Evaluation of an Education-based Training Orientation for Resident Physicians in an Intensive Care Unit in Hawai'i

Victoria M.F. Mank MD; Amanda Wiggins MD; Derek Lowe MD; Crystal Breighner MD

Abstract

The need for multidisciplinary teams to provide complex care has increased as the population ages. As these teams become increasingly integrated, the knowledge, skills, and attitudes of resident physicians to practice safe and effective care in intensive care units (ICUs) evolves. A structured and multidisciplinary orientation day for resident physicians was implemented to assess improvements in physician confidence at Tripler Army Medical Center in Hawai'i from July 2019 to June 2020. ICU residents received an orientation day from a multidisciplinary team, with an emphasis on practical knowledge for common disease processes in a system-based fashion and competency in procedural skills. A total of 30 residents were asked to complete a pre- and post- orientation survey over a 1-year period, with 17 pre and post surveys completed for a response rate of 57%. The survey measured residents' perceived confidence in various tasks. Scores were compared using a paired 2-sampled t-test to assess statistical significance. The majority of resident physicians (76%) had at least 1 month of prior ICU experience. Statistically significant improvement was seen in self-reported abilities in performing 6 of the 10 elements assessed. With the diverse pathophysiology in critical care, it was essential to create a broad orientation with didactic and simulation-based learning, which resulted in observed improvement in more than half of the areas of interest. Adopting an orientation day for resident physicians rotating through the ICU can improve resident physician confidence, review important knowledge and skills, and highlight the role of each contributing multidisciplinary team member.

Abbreviations

ICU = Intensive Care Unit
IRB = Institutional Review Board
PGY = Post-Graduate Year
TAMC = Tripler Army Medical Center

Introduction

As the world's population ages, the medical field continues to evolve in clinician care with the inclusion of multidisciplinary teams.[1-4] In hospital settings, physicians work with a multidisciplinary team, which includes physician associates, nurse practitioners, nurses, respiratory therapists, occupational therapists, physical therapists, dieticians, and pharmacists. In academic institutions, resident physicians, who are physicians in training, are part of the multidisciplinary team. Health care is changing quickly in regards to treatment options, physical care of patients, electronic medical records, imaging studies, procedures, and physician resident work hours and academics.[3,4] The knowledge, skills, and attitudes resident physicians must possess in order to practice safe and effective patient care in an intensive care unit (ICU) has significantly increased with the inclusion of a multidisciplinary team. However, many resident physicians at Tripler Army Medical Center (TAMC) in Honolulu, Hawai'i had little to no experience in an ICU setting when they began training.

In the past, resident physician orientations focused on promoting group cohesion with activities tailored to hospital services and administrative work.[5] Resident physicians are prepared in a variety of ways prior to on-the-job training. For example, during the transition from a medical school student to resident physician, surgical interns undergo a focused and in-depth orientation to supplement their learning, standardize their surgical knowledge, and to give them adequate hands-on experience prior to performing surgery on a patient.[6-8] Educational orientation curricula are helpful in very demanding residency tracks. An institution in Honolulu Hawai'i, within the obstetrics and gynecology department, an orientation curriculum involved lectures, simulation, online modules, and clinical scenarios, similar to the multimodal approach implemented at TAMC.[9] This curriculum approach resulted in great improvement among resident physician confidence.

Currently, a common model is to introduce incoming resident physicians to important critical care topics and skills several weeks prior to the residency start date. At TAMC, this was done during the month of June, with hospital rotations beginning July 1. Prior to July 2019, the orientation to the TAMC ICU was conducted on the first day of the rotation and focused on the resident physician rotation schedule and daily workflow, with much of the day revolving on administrative topics. Results of in-service exam scores, resident physician feedback, and attending physician discussions made it apparent that the orientation structure was insufficient and needed to change. TAMC residents and attending physicians were surveyed on rotation experience at other hospitals as well as in civilian and military medical schools. The general consensus of the survey was that the traditional orientation model is commonly used in other ICUs. The traditional model is efficient in time by allowing all incoming resident physicians to participate once and without work-related interruptions. However, this traditional model has several limitations. At the time the orientation is delivered, resident physicians have not learned the necessary skills for completing the basic tasks in their daily workflow, thus limiting the immediate applicability of orientation topics. Additionally, resident physician schedules vary widely and clinical situation assessment of specific topics or skills discussed in the orientation may not occur for many months. As a result, when evaluating previous TAMC interns, the critical care topics

and skills taught during an intern orientation are often forgotten by the time their first individual ICU rotation begins. For these reasons, along with the convenience of a 1-day training, TAMC's ICU curriculum was changed to improve effectiveness and increase the self-confidence of resident physicians.

When designing the education-based orientation day for the resident physicians in TAMC's ICU, the basics of learning theory were used in the curriculum design.[10] The concepts of behaviorism, controlled environments, structured learning sessions, and educational handouts all fall under the umbrella of learning theory, which was used in designing the ICU orientation. The environment and topics presented in the course were controlled.[10,11] For example, the orientation took place directly in the physical location that the residents would be working in, surrounded by other members of the critical care team. This provided an opportunity for the resident to adjust to the new environment and become comfortable working in the ICU The new curriculum also trained residents to appropriately respond to the fast-paced critical care environment in the future. Educational handouts and structured learning sessions helped build upon previous knowledge the residents gained in medical school and previous hospital rotations. This further strengthened the learning they obtain from the orientation day. The objective of this paper is to assess resident physician confidence after their participation in the newly implemented curriculum.

Methods

Starting in July 2019, a structured, multidisciplinary, and multifaceted education-based orientation was implemented for resident physicians on the first day of each ICU rotation, approximately every 28 days. Efficacy of the education-based orientation on resident physician confidence in patient care in the ICU was measured.

From July 1, 2019 through June 30, 2020, all intern resident physicians rotating through the adult ICU at TAMC, received a mandatory, dedicated education-based orientation. The TAMC adult ICU is a 10-bed, mixed medical-surgical unit. Resident physicians from various fields, including internal medicine, family medicine, general surgery, orthopedic surgery, obstetrics and gynecology, and transitional year medicine were included in this study. All resident physicians were first-year resident interns. Each 12-hour shift in the ICU includes 1 upper-level resident, either from the general surgery or internal medicine department, and 2 interns from any of the aforementioned departments. A total of 30 resident interns rotating through the ICU in the academic year of 2019-2020 participated in the orientation including 5 post-graduate year (PGY) 2 or 3 residents and the remainder resident interns. A subset of the internal medicine and general surgery residents had more than 1 rotation through the ICU in the academic year. However, they only participated in the orientation once within the academic year. On the orientation day, resident physicians received a total of 11 presentations given by various members of the ICU multidisciplinary team including respiratory therapists, intensivists, nurses, pharmacists, dieticians, and physical therapists among others, all facilitating practical knowledge for treating common disease processes from their perspectives to improve procedural skills and team care (Figure 1).

The orientation consisted of traditional didactic sessions, simulation, and hands-on training. Sessions varied in length from 30 minutes to 90 minutes. The staff intensivist demonstrated the nuances of the physical examination of a critically ill patient and gave a brief overview of the various machines used in the ICU. Arterial and central line simulation was also a focus of the procedure portion of the orientation. Simulation was completed on a SimMan® 3G model (Laerdal Medical, Gatesville, TX) that was able to demonstrate various physical

ICU Day One: Orientation Day

Time	Topic	Presenter	Location
0600-0645	Pre-test, Survey		ICU Education Conference Room
0645-0725	Examining an ICU patient	Physician, Intensivist	ICU Patient Room
0730-0815	Academic Residency Educational Lecture	Chief Residents	Internal Medicine Conference Room
0830-0900	Infection Control	Infection Control Specialists	ICU Education Conference Room
0915-0945	The ICU Liberation Bundle	Critical Care Clinical Nurse Specialist	ICU Education Conference Room
0945-1045	Oxygen from Nasal Cannula to Invasive Mechanical Ventilation	Respiratory Therapist	ICU Education Conference Room/ICU Patient Room
1045-1130	Vasopressor Pharmacology	Critical Care Pharmacist	ICU Education Conference Room
1130-1200	Environment of Care	Critical Care Nurse	ICU
1200-1300	Lunch		
1300-1330	Nutrition in Critical Care	Critical Care Dietician	ICU Education Conference Room
1330-1400	Physical Therapy in Critical Care	Physical Therapist	ICU Education Conference Room
1400-1530	Central and arterial line simulation	Physician, Intensivist	Simulation Center
1530-1600	Social Work in the Care of the Critically Ill	Social Worker	ICU Education Conference Room
1600-1615	Survey, Post-test		ICU Education Conference Room

Figure 1. ICU Orientation Training Day Schedule

examination findings as well as anatomically correct vasculature to allow for procedures. An infection control specialist reviewed isolation precautions, proper personal protective equipment, and strategies for preventing hospital associated infections. The resident physicians learned about dosages of intravenous medications, scales used to titrate and adjust medications, and nurse-physician teamwork from the critical care clinical nurse specialist. A respiratory therapist educated resident physicians on various devices used to provide supplemental oxygen to patients and ventilator management. Residents had hands-on exposure to the various oxygenation and ventilator machines available in the ICU. The critical care pharmacist reviewed the pharmacology and pharmacokinetics of vasopressors, the body's physiologic response to these medications, and provided expert guidance for vasopressor selection in various clinical scenarios. Each educational session concluded by providing the resident physicians with an educational handout, further reinforcing the skills and knowledge given during the teaching session.

To assess the impact of the reformed ICU orientation, resident physicians were surveyed at the beginning and end of the day. The survey was voluntary and consisted of 10 questions in which the resident physician selected responses based on their perceived ability to present and manage patients, as well as perform procedures, in an ICU. Questions included in the survey referred to preparedness for the ICU, understanding of pharmacology of critical care medications, management of ventilated patients, performance of bedside procedures, and resident physician perceived comfort in managing patient nutrition, performing point of care evaluations, managing complex cardiothoracic surgery patients, interpreting chest radiographs, presenting ICU patients, and prescribing medications in the ICU. The answers to each of the 10 questions was based on a 5-point Likert scale. The graded scale equated a score of 1 with "strongly disagree" and a score of 5 with "strongly agree." The pre- and post-orientation scores were compared using paired 2-sampled t-tests to assess statistical significance using Microsoft Excel software version 16.17 (Microsoft Corporation, Redmond, WA). A P-value < .05 was considered significant.

The orientation assessment on resident physician confidence was exempt from TAMC Institutional Review Board (IRB) approval since the training was incorporated into the resident ICU curriculum.

Results

A total of 17 Army and civilian resident physicians completed a pre- and post-orientation survey for a response completion rate of 57%. Most of the respondents (76%) had at least 1 month of prior ICU experience.

Among the 10 elements assessed, residents reported statistically significant improvement in their ability to perform 5 elements following the orientation (Table 1). Specifically, residents improved in their ability to present patients in the ICU (P = .03), manage nutritional needs of critically ill patients (P = .0004), understand vasopressor pharmacology (P = .02), ventilator management (P = .04), and place central or arterial lines in patients (P = .002). Additionally, there was a statistically significant improvement in the resident physicians' overall perceived preparedness for the rotation following the orientation (P = .003).

There were no statistically significant improvements found in self-reported ability to perform point-of-care ultrasound, postoperative management of cardiothoracic surgical patients, comfort with prescribing antibiotics, and interpretation of chest radiographs.

Table 1. Pre- and Post-Orientation Confidence Mean Scores and Standard Deviation (N = 17).

Survey Statement	Pre-Orientation Mean ± SD	Post-Orientation Mean ± SD	Mean Difference	*P*-value
I am adequately prepared for the ICU rotation	2.41 ± 0.43	3.12 ± 0.37	0.71	.003
I am comfortable interpreting chest radiographs in the ICU setting	2.82 ± 0.45	2.88 ± 0.47	0.06	.290
I am ready to present medically complex ICU patients systematically by organ system	2.76 ± 0.57	3.12 ± 0.44	0.36	.030
I am comfortable prescribing antibiotics in the ICU setting	2.24 ± 0.57	2.29 ± 0.58	0.05	.400
I am comfortable managing patient nutrition in the ICU setting	1.94 ± 0.54	3.06 ± 0.46	1.12	.0004
I understand the pharmacology of different vasopressors and how to select between them	2.35 ± 0.44	3.12 ± 0.44	0.77	.020
I am prepared to manage post-operative CT surgery patients	2.12 ± 0.44	2.35 ± 0.47	0.23	.190
I am prepared to manage patients on the ventilator	2.24 ± 0.46	2.71 ± 0.40	0.47	.040
I can perform bedside procedures such as central and arterial line placement	2.47 ± 0.56	3.12 ± 0.53	0.65	.002
I can perform point of care ultrasound evaluations such as IVC evaluation, FAST exam, and evaluation for pneumothorax	3.06 ± 0.52	3.12 ± 0.53	0.06	.290

Discussion

New resident physicians often feel anxious and unprepared for inpatient rotations, especially in high-acuity environments such as the ICU, which has been well documented and studied in critical care and inpatient rotations.[12,13] Practical or a hands-on orientation can help alleviate uneasiness and improve provider confidence.[7,10,14] This has been seen in other members of the multidisciplinary team, such as nurses, in the critical care environment.[14] The ICU requires additional training for specialized knowledge to improve provider confidence and competence.[14] This knowledge is often gained from health care professional experts teaching the fundamentals of critical care in procedural competence, shock pathophysiology, vasopressor pharmacology, nutrition, and mechanical ventilation management, all of which can be familiarized and achieved through an orientation. The TAMC education-based orientation day was designed to supplement prior learning from medical school and previous hospital rotations to promote residents' confidence for real-world performance.

Appropriate care for critically ill patients with diverse disease processes requires a broad foundation of knowledge, skills, and attitudes that can be obtained by using protected didactic and simulation-based learning time. Simulation-based education was included in the orientation day due to promising literature on long-term benefit through this method of learning.[15,16] Having hands-on exposure through simulation improves participant comfort and competence when faced with similar situations later in the ICU rotation, as supported by many other fields of medicine using this method with excellent results.[16,17]

In many academic institutions, formalized educational orientations are held to prepare clinicians for the environment in which they will begin working. Other members of the ICU multidisciplinary team, such as critical care nurses, receive similar training across the country prior to beginning work.[18-20] However, there are limited published data on resident physician orientations preparing specifically for the ICU environment. The current study supports the need for resident physician training prior to an ICU rotation, as the mean score for perceived preparedness prior to the orientation was lower than that following the orientation, suggesting that the majority of resident physicians do not feel adequately prepared for their first ICU rotation. With the current ICU orientation, resident overall self-reported confidence increased, despite more than 75% of participating resident physicians reporting significant prior ICU experience.

TAMC previously had a well-established ICU orientation, including an hour-long slideshow exploring a daily schedule and explanations of administrative procedures. The orientation was remodeled to include didactic lectures and simulation training with a multidisciplinary team to improve resident physician preparedness in the ICU. The assessment of residents' confidence provides feedback for future improvements in the curriculum such as ultrasound guidance and chest radiology. The most likely reason behind insignificant findings may have been the complexity of care required in the cardiothoracic surgery patient management, which may need reiteration and further training. Additional training sessions are needed to focus on complex care in the ICU throughout the year in order to improve resident confidence. Examining the collected data further, ultrasound, management of cardiothoracic surgical patients, comfort with prescribing antibiotics, and interpreting radiographs were found to have little change in self-reported confidence. A possible reason for these not improving after the orientation day, was that these are areas that require time and experience to gain appropriate knowledge and skill. The basics were covered in the orientation day, but more patient exposure is likely required before confidence will be reported to improve. Based on the current results, the intervention of tailoring the educational curriculum throughout the year based on resident confidence results should be considered or applied to other medical specialties where feasible. This can be done through an orientation and additional educational trainings throughout the rotations in individual specialties. Additional educational trainings throughout the year may compliment the orientation day, as they further add to the on-the-job trainings that the residents gain from caring for patients daily. Overall, the results from the orientation survey provide support for orientations to include multidisciplinary team training and additional training in other medical specialties in academic medicine.

A strength of this study was its focus on multidisciplinary learning in the ICU. This limited the attending physicians teaching burden, reduced scheduling conflicts, and allowed resident physicians to meet other members of the multidisciplinary team. The members of the multidisciplinary team who participated in the orientation showed great enthusiasm and support of the new curriculum. An unexpected outcome was the interest from students and new employees in various disciplines outside of the resident class who frequently attended the lectures in their respective fields or fields of interest. The restructured orientation intended for resident physicians also became a training for other members of the multidisciplinary team.

There were several limitations to this study. The orientation was implemented in an Army hospital's ICU with a majority of military resident physicians, which limits the generalizability to physicians in non-military hospitals. The sample size was small with the pre- and post-orientation survey responses. Finally, the project lacked an objective measurement of resident physicians' critical care knowledge or procedural competency. Future research is needed to assess these measures and verify reproducibility in other medical centers as well as other specialties.

The next step would be to implement orientations for all members of the critical care team and assess confidence in their various occupations within the ICU. A long-term study evaluating patient outcomes from the trained team members in comparison to untrained team members would be useful for the effectiveness of the curriculum.

Conclusion

Critical care encompasses a wide range of complex medical conditions and diverse pathophysiology. Resident physicians at TAMC received an intensive 1-day orientation taught by a multidisciplinary team to increase confidence in caring for medically complicated patients in the ICU. The results from the surveys helped to improve the ICU curriculum by focusing on measures with low confidence levels. Learning the various roles of the multidisciplinary team have improved resident preparation for the ICU. Overall, adopting a focused education-based orientation for incoming resident physicians in demanding specialties may increase foundational knowledge, improve competency skills and patient care, foster self-confidence, and promote team cohesion within their rotation and beyond.

The views expressed in this publication are those of the author(s) and do not necessarily reflect the official policy of the Department of Defense, Department of the Army, US Army Medical Department, or the US Government.

Conflict of Interest

None of the authors identify a conflict of interest.

Authors' Affiliations:
- Department of Internal Medicine, Tripler Army Medical Center, Honolulu, HI (VMFM, CB)
- Department of Pulmonary and Critical Care, Emory University, Atlanta, GA (AW)
- Bassett Army Community Hospital, 1-24 IN 1/25 SBCT, Ft. Wainwright, AK (DL)

Corresponding Author:
Victoria Mank MD; Tripler Army Medical Center, MCHK-DM, 1 Jarrett White Rd., TAMC, HI 96859; Email: victoriammank@gmail.com

References

1. Barrett DJ, McGuinness GA, Cunha CA, et al. Pediatric hospital medicine: a proposed new subspecialty. *Pediatrics*. 2017 Mar;139(3):e20161823. doi: 10.1542/peds.2016-1823. PMID: 28246349.
2. Ratcliffe TA, Crabtree MA, Palmer RF, et al. Service and education: The association between workload, patient complexity, and teaching on internal medicine inpatient services. *J Gen Intern Med*. 2018 Apr;33(4):449-454. doi: 10.1007/s11606-017-4302-9. Epub 2018 Feb 1. PMID: 29392597; PMCID: PMC5880780.
3. Harrison R, Allen E. Teaching internal medicine residents in the new era. Inpatient attending with duty-hour regulations. *J Gen Intern Med*. 2006 May;21(5):447-52. doi: 10.1111/j.1525-1497.2006.00425.x. PMID: 16704386; PMCID: PMC1484793.
4. Swide CE, Kirsch JR. Duty hours restriction and their effect on resident education and academic departments: the American perspective. *Curr Opin Anaesthesiol*. 2007 Dec;20(6):580-4. doi: 10.1097/ACO.0b013e3282f0efd4. PMID: 17989554.
5. Grover M, Puczynski S. Residency orientation: what we present and its effect on our residents. *Fam Med*. 1999;31(10):697-702.
6. Antonoff MB, Swanson JA, Acton RD, et al. Improving surgery intern confidence through the implementation of expanded orientation sessions. *Surgery*. 2010;148(2):181-186. doi:10.1016/j.surg.2010.04.006
7. Esterl RM Jr, Henzi DL, Cohn SM. Senior medical student "boot camp": can result in increased self-confidence before starting surgery internships. *Curr Surg*. 2006;63(4):264-268. doi:10.1016/j.cursur.2006.03.004
8. Todd SR, Fahy BN, Paukert J, et al. Surgical intern survival skills curriculum as an intern: does it help?. *Am J Surg*. 2011;202(6):713-719. doi:10.1016/j.amjsurg.2011.06.049
9. Hiraoka M, Kamikawa G, McCartin R, et al. A pilot structured resident orientation curriculum improves the confidence of incoming first-year obstetrics and gynecology residents. *Hawaii J Med Public Health*. 2013;72(11):387-390.
10. Kay D, Kibble J. Learning theories 101: application to everyday teaching and scholarship. *Adv Physiol Educ*. 2016 Mar;40(1):17-25. doi: 10.1152/advan.00132.2015. PMID: 26847253.
11. Wood R, Bandura A. Social cognitive theory of organizational management. *Acad Manage Rev* 14: 361–384, 1989.
12. Peterlini M, Tiberio IF, Saadeh A, et al. Anxiety and depression in the first year of medical residency training. *Med Educ*. 2002;36(1):66-72.
13. Sajjadi S, Norena M, Wong H, et al. Moral distress and burnout in internal medicine residents. *Can Med Educ J*. 2017;8(1):e36-e43.
14. Innes T, Calleja P. Transition support for new graduate and novice nurses in critical care settings: An integrative review of the literature. *Nurse Educ Pract*. 2018 May;30:62-72. doi: 10.1016/j.nepr.2018.03.001. Epub 2018 Mar 5. PMID: 29571106.
15. Masiello I, Mattsson A. Medical simulation training – an overview of the evidence. *Lakartidningen*. 2017 Oct 23;114:ETDY. Swedish. PMID: 29064518.
16. Lopreiato JO, Sawyer T. Simulation-based medical education in pediatrics. *Acad Pediatr*. 2015 Mar-Apr;15(2):134-42. doi: 10.1016/j.acap.2014.10.010. PMID: 25748973.
17. Padaki A, Redha W, Clark T, et al. Simulation training for in-flight medical emergencies improves provider knowledge and confidence. *Aerosp Med Hum Perform*. 2018 Dec 1;89(12):1076-1079. doi: 10.3357/AMHP.4945.2018. PMID: 30487028.
18. Kirchhoff KT, Dahl N. American Association of Critical-Care Nurses' national survey of facilities and units providing critical care. *Am J Crit Care*. 2006;15(1):13-27.
19. Thomason TR. ICU nursing orientation and postorientation practices: a national survey. *Crit Care Nurs Q*. 2006;29(3):237-247. doi:10.1097/00002727-200607000-00008
20. Graham P, Hall P, Sigurdson S. ICU survival guide. *Nurs Manage*. 2008;39(1):41-46. doi:10.1097/01.NUMA.0000305992.00356.3f