

An Immersive Critical Care Pilot Curriculum for Fourth Year Medical Students

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Background

- During the 2019-2020 academic year, only 40% of medical schools reported critical care as a required clerkship [1].
- Critical care experience during medical school training is a recommended competency by residency program directors [2].
- As part of future curricular reform at the University of Colorado School of Medicine, all students will be required to complete a rotation in critical care. We developed a critical care pilot curriculum for fourth year medical students utilizing structured didactics, simulation learning, and hands-on intensive care unit (ICU) experience.

Participants

15 total fourth year medical students voluntarily participated in some aspect of the critical care pilot elective over two different sessions.

- 10 students participated in the full critical care elective. An additional 5 students who were on alternative critical care rotations joined for didactic and simulation sessions.
- 6 students were in the September 2020 session and 9 in October 2021 session

Methods

The University of Colorado School of Medicine critical care pilot was a four-week elective course for fourth year medical students.

Course structure:

- ICU experience:** Students rotated through two different ICUs, including a medical ICU, surgical ICU, and/or cardiothoracic ICU, Each rotation lasted two weeks,
- Didactic and simulation sessions:** Twice weekly didactic lectures were held lasting 1-2 hours followed by a simulation session to apply the knowledge and skills taught during lecture. See **Figure 1** for an example of the didactic structure and topics covered.

Assessments and feedback:

- Assessment of students:** 3 formal assessments contributed to students' course grade:
 - Assessment of performance while on the medical wards.
 - A multiple-choice test was given at the beginning and end of the elective to assess knowledge and gauge improvement over time.
 - A "mega-simulation" at the end of the course to allow students to actively demonstrate the knowledge and skills they learning during the elective.
- Course feedback:** A pre- and post-course survey was administered to understand baseline critical care comfort and experience and evaluate for change after completion of the elective. All survey feedback was anonymous.

Figures and Tables

Figure 1: Example 4-week course outline of lectures and simulation sessions included in the critical care elective.

Sept/Oct 2020 Calendar:

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
	Sept 14 8-10am Intro to clerkship (Course objectives, reading material) Intro to sim-lab pre-test Lecture on approach to Critical care medicine (how to present on rounds, abco, and procedures - Peter) 10-11am Sim #1 (septic shock/hypoxemia)	Sept 15	Sept 16	Sept 17	Sept 18 1-2pm Lecture (Resp failure - Peter) 2-4pm Procedure sim (A-lines, central lines, BVM and intubation practice)	Sept 19
	Sept 20 8-10am Lecture (ABGs and mech vent 1)	Sept 21	Sept 22	Sept 23	Sept 24 1-2pm Lecture (mech vent 2) 2-4pm Sim #2 (ventilator / ARDS sim)	Sept 25
	Sept 26	Sept 27	Sept 28	Sept 29	Sept 30 1-2pm Lecture (shock / circulatory failure) 2-4pm Sim #3 (delirium, SBT, ABG interpretation)	Oct 1
	Oct 2	Oct 3	Oct 4	Oct 5	Oct 6	Oct 7
	Oct 8	Oct 9	Oct 10	Oct 11	Oct 12	Oct 13
	Oct 14	Oct 15	Oct 16	Oct 17	Oct 18 1-2pm Final test and course evaluation 2-3pm Final sim	Oct 19

Table 2: Results of the average scores out of 30 for the pre- and post-elective multiple choice test.

	Pre-test score	Post-test score
Overall cohort (N = 15)	16.5 (55%)	21.6 (72%)
CC pilot students (N = 10)	17.4 (58%)	22.1 (74%)
Traditional curriculum students (N = 5)	14.8 (49%)	20.5 (68%)

Table 3: Student identified areas for improvement in future pilot rotations.

- Decreasing lecture time in favor of increasing hands-on teaching during simulation sessions.
- Increase hands-on experience with ICU machines (i.e. infusion pumps, ventilators).
- Simulation training on rapid responses and code blues.
- Inclusion of didactics on specialty specific ICU topics (i.e., peri-operative care in the ICU, acute coronary syndrome, ECMO).
- Increase critical care procedure exposure and experience while on the ICU wards.

Table 1: Pre and post survey data from critical care elective participants regarding their comfort level with multiple common ICU topics and scenarios.

	Pre-rotation survey (N=12)				Post-rotation survey (N=12)			
	Very comfortable	Somewhat comfortable	Uncomfortable	Very uncomfortable	Very comfortable	Somewhat comfortable	Uncomfortable	Very uncomfortable
Septic shock	0.00%	83.33%	8.33%	8.33%	58.33%	41.67%	0.00%	0.00%
Cardiogenic shock	0.00%	58.33%	33.33%	8.33%	8.33%	66.67%	25.00%	0.00%
Hypovolemic shock	0.00%	83.33%	8.33%	8.33%	50.00%	50.00%	0.00%	0.00%
Undifferentiated shock	0.00%	41.67%	50.00%	8.33%	8.33%	83.33%	8.33%	0.00%
Acute hypoxic respiratory failure	8.33%	58.33%	25.00%	8.33%	50.00%	50.00%	0.00%	0.00%
Acute hypercarbic respiratory failure	0.00%	50.00%	41.67%	8.33%	25.00%	66.67%	8.33%	0.00%
Acute respiratory distress syndrome (ARDS)	8.33%	41.67%	33.33%	16.67%	58.33%	41.67%	0.00%	0.00%
Patient needing a mechanical ventilator	0.00%	33.33%	50.00%	16.67%	41.67%	58.33%	0.00%	0.00%
Reading a ventilator screen	16.67%	41.67%	41.67%	0.00%	58.33%	41.67%	0.00%	0.00%
Presenting ventilator settings on ICU rounds	25.00%	50.00%	16.67%	8.33%	100.00%	0.00%	0.00%	0.00%
Choosing initial settings for a patient being started on mechanical ventilation	0.00%	25.00%	58.33%	16.67%	50.00%	50.00%	0.00%	0.00%
Differentiating between modes of mechanical ventilation	0.00%	41.67%	50.00%	8.33%	58.33%	41.67%	0.00%	0.00%
Providing a differential diagnosis for high peak pressure alarm on a ventilator	8.33%	25.00%	33.33%	33.33%	58.33%	41.67%	0.00%	0.00%
Providing a differential diagnosis for high plateau pressure on a ventilator	8.33%	33.33%	33.33%	25.00%	58.33%	41.67%	0.00%	0.00%
Performing an inspiratory hold maneuver on a ventilator and interpreting the result	0.00%	0.00%	58.33%	41.67%	75.00%	8.33%	16.67%	0.00%
Making ventilator changes based on an ABG result	0.00%	50.00%	50.00%	0.00%	58.33%	33.33%	8.33%	0.00%

● = topics a majority of students felt "very uncomfortable" or "uncomfortable" with before starting the elective.

Results

- 10 of the 14 students (71%) who answered the pre-rotation survey reported having rotated through an ICU. 6 of the 14 students (43%) reported ever managing a ventilated patient prior to the critical care elective.
- At the end of the course, 100% of the students who responded to the post-rotation survey said they would recommend the course to their classmates.
- A majority of students reported feeling "uncomfortable" or "very uncomfortable" with the 6 of 16 common critical care issues at the beginning of the rotation (designated with a ● in **Table 1**). At the end of the rotation, all students reported feeling "very comfortable" or "comfortable" with the clinical issues they previously had felt uncomfortable with.
- Only 1 student received a passing score of 70% on the 30-question pre-course multiple choice knowledge assessment in either curriculum group. The mean score on the post-course knowledge assessment for the novel-curriculum students was 22.1 (74%), compared to 20.5 (68%) for the students in the traditional curriculum (**Table 2**).
- Students reported that the rotation helped to "demystify the terror of being in the ICU" and "improved... understanding of and comfort with critical care." Additional positive feedback was given on the use of simulation to assist with learning.
- Student identified areas for rotation improvement are outlined in **Table 3**.

Conclusions

- We successfully created an immersive critical care pilot rotation for fourth year medical students.**
- Through the combined use of medical wards experience, didactic teaching, and simulation learning, students were able to master the basic knowledge and skills needed to successfully care for patients in a critical care setting.**

References

- Association of American Medical Colleges (AAMC). Clerkship Requirements by Discipline. AAMC Curriculum Inventory, 2019-2020. [https://www.aamc.org/data-reports/curriculum-reports/interactive-data/clerkship-requirements-discipline]. Accessed Feb 20, 2022.
- Lyss-Lerman, P., et al., *What training is needed in the fourth year of medical school? Views of residency program directors.* Acad Med, 2009. 84(7): p. 823-9.



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