibility based on the needs of multiple stakeholders. It is also an opportunity for deliberate practice and feedback for pulmonary and critical care fellows as a means to develop educational skills. Curriculum evaluation is ongoing.

### REFERENCES:

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# University of Nebraska Medical Center

## Simulation to Improve Critical Care Fellows' Confidence in Intubation

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**Program Director:** Craig Piquette, MD

**Associate Program Director:** Amol Patil, MD

### PROGRAM DESCRIPTION:

Our Pulmonary and Critical Care Medicine program is based at Nebraska Medicine, the tertiary and quaternary referral center for Nebraska and the surrounding region. Fellows get excellent training in all aspects of Pulmonary Disease including cystic fibrosis, pulmonary hypertension and lung transplantation. Each fellow gets extensive experience in the MICU, NeuroICU and CVICU triaging and managing a wide variety of critical illness. Learning to be good clinical educators is an important part of their training.

### BACKGROUND:

Airway management is a core competency for Pulmonary and Critical Care Medicine (PCCM) fellows as prescribed by the ACGME. Intubations in the ICU are known to be more difficult and have more complications; commonly hypotension and hypoxia.<sup>1,2</sup> Simulation has been shown to improve first pass success rate and to decrease adverse events while intubating in the ICU.<sup>3</sup> We hypothesized by implementing a simulation course fellows' confidence and experience in airway management would improve.

### ABSTRACT PRESENTATION:

A ten-session simulation course was created modeling a course by Mosier et al<sup>3</sup> previously described in the literature. Similar to their course, our course also incorporates principles of crew resource management, leadership, and effective communication in order to improve outcomes. The early sessions of the course focus on basic intubation skills, like airway evaluation, pharmacology, and decision-making strategies with later sessions progressing to advanced techniques like awake fiberoptic intubation and cricothyrotomy. We wrote our own cases for the course to meet the needs of our own hospital including neurological emergency cases for our Neurocritical care unit, and we partnered with other disciplines like ENT to teach cricothyrotomy. Pre-course surveys evaluating confidence in increasingly difficult airway situations were completed prior to initiation of the course and were compared with the same survey post-course. Billing codes were used to estimate the number of intubations performed

by the fellows in the ICU prior to the initiation of the course. An airway survey was also used to capture clinical outcomes including first pass success and complication rates.

### DISCUSSION:

From 2015 through 2017, the average number of intubations billed for by CCM faculty was 34 per year. Prior to implementing the course most of the intubations performed were done by Anesthesiology. Fellows cannot intubate without an attending present with the exception of a code. Anecdotally, some faculty cited lack of confidence in the fellows' knowledge and ability as reason not to supervise an intubation on a difficult airway in addition to the cultural norm to call Anesthesiology for a predicted difficult airway. Since implementing the course, some faculty members have also participated in an effort to improve their own skills and have cited an increase in their confidence regarding the fellows' ability to manage difficult airways. The number of intubations performed since implementing the program in 2018 is projected to increase to 116 intubations per year. Confidence surveys showed an increase in confidence on all scenarios (P Value Range 0.01-0.03) and by all methods (direct laryngoscopy P=0.01, video laryngoscopy P= 0.03, cricothyrotomy P=0.02) except bronchoscopic and placement of LMA. Clinically, first pass success rate was 78.3% on 120 intubations. Complications included esophageal intubation (N= 4/120, 3.3%), Severe Hypoxemia (Sat < 70 N= 9/120, 7.5%), Hypotension (N = 20/120, 16.7%), Cardiac Arrest (N= 1/120, 0.8%).

### CONCLUSIONS:

By implementing an airway simulation course, we were able to increase the number of intubations performed by PCCM fellows in the ICU by more than 3-fold. We were also able to increase the confidence of our fellows while achieving similar first pass success rates previously described in the literature. The course has also improved the confidence of the faculty in their own airway management skills and ability to supervise the fellows in this important clinical skill.

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# University of Pennsylvania Perelman School of Medicine

## A Novel, Longitudinal Curriculum for Communication, Professionalism and Ethics

**Authors:** Joshua B. Kayser, MD, MPH, MBE; Caitlin B. Clancy, MD; Maryl Kreider, MD, MSCE; Horace M. DeLisser, MD

**Program Director:** Maryl Kreider, MD, MSCE

### PROGRAM DESCRIPTION:

The Pulmonary and Critical Care Medicine Fellowship at the Hospital of the University of Pennsylvania is an academic training program situated in a large tertiary academic medical center. Our program currently has 28 fellows, in first to fourth year of subspecialty training, with typical completion of training at 3.5 years. Upon graduation, our fellows establish careers in basic science and translational research, clinical research and medical education.

### INTRODUCTION:

The ACGME subcompetencies for Pulmonary and Critical Care Medicine (PCCM) fellowship require training in communication, professionalism and ethics. However, the best methods for developing these competencies in fellowship learners are unknown. To address this knowledge gap, we designed, implemented and evaluated a comprehensive, longitudinal curriculum for communication, professionalism and ethics in PCCM fellowship, including didactics, simulation training, medical humanities experiences, and workplace assessment and observation.

### METHODS:

**Curriculum Description:** The curriculum was designed as a longitudinal experience including a variety of educational settings, and was organized and administered by two faculty members with training in biomedical ethics and palliative care.

Didactics include sessions on ICU communication and cultural competency as part of the fellowship’s Summer Lecture Series, and continue with a monthly Humanism and Professionalism

conference series, covering topics such as medical ethics, conflict resolution, rationing and organ allocation, informed consent, medically assisted death and dying, and professionalism.

Fellows participate in three simulation experiences spaced throughout the first year of training, focusing on delivering bad news, disclosure of adverse events, and managing moral emotions (e.g. anger, indignation, guilt) and religious or spiritual beliefs in family meetings. Trained standardized patients are engaged for all simulations, and sessions are followed by a debrief and feedback session. One simulation is recorded and reviewed by the fellow as a narrative reflection activity.

All fellows are provided with a book and a journal to encourage narrative reflection. Additionally, first year fellows participate in two “grieving rounds” sessions to process emotional responses to caring for dying and critically ill patients, and participate in a narrative medicine experience at the local art museum to enhance their observational skills.

**Table 1. Self-Rated Competency in Family Meeting Skills**

	Mean Ability Rating* (SD)
Conduct a family meeting to discuss goals of care and/or end-of-life	4.65 (0.49)
Establish the conditions for a productive family meeting	4.65 (9.49)
Use active listening skills during a family meeting	4.76 (0.44)
Present medical facts during a family meeting	4.59 (0.51)
Communicate prognosis during a family meeting	4.18 (0.53)
Make unambiguous recommendations for patient care during a family meeting	4.18 (0.53)
Manage conflict during a family meeting	4.09 (0.66)
Respond to emotion during a family meeting	4.47 (0.62)

\*1-5 scale where 1= “I am not able to perform”, 2= “I am able to perform with close supervision”, 3= “I am able to perform with minimal supervision”, 4= “I am able to perform independently”, 5= “I am able to teach others to perform this skill”

During the first six months, first year fellows must observe and reflect on three family meetings led by ICU attendings. In the second six months, fellows are required to have three family meetings observed by their ICU attending.

**PROGRAM EVALUATION:**

We conducted a voluntary, confidential paper survey of fellows who had participated in at least one year of the curriculum to assess comfort and perceived competence in ICU communication skills, and perceptions of the importance of individual curricular elements to their professional development in the areas of communication, ethics, and professionalism. Survey questions were developed and pilot tested with a group of fellows and faculty educators. Summary statistics were performed to describe the responses.

**RESULTS:**

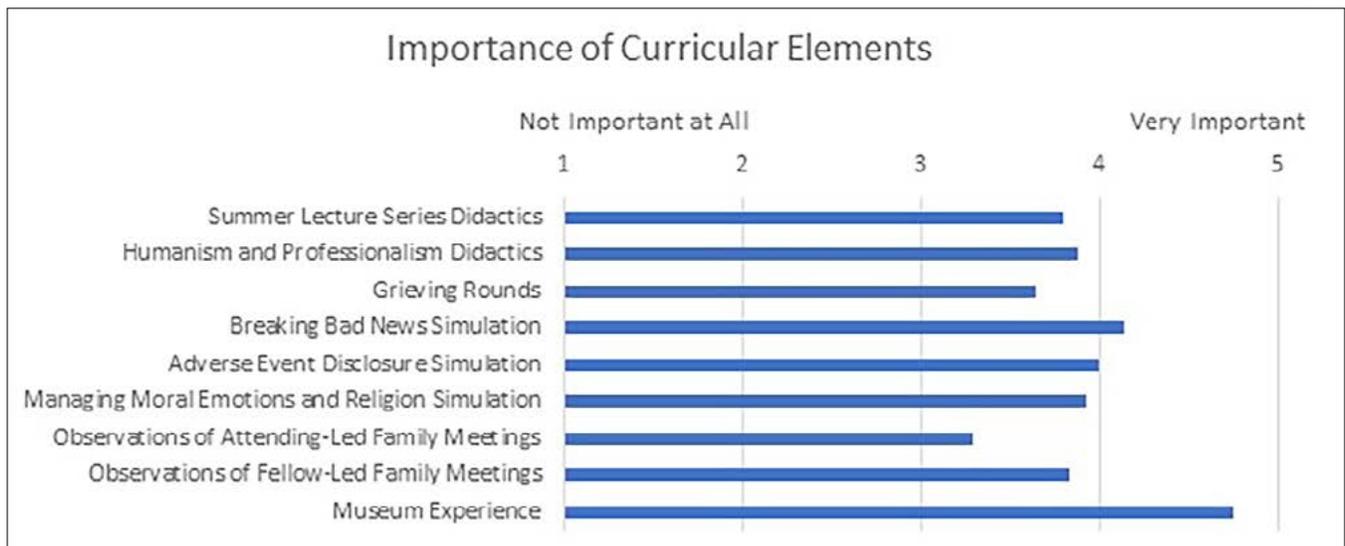
All fellows completed the survey (n= 19 with 8 second years, 6 third years, and 5 fourth years). All participants agreed or strongly agreed that they feel well prepared to engage and communicate with patients and families in the ICU and are comfortable conducting a family meeting to discuss goals of care and end-of-life. Fellow self-assessments of ICU

communication skill competency are listed in Table 1. Fellows rated the importance of each curricular element, shown in Figure 1 – the museum experience had the highest mean importance rating, while observations of attending-led family meetings had the lowest mean rating. While most fellows felt that the curriculum included the right amount of didactic sessions and simulation experience, 31% wanted more medical humanities experiences, and 53% wanted more workplace-based observation and assessment.

**CONCLUSIONS:**

We found that a longitudinal, multifaceted curriculum for communication, ethics, and professionalism was acceptable to the fellows at our institution. Overall, our fellows endorsed feeling prepared and comfortable with ICU communication and goals of care discussions, and rated themselves as competent in family meeting skills. Next steps include revision of our current curriculum to increase workplace-based observation and assessment. The framework of our curriculum could be easily transported to other large, well-resourced fellowships, and modified versions could also be considered in lower-resourced environments.

**Figure 1:**



# University of Pennsylvania Perelman School of Medicine

## Implementation and Assessment of a Novel Ambulatory Curriculum for Pulmonary and Critical Care Fellowship Trainees

**Authors:** Stacey Kassutto, MD; Lekshmi Santhosh, MD; Jennifer Lapin, PhD; Judy Shea, PhD; C. Jessica Dine, MD, MSHP; Maryl Kreider, MD, MSCE; Rupal Shah, MD, MSCE

**Program Director:** Maryl Kreider, MD, MSCE

### PROGRAM DESCRIPTION:

The Pulmonary and Critical Care Medicine Fellowship at the Hospital of the University of Pennsylvania is an academic training program situated in a large tertiary academic medical center. Our program currently has 24 fellows, in first to fourth year of subspecialty training, with typical completion of training at 3.5 years. Upon graduation, our fellows establish careers in basic science and translational research, clinical research and medical education.

### INTRODUCTION:

Pulmonary and Critical Care Medicine (PCCM) fellowship trainees are expected to obtain the knowledge and skills necessary for independent ambulatory pulmonary practice. However, only 7% of training is currently required to take place in the outpatient setting. In order to enhance ambulatory education, a novel two-year longitudinal

outpatient pulmonary fellowship curriculum was previously developed and piloted at the University of Pennsylvania. However, the curriculum's exportability to and impact on other fellowship programs is not known.

### METHODS:

The curriculum consisted of 40 teaching scripts that targeted disease states and clinical management areas that were not often seen in the inpatient setting or were unique to outpatient care (see Table 1 for list of topics). Each script was designed to take approximately 60 minutes and included the following: stated learning objectives, clinical case vignettes, illustrative clinical questions with evidence-based answers, and references to key articles. Faculty were instructed to focus on practical clinical management and decision-making.

Year 1 Content Topics		Year 2 Content Topics	
COPD 1: Inhaler Overview	Idiopathic Pulmonary Fibrosis	Approach to Pneumonia and Pulmonary Infections	Introduction to Sarcoidosis
COPD 2: Advanced Pharmacologic Therapies	Pulmonary Hypertension	Cystic Fibrosis	Post-Lung Transplant Complications
Palliative Care/Management of Dyspnea at End of Life	Venous Thromboembolic Disease	Bronchiectasis	Tuberculosis and Non-tuberculous Mycobacterial Infections
Pleural Effusion	Asthma Overview	Occupational Lung Disease	Pulmonary Rehabilitation
Solitary Pulmonary Nodule	Lung Transplantation: Overview and When to Refer	Post-Solid and Liquid Transplant Complications	Obstructive Sleep Apnea and Obesity Hypoventilation Syndrome
Interstitial Lung Disease: Initial Evaluation	HIV-Associated Lung Disease	Asbestos-Related Lung Disease	Clinical Applications of Cardiopulmonary Exercise Testing
Tobacco Cessation Strategies	Billing and Chart Documentation Overview	Vaccines and Primary Prevention in Pulmonary Clinic	Chronic Respiratory Failure/Hypoventilation
Asthma During Pregnancy	Neuromuscular Respiratory Disease	Lung Cancer Screening and Overview of Staging	Interstitial Lung Disease Therapeutics
Approach to Challenging Patient Interactions in Clinic	Chronic Cough	Work-Related Asthma and Reactive Airways Dysfunction Syndrome	COPD III: Surgical Approaches
Asthma Mimics	Pre-Operative Risk Assessment	Oxygen Delivery Devices and Inhaler Technique Overview	Cystic Lung Disease

**Table 1. Summary of 40 topics included in the 24-month ambulatory curriculum**

19 programs of varying sizes and geographic locations were invited to participate via the Association of Pulmonary and Critical Care Program Directors annual meeting. 7 programs received the entire 2-year curriculum (intervention), 6 only 1 year of content (intermediate) and 7 served as controls. Topic order, faculty selection and conference scheduling was left to the discretion of each program. Between July 2017-June 2019, fellows, faculty and program directors (PDs) completed surveys assessing satisfaction with ambulatory education and the curriculum including a baseline needs assessment. Fellows completed annual summative knowledge assessments and pre/post test knowledge inventories for each session in the curriculum. In addition, programs submitted summative average in-training exam scores from 2015-2019.

#### RESULTS:

A total of 221 fellows (39%) and 19 PDs (100%) completed the pre-curriculum surveys (summary findings in Table 2), while 12% of fellows and 53% of PDs completed post-curriculum surveys. Before curriculum implementation, 34.4% of fellows rated their ambulatory education as good or outstanding compared with 57.9% at the end of the study ( $p=0.001$ ). 31.1% of fellows felt they had a strong ambulatory knowledge-base pre-curriculum vs 59.5% post-curriculum ( $p=0.001$ ). Before the curriculum, self-reported confidence in managing patients in the outpatient setting was only 60% compared to 72.6% in inpatient consultation and 79% in critical care. The reported confidence in managing patients improved the most in the outpatient setting following

implementation (18.4% improvement) compared to inpatient consultation (11.2%) and critical care (7.5%). 52 faculty facilitators completed the surveys, the majority of whom felt the teaching scripts were easy to use (78.4%), factually accurate (86.3%) and provided high-yield information (82.1%). PDs had similarly positive impressions, with 78% noting that the conference positively impacted patient care and 100% noting that the curriculum fulfilled an unmet educational need. 89% of PDs agreed that it was easy to recruit faculty and 78% plan to continue the curriculum after the study. Feedback surrounded need for updated content based on recently published guidelines and studies. The average pre-curriculum summative knowledge assessment score was 38.8% correct. The average scores were 45.4%, 40.4% and 37.6% for the intervention, intermediate and control groups respectively. The average score for 36 post-session knowledge assessments improved by 15.2% compared to session pre-tests. Regardless of study cohort, the average in-training exam scores decreased slightly for all years.

#### CONCLUSIONS:

PCCM ambulatory training represents an area of opportunity for enhanced trainee education. A two-year ambulatory curriculum was well received by fellows, faculty and PDs and positively impacted perceptions of ambulatory education, self-perceived preparedness for independent outpatient practice and knowledge assessment scores. The curriculum provides a standardized, feasible and exportable way to address an unmet need in PCCM fellowship education.

Fellowship Needs Assessment Results				Fellowship Survey Respondent Demographics			
		n	% of respondents			n	% respondents
Ambulatory pulmonology will be a substantial part of my future clinical practice.	Strongly Disagree	3	1.4%	Fellowship Training Year	1st Year Fellow	82	38.5%
	Disagree	13	5.9%		2nd Year Fellow	58	27.2%
	Neutral	25	11.3%		3rd Year Fellow	71	33.3%
	Agree	102	46.2%		4th Year Fellow	2	0.9%
	Strongly Agree	69	31.2%		5th Year Fellow	0	0.0%
	Unsure at this time	9	4.1%		Other	0	0.0%
Overall rating of ambulatory education	Outstanding	13	6.0%	Total number of fellows in program (all years)	1-4	2	0.9%
	Good	62	28.4%		5-9	16	7.5%
	Satisfactory	53	24.3%		10-14	71	33.3%
	Fair	37	17.0%		15-19	47	22.1%
	Poor	16	7.3%		20-24	61	28.6%
	Unable to Assess/Not Applicable	37	17.0%		25-29	8	3.8%
Monthly time spent on ambulatory education	0 days	0	0.0%	>29	7	3.3%	
	1-2 days	49	22.6%	Not sure	1	0.5%	
	3-4 days	120	55.3%	Current Career Aspiration	Advanced Clinical Training (Transplant, Interventional Pulmonary, etc)	19	8.6%
	5-6 days	37	17.1%		Basic Science Research	8	3.6%
	7-8 days	9	4.1%		Clinician Education/Medical Education	39	17.6%
	9-10 days	1	0.5%		Clinically Focused	47	21.3%
	>10 days	1	0.5%		Clinical Research Focused	17	7.7%
					Health Services Research	1	0.5%
Current ambulatory educational offerings (check all that apply)	Faculty precepting related to direct patient care in clinic	202	100.0%	Mix of some combination of the above	74	33.5%	
	Regular ambulatory didactics	40	100.0%	Unsure at this time	15	6.8%	
	Self-directed learning	162	100.0%	Other	1	0.5%	
	Small group case-based discussions	19	100.0%	What is your gender?	Male	139	65.3%
	N/A- I do not receive any ambulatory education	5	100.0%		Female	71	33.3%
	Other (please describe)	8	100.0%		Other	0	0.0%
			Prefer not to say		3	1.4%	
I have a strong medical knowledge base in ambulatory pulmonology topics	Strongly agree	7	3.3%	Fellowship program setting (check all that apply)	Academic Affiliated Community Based Hospital	66	15.2%
	Agree	64	29.8%		Community Practice	7	1.6%
	Neutral	62	28.8%		County Hospital	47	10.9%
	Disagree	55	25.6%		Large tertiary care academic medical center	195	45.1%
	Strongly disagree	10	4.7%		Private Practice	3	0.7%
	Not applicable/Unable to answer at this time	17	7.9%		VA Medical Center/Military Facility	113	26.2%
I am confident in my ability to clinically manage an ambulatory pulmonary patient panel	Strongly agree	8	3.7%	Other (please describe)	1	0.2%	
	Agree	78	36.3%	<b>Program Director Needs Assessment Results</b>			
	Neutral	69	32.1%	Our fellows are generally satisfied with the quality of their ambulatory pulmonary education	Strongly agree	1	5.9%
	Disagree	39	18.1%		Agree	7	41.2%
	Strongly disagree	6	2.8%		Neutral	5	29.4%
	Not applicable/Unable to answer at this time	15	7.0%		Disagree	3	17.6%
			Strongly disagree		1	5.9%	
The faculty preceptors actively teach during my outpatient clinics	Strongly agree	37	17.3%	Presence of additional formal ambulatory teaching sessions beyond clinic	Yes	8	47.1%
	Agree	96	44.9%		No	9	52.9%
	Neutral	27	12.6%	Frequency of additional ambulatory teaching	A few times a year	4	50.0%
	Disagree	11	5.1%		Monthly	1	12.5%
	Strongly disagree	4	1.9%		Bi-weekly	1	12.5%
	Not applicable/Unable to answer at this time	39	18.2%		Weekly	2	25.0%
			Several days a week		0	0.0%	
My ambulatory pulmonary education is preparing/has prepared me well for independent practice	Strongly agree	13	6.1%	Total amount of fellowship content currently devoted to ambulatory pulmonology at our fellowship program	Too much	0	0.0%
	Agree	73	34.1%		Just right	3	17.6%
	Neutral	48	22.4%		Too little	14	82.4%
	Disagree	16	7.5%	Overall quality of ambulatory education	Terrible	0	0.0%
	Strongly disagree	6	2.8%		Poor	3	17.6%
	Not applicable/Unable to answer at this time	58	27.1%		Fair	7	41.2%
			Good		7	41.2%	
			Excellent		0	0.0%	
I would benefit from additional dedicated ambulatory teaching	Strongly agree	94	43.9%	Not sure/unable to assess	0	0.0%	
	Agree	66	30.8%	Approximately what percentage of your fellows obtain post-fellowship jobs that incorporate outpatient pulmonary medicine?	0-24%	0	0.0%
	Neutral	12	5.6%		25-49%	1	5.9%
	Disagree	5	2.3%		50-74%	4	23.5%
	Strongly disagree	4	1.9%		75-100%	12	70.6%
	Not applicable/Unable to answer at this time	33	15.4%		Don't know/not sure	0	0.0%
I would benefit from additional time in an ambulatory patient care setting	Strongly agree	46	21.5%				
	Agree	68	31.8%				
	Neutral	38	17.8%				
	Disagree	20	9.3%				
	Strongly disagree	3	1.4%				
	Not applicable/Unable to answer at this time	39	18.2%				

Current comfort level for patient management by care setting		ICU				Inpatient Ward/Consults				Outpatient			
		Upper Years		All Fellows		Upper Years		All Fellows		Upper Years		All Fellows	
		n	%	n	%	n	%	n	%	n	%	n	%
Very Confident		42	32.8%	48	22.6%	30	23.40%	37	17.5%	18	14.2%	20	9.5%
Confident		79	61.7%	119	56.1%	84	65.60%	117	55.2%	80	63.0%	106	50.5%
Neutral		6	4.7%	35	16.5%	13	10.20%	46	21.7%	24	18.9%	68	32.4%
Unconfident		0	0.0%	6	2.8%	4	0%	9	4.2%	3	2.4%	12	5.7%
Very Unconfident		0	0.0%	2	0.9%	0	0%	1	0.5%	0	0.0%	2	1.0%
Not applicable to my future practice		1	0.8%	2	0.9%	1	1%	2	0.9%	2	1.4%	2	1.0%

Table 2. Summary of Needs Assessment Findings of Pulmonary and Critical Care Medicine Fellows and Fellowship Program Directors