

Example #1

Integrated Critical Care Curriculum for the Third-Year Internal Medicine Clerkship

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Abstract

Introduction: A majority of residents provide care for critically ill patients, yet only a minority of medical schools require ICU rotations. Therefore, many medical students enter residency without prior ICU experience. The third-year internal medicine (IM) clerkship at our institution's Veterans Affairs Medical Center (VAMC) provided an opportunity for medical students to rotate through an open ICU as part of their inpatient ward rotation. Prior to March 2019, no structured critical care curriculum existed within the IM clerkship to prepare students for this experience. **Methods:** We created a seven-session ICU curriculum integrated within the VAMC IM clerkship addressing core critical care topics and skills including bedside presentations, shock, and respiratory failure. IM residents facilitated the curriculum's case-based, small-group discussions. We assessed curricular efficacy and impact with a pre- and posttest and end-of-curriculum survey. **Results:** Forty-one students participated in the curriculum from March to November 2019. As a result, students agreed that their overall clerkship experience improved (73% *strongly agree*, 24% *agree*). Students also reported increased comfort in their ability to participate in the management of critically ill patients (44% *strongly agree*, 51% *agree*). Objectively, student performance on a 15-question pre- and posttest improved from a precurricular average of 7.5 (50%) questions correct to a postcurricular average of 10.7 (71%) questions correct ($p < .0001$; CI 2.2-4.4). **Discussion:** Following implementation of our ICU curriculum, medical student attitudes regarding overall IM clerkship experience, self-perceived confidence in critically ill patient management, and medical knowledge all improved.

Keywords

ICU, Intensive Care Unit, Chalk Talk, Critical Care Medicine, Internal Medicine, Case-Based Learning

Educational Objectives

By the end of this activity, learners will be able to:

1. Apply a standardized approach to rounding presentations in the medical ICU.
2. Describe a physical exam-based approach for working through the differential diagnosis in an undifferentiated shock patient.
3. Describe the management for a patient with septic shock, including IV fluid resuscitation, appropriate antibiotics, and vasopressors.
4. Describe the management for a patient in cardiogenic shock, including inotropes, afterload reduction, and diuresis.
5. Describe the management for a patient with hemorrhagic shock from an acute gastrointestinal bleed, including volume resuscitation, blood transfusion thresholds, and adjunctive therapies utilized for patients with cirrhosis.
6. Identify patients with acute respiratory failure that may benefit from noninvasive positive pressure ventilation.
7. Identify indications for intubation and mechanical ventilation.

Introduction

As described by the core Entrustable Professional Activities (EPAs) outlined by the AAMC, a medical school graduate must be able to "recognize a patient requiring urgent or emergent care and initiate evaluation and management."¹ Included in the specific functions of this EPA are the abilities to "recognize normal vital signs and variations," "recognize severity of a patient's illness and indications for escalating care," and to "start initial care plan for the decompensating patient."¹ Despite this AAMC recommendation, formalized critical care education during medical school is limited. As of 2015, only 46 of

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136 (34%) surveyed medical schools required ICU rotations during a student's fourth year.² Furthermore, prior research in student decision-making regarding fourth-year course selection revealed significant fear and anxiety surrounding the choice to pursue an ICU rotation.³ Regardless of student participation in an ICU course during medical school, a majority of resident physicians are required to care for the critically ill by the ACGME. The six largest residency specialties (internal medicine, family medicine, pediatrics, general surgery, emergency medicine, and anesthesiology) all require residents to provide care for critically ill patients during their training.⁴⁻⁹ In total, the aforementioned groups encompass 64% of all currently practicing residents.¹⁰

At the University of Colorado, similar to the national landscape, there is significant variability in the exposure to formalized critical care education. The University of Colorado internal medicine (IM) third-year clerkship at the Rocky Mountain Regional Veterans Affairs Medical Center (VAMC) provided an opportunity for medical students to rotate through an ICU as part of an open-ICU staffing model. An open-ICU staffing model allows an inpatient medical team to care for patients simultaneously on the floor and in the ICU, as opposed to a closed-ICU model in which critically ill patients are managed exclusively by an intensivist and dedicated ICU service. Prior to March 2019, no structured critical care curriculum existed within the IM clerkship to prepare third-year students for this added ICU experience. Furthermore, a designated ICU course is not a clinical requirement for medical students at our institution. Many medical students miss the opportunity to develop the knowledge and skills necessary to care for the critically ill patient prior to graduation. As currently constructed, the VAMC IM clerkship may represent a student's only formal exposure to critical care medicine prior to residency training.

A needs assessment of students, residents, and faculty at our institution identified a need for increased education in core critical care topics and skills for third-year students during the VAMC IM rotation. Specifically, our assessment highlighted existing skill deficiencies surrounding bedside presentations during ICU teaching rounds, and knowledge gaps regarding support devices, shock, and respiratory failure. Furthermore, there is a paucity of literature describing educational strategies aimed at developing knowledge and skills in critical care targeted toward the third-year medical student. A review of existing resources on *MedEdPORTAL* utilizing the search terms "critical care" or "ICU" returned 16 results, of which only four resources pertained to medical student education. Three of these student-targeted curricula focused on pediatric critical care,¹¹ preparation

for surgical residency,¹² and palliative care.¹³ The most relevant resource published by Luks et al in 2011 described a 10-week course offered to second-year medical students during the preclinical training period.¹⁴ A review of Ovid MEDLINE utilizing the terms "critical care" or "ICU" and "medical student" and "curriculum" yielded no relevant results. To our knowledge, there are no critical care curricula or resources specifically designed for third-year clerkship students available in *MedEdPORTAL* or in the broader literature.

To address this local and national gap in critical care education, we created an integrated critical care curriculum within the third-year IM clerkship at the VAMC. Our curriculum represents the first integrated critical care resource designed for third-year learners rotating through an IM clerkship with an open ICU. We designed the curriculum as a series of small-group, case-based chalk talks. A chalk talk is an educational format in which an instructor utilizes a whiteboard to convey learning objectives in real time by diagramming key concepts and writing high-yield points. Our primary goal was to improve the student experience during the IM clerkship. Secondary goals included improving attitudes regarding self-perceived confidence in critically ill patient management and objective knowledge of core critical care topics.

Methods

Curricular Context

We integrated our curriculum within the third-year IM clerkship at the VAMC site. Third-year medical students rotated at the VAMC for 4-week periods during their IM clerkship. Similar to other VAMCs, our institution's VAMC utilized an open-ICU staffing model. Due to this open-ICU model, the VAMC is the only IM clerkship site at the University of Colorado at which third-year students provided care for critically ill patients.

Implementation

We constructed a seven-session curriculum, delivered twice per week during the first 3 weeks of the students' VAMC rotation, and once during the fourth and final week. Existing educational commitments limited student availability to 3 afternoons per week during the first 3 weeks, and 2 afternoons during the final week. Consequently, we developed a seven-session curriculum to comply with student availability. We selected topics based on our institution's needs assessment and review of the existing Clerkship Directors in Internal Medicine IM clerkship educational objectives, which required students to care for patients with gastrointestinal (GI) bleeding, heart failure, chronic obstructive pulmonary disease, and sepsis.¹⁵ Our group developed critical

care-focused content as a natural extension of these existing objectives. Curriculum sessions occurred in a conference room with a whiteboard and lasted approximately 30 minutes. Second- and third-year IM residents and pulmonary and critical care medicine (PCCM) fellows led curricular sessions. Our curriculum specifically prioritized the participation of residents and fellows as educators in order to increase availability of small-group teaching opportunities during their training.

To ensure facilitator availability for every session, we emailed the dates of teaching sessions to all second- and third-year IM residents rotating at the VAMC 1 week prior to the start of their VAMC rotation. If facilitator spots remained open following this inquiry, we queried IM residents within our institution's clinician-educator pathway or the PCCM fellow at the VAMC. We encouraged facilitators to lead multiple sessions if interested. Notably, this process ensured complete staffing of all sessions throughout the implementation process and created the opportunity for a total of seven different facilitators to participate over a 4-week rotation.

Following the scheduling period, we sent all facilitators the facilitator guide (Appendix A). Our group developed this guide in response to student feedback following preliminary implementation to assist facilitators in the creation of their chalk talks while ensuring delivery of key curricular content. The facilitator guide provided a step-by-step walkthrough of each session's educational objectives along with corresponding definitions, clinical examples, and teaching ideas for various learning points. We encouraged facilitators to utilize the guide when preparing for each session.

We introduced the curriculum and provided the syllabus to students via email 1 week prior to the start of their VAMC rotation (Appendices B and C). The first session of the curriculum, entitled Introduction to the ICU, occurred on the second day of the 4-week rotation. This session described services provided by the ICU, reviewed illnesses requiring ICU-level care, and demonstrated a systematic approach to bedside ICU rounding presentations. At the conclusion of the session, we provided students a pocket-sized laminated placard entitled ICU Presentation Template (Appendix D). The placard served as a quick reference guide for the remainder of the clerkship. At the conclusion of the initial session, students also received the ICU Student Handout, a comprehensive handout with high-yield learning points outlining future sessions (Appendix E). We designed the handout as both a reference tool and note-taking template based on student feedback following preliminary implementation.

The second session covered IV access, central venous catheters (CVC), and endotracheal tubes (ETT). During this session, students practiced pushing fluids through peripheral IVs and CVCs to demonstrate Poiseuille's Law. Students also reviewed the parts of an ETT and practiced inflating the cuff of the ETT. The third session defined acute respiratory failure and reviewed indications for noninvasive positive pressure ventilation (NIPPV). During this session, students also reviewed contraindications to NIPPV and indications for endotracheal intubation. The fourth session, entitled Introduction to Shock, defined shock, described clinical manifestations of shock, and provided students with the SHOCK+AWE physical exam-based approach to the undifferentiated shock patient (Appendix E, page 4). Utilizing the SHOCK+AWE framework, the remainder of the curriculum covered principles of management of septic shock (fifth session), hemorrhagic shock in the context of acute gastrointestinal bleed (sixth session), and cardiogenic shock (seventh session). Facilitators taught all curricular sessions as small-group, case-based chalk talks using the information provided in the facilitator guide (Appendix A).

Facilitators and students participated on a voluntary basis. Student participation in our curriculum did not affect clinical grade determination. Our curriculum did not meet the definition for human subject research and, thus, did not require approval by the University of Colorado Institutional Review Board.

Evaluation

We assessed curricular efficacy with regard to medical student attitudes with a novel 13-question end-of-curriculum survey (Appendix F). Ten questions assessed level of agreement on a 5-point Likert scale (1 = *strongly disagree*, 5 = *strongly agree*), while three questions allowed for open-ended responses. We constructed the survey to focus on respondent attitudes regarding overall clerkship experience, confidence in critically ill patient management, likelihood of pursuing critical care in the future, and the logistics of curriculum delivery. Following development, we reviewed survey content with medical students that had previously completed the VAMC IM clerkship rotation to determine if questions aligned with student experience and if respondent interpretation of items matched expectations. Educators with experience in curriculum development reviewed the final version of the survey prior to dissemination. Following the final session, students completed the end-of-curriculum survey via Qualtrics, an online survey tool.

Beginning in July 2019, we incorporated pre- and posttests into the curriculum to assess objective knowledge gains of core critical care topics. The 15-question pre- and posttests consisted

of nine resident-level questions from the Medical Knowledge Self-Assessment Program and six student-level questions from *IM Essentials*.^{16,17} We selected previously published and expert-reviewed content-specific questions to ensure evaluation accuracy. Students completed the pretest on the first day of their rotation following the initial VAMC site orientation. Students completed the posttest following the final curriculum session during the fourth week of their rotation.

Results

Fifty-six third-year medical students rotated through the VAMC from March 2019 to November 2019. An average of five students participated in our curriculum per 4-week clerkship rotation. From July to November 2019, we collected data regarding the total number of curriculum sessions attended by each student. During this time period, 56% of students attended six or seven sessions, 37% attended four or five sessions, and 7% attended two or three sessions. IM residents taught 95% of curriculum sessions. PCCM fellows taught 5% of sessions.

Overall, 41 students (73%) completed the end-of-curriculum survey. Students agreed that their overall clerkship experience improved as a result of our curriculum (73% *strongly agree*, 24% *agree*; Table). With regard to attitudes, students reported increased comfort in their ability to participate in the management of critically ill patients (44% *strongly agree*, 51% *agree*) as well as increased comfort presenting a patient during teaching rounds in the ICU (41% *strongly agree*, 41% *agree*). Students also reported an increased likelihood of applying for an ICU subinternship during their fourth year of medical school (24% *strongly agree*,

32% *agree*) and a higher likelihood of pursuing a specialty in which they could practice critical care medicine (20% *strongly agree*, 32% *agree*). From a curriculum delivery perspective, students found session topics applicable to their clerkship experience (71% *strongly agree*, 27% *agree*), appropriate in duration (68% *strongly agree*, 27% *agree*), and appropriate for their level of training (73% *strongly agree*, 24% *agree*). Overall, students found protected educational time for our curriculum a valuable part of their clerkship experience (66% *strongly agree*, 32% *agree*).

A thematic analysis of the open-ended response portion of the end-of-curriculum survey revealed the following themes:

- The benefits of early exposure to critical care medicine:
 - “This material isn’t taught anywhere else and it provided a brief review, built on what we know as a framework, and ultimately taught us an outline and approach to management of ICU patients.”
 - “Exposure to topics that are not well-covered in medical school didactics.”
 - “It was helpful and concise. Explained a lot of concepts I would have otherwise never learned.”
 - “Really helped to clarify topics that were frequently confused previously; very helpful for the shelf and moving forward.”
- The advantages of small-group, case-based chalk talks:
 - “The small-group, chalk talk nature. I thought there was a good flow to the series and that each talk built off each other.”

Table. End-of-Curriculum Survey Results (N = 41)

Statement	Strongly Agree (%) ^a	Agree (%) ^a	Neither Agree Nor Disagree (%) ^a	Disagree (%) ^a	Strongly Disagree (%) ^a	M (SD) ^b
The critical care curriculum improved my overall VA internal medicine clerkship experience.	73	24	0	2	0	4.7 (0.6)
As a result of the critical care curriculum:						
I am more comfortable presenting a patient during teaching rounds in the MICU.	41	41	15	2	0	4.2 (0.8)
I am more comfortable participating in the medical management of critically ill patients.	44	51	2	2	0	4.4 (0.7)
I am more likely to apply for a MICU sub-internship during my fourth year of medical school.	24	32	34	7	2	3.7 (1.0)
I am more likely to select a specialty in which I can practice critical care medicine.	20	32	39	7	2	3.6 (1.0)
I am inspired to create my own chalk talks for future teaching opportunities.	42	29	24	2	2	4.1 (1.0)
The session topics were applicable to my clerkship experience.	71	27	2	0	0	4.7 (0.5)
The duration of the sessions was appropriate.	68	27	2	2	0	4.6 (0.7)
Protected time for the critical care curriculum was a valuable part of my VA internal medicine clerkship experience.	66	32	0	2	0	4.6 (0.5)
The material was presented in a manner that was appropriate for my level of training.	73	24	2	0	0	4.7 (0.5)

Abbreviations: VA, veterans affairs; MICU, medical intensive care unit.

^aPercentages may not total 100% due to rounding.

^bLevel of agreement assessed on 5-point Likert scale (1 = *strongly disagree*, 5 = *strongly agree*).

- “The case-based approach was a useful framework for each session.”
- “The small-group nature of the sessions made asking questions comfortable.”
- “Intimate, structured Q&A feel.”
- “I really enjoyed the content and being able to think through concepts as a group.”
- The importance of residents as educators:
 - “Excellent teachers; able to connect with [residents] and ask questions without the pressure of rounds/patient care.”
 - “I loved the one-on-one interaction with residents ...in a low-pressure environment.”
 - “Being taught by the residents was great.”
- The necessity of developing an organized, efficient curriculum:
 - “Short presentations but very high-yield topics. Loved coming to these sessions.”
 - “I enjoyed how efficient these sessions were. They were informative but also quite quick, which made for a great learning opportunity.”
 - “Succinct and clear explanations; handouts were fantastic and presented in an easy-to-consume way.”
 - “The brevity but clarity was perfect.”
 - “Material laid out in a format that helped me organize topics in my mind and was not too in depth or overwhelming.”
 - “The organized teaching to our level with diagnosis and management outlines.”

Between July and November 2019, we offered our curriculum to all 32 students that rotated through the VAMC. All 32 students completed the pretest and, of these, 27 (84%) completed the posttest. We utilized posttest completion as a marker of curriculum participation during this time period. Overall, student testing performance improved from a precurricular average of 7.5 (50%) questions correct to a postcurricular average of 10.7 (71%) questions correct (mean improvement of 3.2 questions correct, 21%, $p < .0001$, CI 2.2-4.4).

Discussion

An integrated ICU curriculum within the third-year IM clerkship improved the overall clerkship experience for students while providing foundational training and exposure to core topics in critical care medicine. Following curriculum implementation, we observed an improvement in medical student attitudes regarding self-perceived confidence in critically ill patient management, heightened interest in further ICU training, as well as improved

objective knowledge. Students found that the small group, chalk talk nature of our curriculum provided the opportunity to learn in a relatively informal, low-pressure situation compared to typical bedside ICU teaching rounds. In addition, students consistently and overwhelmingly agreed that our curriculum provided applicable, efficient, and appropriate content for their level of training. Ultimately, our novel curriculum demonstrated that it was both feasible and beneficial to provide students with an early introduction to critical care medicine while rotating through an IM clerkship site that utilizes an open-ICU staffing model.

Students emphasized the importance of residents as educators during the IM clerkship. Our curriculum created seven unique teaching opportunities per 4-week rotation for IM residents and PCCM fellows to practice chalk talk delivery, develop small-group facilitation skills, and gain experience as educators. In addition, our curriculum allowed residents in our institution's clinician-educator pathway to gain valuable, hands-on teaching experience.

Scheduling of sessions and facilitators proved to be one of the more difficult aspects of implementation. After trialing several time slots, we found session attendance highest on Monday and Tuesday afternoons. We also found greater success scheduling facilitators if we reached out 1 week prior to the first curriculum session. Ultimately, many facilitators expressed interest in leading multiple sessions, which improved rapport and engagement with students. For future groups interested in implementing our curriculum, we recommend establishing a curriculum coordinator role for one to three IM residents. Coordinator responsibilities would include facilitator scheduling, communicating with students, and collecting evaluation materials.

Our curriculum had several limitations. The curriculum was designed for incorporation into IM clerkships with access to an open ICU. We recognize that the majority of academic medical centers employ a closed-ICU model that typically precludes ICU exposure for third-year students on non-ICU rotations. A significant number of medical schools utilize VAMCs as a clinical site for at least part of the IM clerkship. VAMCs commonly employ an open-ICU staffing model offering the opportunity for the widespread application of our curriculum. The subject content and educational strategies of our curriculum could similarly be applied during a dedicated ICU rotation. Our curriculum objectives focused on knowledge acquisition of core critical care topics and development of skills to improve bedside rounding presentations. Our evaluation methods predominantly captured attitudes and perceptions of the learner. We created the pre- and

posttest to address this limitation, but only applied the testing component to students who participated in the curriculum from July to November 2019. As currently constructed, we cannot determine whether the benefits of our curriculum translated to student performance improvement during the IM clerkship, as our evaluation methods focused solely on attitudes and knowledge. We intend to address this limitation by modifying our current evaluation strategy to include direct observation of bedside presentations and simulation performance. Improvements in medical student attitudes and knowledge may be confounded by the maturation effect associated with rotating through an open ICU for a 4-week period. This limitation could be addressed in the future by utilizing a control group at an IM clerkship site without ICU exposure. Finally, our knowledge assessment tool utilized previously published questions, limiting the generalizability due to copyright protections.

Since implementation in March 2019, we fully incorporated our curriculum into the framework of the third-year IM clerkship rotation at the VAMC site. Our curriculum improved the overall clerkship experience while positively impacting both attitudes and knowledge of critical care medicine. Future directions include utilizing the chalk talks as primers for high-fidelity simulation scenarios, as well as creating electronic learning content such as videos to promote wider dissemination and a flipped classroom approach. We also intend to collect data from prior student participants to determine whether our curriculum ultimately affected decisions to pursue ICU rotations during their fourth-year or impacted their choice of career specialty. Overall, our integrated critical care curriculum is the first resource specifically designed to maximize the benefits of an open ICU for third-year learners and represents one possible avenue for addressing both local and national gaps in critical care education prior to residency training.

Appendices

- A. Facilitator Guide.docx
- B. Student Welcome Email.docx
- C. ICU Curriculum Syllabus.docx
- D. ICU Presentation Template.pdf
- E. ICU Student Handout.pdf
- F. End-of-Curriculum Survey.docx

All appendices are peer reviewed as integral parts of the Original Publication.

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Prior Presentations

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Ethical Approval

Reported as not applicable.

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Example #2

Early Intervention for LGBTQ Health: A 10-Hour Curriculum for Preclinical Health Professions Students

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Abstract

Introduction: Individuals who identify as lesbian, gay, bisexual, transgender, or queer (LGBTQ) face significant health disparities and barriers to accessing care. Patients have reported provider lack of knowledge as one of the key barriers to culturally responsive, clinically competent care. Many US and Canadian medical schools still offer few curricular hours dedicated to LGBTQ-related topics, and medical students continue to feel unprepared to care for LGBTQ patients. **Methods:** We developed a 10-hour LGBTQ health curriculum for preclinical medical and physician assistant students. The curriculum included lectures and case-based small-group discussions covering LGBTQ terminology, inclusive sexual history taking, primary care and health maintenance, and transition-related care. It also included a panel discussion with LGBTQ community members and a small-group practice session with standardized patients. Students were surveyed before and after completing the curriculum to assess for increases in confidence and knowledge related to LGBTQ-specific care. **Results:** Forty first- and second-year medical students completed the sessions and provided valid responses on pre- and postcourse surveys. Nearly all students initially felt unprepared to sensitively elicit information, summarize special health needs and primary care recommendations, and identify community resources for LGBTQ individuals. There was significant improvement in students' confidence in meeting these objectives after completion of the five sessions. Knowledge of LGBTQ health issues increased minimally, but there was a significant increase in knowledge of LGBTQ-related terminology. **Discussion:** Our 10-hour LGBTQ health curriculum was effective at improving medical students' self-confidence in working with LGBTQ patients but was less effective at increasing LGBTQ-related medical knowledge.

Keywords:

LGBT Health, LGBT Terminology, Sexual and Gender Minority, LGBTQ, Transgender, Case-Based Learning, Gender Identity, Human Sexuality, LGBTQ+, Primary Care, Diversity, Inclusion, Health Equity, Editor's Choice

Educational Objectives

By the end of this activity, students will be able to:

1. Sensitively and effectively elicit relevant information about sex anatomy, sexual behavior, sexual history, sexual orientation, and gender identity from all patients.
2. Demonstrate respectful and affirming interpersonal exchanges with others, regardless of gender identity, gender expression, body type, or sexual orientation.
3. Describe historical, political, institutional, and sociocultural factors that may underlie health disparities in LGBTQ individuals.
4. Articulate the special health needs and available options for quality care for LGBTQ patients.
5. Summarize recommended primary care, anticipatory guidance, and health care maintenance for LGBTQ patients.
6. Identify special resources available to support the health and wellness of LGBTQ individuals.

Introduction

Lesbian, gay, bisexual, transgender, and queer (LGBTQ) individuals face significant health disparities and barriers to care.¹ The LGBT companion document to Healthy People 2010² and the 2011 Institute of Medicine report³ highlight how some LGBTQ individuals experience significantly higher rates of certain mental health, substance abuse, and chronic medical problems when compared with non-LGBTQ individuals, as well as how some LGBTQ individuals have difficulty obtaining adequate

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health insurance or may face other forms of discrimination from insensitive providers or health systems.

Attitudes among providers and educators toward LGBTQ patients are likely a contributor to health disparities and barriers to accessing quality care. Meyer's minority stress theory⁴ has long been used to understand mental health disparities among LGBTQ individuals, and there is evidence to suggest that stressors such as prejudice, discrimination, and stigma may also adversely affect physical health.⁵ Gender stereotypes, bias, and ridiculing of LGBTQ people may be components of the medical school hidden curriculum,^{6,7} although some investigators have noted relatively high levels of acceptance of and positive treatment attitudes toward LGBTQ individuals.⁸ In one survey of US first-year medical students, 46% of respondents possessed some degree of explicit bias toward LGBTQ people, and 82% possessed some degree of implicit bias.⁹ Almost half of respondents to a survey of Canadian medical students reported witnessing offensive jokes or discriminatory behavior directed toward LGBTQ people by classmates or other health professionals.¹⁰ Attitudes toward LGBTQ individuals are more positive among those who self-identify as LGBTQ,⁸ who have a friend or family member who identifies as LGBTQ,¹¹ or who have had favorable past interactions with LGBTQ individuals.⁹ This suggests to us that knowledge of the lived experience of LGBTQ people may promote greater acceptance and access to care.

Lack of consistent content related to LGBTQ health in medical education programs likely contributes to LGBTQ health disparities. A 2011 survey¹² of US and Canadian medical schools revealed that the median number of hours in the curriculum dedicated to LGBTQ-related content was 5. Nine of the surveyed schools reported 0 hours of LGBTQ-related education in the preclinical years, while 44 reported 0 hours of such content during the clinical years.¹² In a 2015 survey¹³ of US and Canadian medical students, 67% rated the LGBTQ-related curriculum at their school as fair or worse. While many students were comfortable with the topics of HIV and other sexually transmitted diseases, most felt unprepared to address topics related to gender transitioning.¹³ This feeling of unpreparedness was justified by additional work suggesting that many medical students lack actual knowledge of LGBTQ-related medical issues.⁸ LGBTQ health topics, especially transgender health topics, appear also to be underrepresented in US physician assistant (PA) training programs.¹⁴ Recognition of health disparities and the lack of LGBTQ content in medical education prompted the development and publication of AAMC recommendations¹⁵ for instituting medical school curricular changes to improve care for LGBTQ individuals.

Similar trends were observed in our home state of Colorado. A 2011 survey¹⁶ of LGBTQ Coloradoans revealed that 21% of LGB respondents reported having been refused care by a provider because of their sexual orientation. Among transgender respondents, 53% reported having been refused care on the basis of their gender identity. In the same survey, 65% of LGB respondents and 85% of transgender respondents felt that there were not enough adequately trained providers.¹⁶ In a 2013 survey¹⁷ of University of Colorado medical students, 25% had witnessed disparaging remarks made by students or residents toward LGBT individuals, and 7% had witnessed such remarks from faculty. At that time, students at the University of Colorado School of Medicine received 3 hours of required LGBT-related content across the 4 years of medical school.

Many health education programs have made efforts over the past decade to improve LGBT-related training and education. The majority of these efforts consist of discrete interventions or chunks of curricular time dedicated to addressing one or more of the gaps described above.¹⁸ While these interventions are often elective in nature, it has been recognized that they are often an important first step toward including more LGBT-related content in the required curriculum.¹⁸ Despite obvious progress, much remains to be done. Transgender health, in particular, has not yet gained widespread inclusion in health education programs.¹⁹ There also remain opportunities to include LGBT-related topics in interprofessional or team-based learning activities and to increase LGBT patient perspectives in all types of learning activities.¹⁸

The curriculum described here was developed by students with the assistance of faculty members at the University of Colorado School of Medicine. We intentionally targeted students in the preclinical stage of their training with the hope that doing so would foster empathy and understanding before they encountered LGBTQ patients in the clinical setting. Our primary focus throughout the project was to improve cultural competency and sensitivity. Improving students' knowledge of LGBTQ-specific medical care remained a secondary focus.

Specific examples of initiatives similar to ours can be found throughout the medical education literature.²⁰⁻²⁵ These examples demonstrate the effectiveness of LGBTQ health education initiatives, but many lack the necessary materials and sufficient detail for easy integration into another institution's preclinical curriculum. *MedEdPORTAL* has previously published similar content, much of which consists of discrete activities (e.g., case discussions,^{26,27} standardized patient cases/simulations,²⁸⁻³³ and other brief activities³⁴⁻³⁷) that are similar to individual

components of the curriculum presented here. Some of these publications describe more comprehensive activities but tend to focus on specific skills³⁸⁻⁴³ or specific subpopulations of LGBTQ individuals,⁴⁴⁻⁴⁶ and many are targeted toward learners at later stages of their training.^{33,34,41,42,45-50} Our curriculum represents a unique contribution by including a more comprehensive set of activities (including didactic presentations, case discussions, a community panel, and a session with standardized patients) that provide a general overview of LGBTQ-related health topics directed toward learners early in their training. Our curriculum is flexible and inexpensive to implement. It includes annotations and instructions to allow facilitators with minimal expertise in LGBTQ health to deliver the content effectively.

Methods

We developed a 10-hour LGBTQ health-related curriculum targeted toward first- and second-year medical and PA students at the University of Colorado. We delivered the curriculum as an elective course within the School of Medicine, offering it during the spring semester of 2016, the fall semester of 2016, and every subsequent fall semester since that time. We did not require students to have any prior knowledge of course-related material before participating in the course. We actively recruited subject matter experts to facilitate different aspects of the course but also designed the curriculum so that anyone with knowledge of the annotated course materials could effectively deliver the content. At least one facilitator identified as LGBT, but facilitators were not recruited based upon LGBT identity.

Implementation

The course's five 2-hour sessions took place in classrooms on the University of Colorado campus. The first session began with an introductory presentation (Appendix A) covering LGBTQ-related terminology and techniques for taking an inclusive sexual history. An inclusive communication handout (Appendix B) was provided at the beginning of this presentation as a reference for sexual history taking and to offer additional tips for creating an inclusive health care environment. Students then divided into groups of two or three and role-played cases (Appendix C) that allowed them to practice using the terminology and history taking skills learned.

We designed sessions 2-4 so that they could be delivered in any order to allow flexibility in scheduling facilitators and community panelists. We dedicated session 2 to discussion of LGBTQ adult health issues. It included presentations (Appendices D and E) covering health disparities among LGBTQ adults, primary care recommendations and anticipatory guidance for LGBTQ adults,

and general principles of transition-related care for transgender adults. The didactic session was followed by small-group, case-based discussion (Appendices F and G).

Issues specific to LGBTQ children and adolescents were discussed in session 3. This session's presentation (Appendix H) focused on health disparities among transgender youth, specific challenges in working with transgender youth (persistence/desistance of transgender identity through childhood, working with parents of transgender youth), and best-practice recommendations for transgender adolescents wishing to transition.

Session 4 consisted entirely of a panel discussion (Appendix I) with members of the LGBTQ community. The Gender Identity Center of Colorado and the GLBT Community Center of Colorado assisted in identifying members of the community to sit on the panel. They also provided facilitators familiar with the panelists to guide the discussion. We aimed to include four to five panelists, with diversity in race/ethnicity, gender identity, and sexual orientation. We asked panelists to come prepared to share their experiences with the health care system, including challenges they had faced in accessing care, experiences that were particularly invalidating, and any that were empowering. Panelists were provided free parking for the session, but we were otherwise not able to compensate them for their participation.

The final session began with a 1-hour practice using standardized patients (Appendix J). Students divided into small groups and rotated through three cases. Several suitable cases were available through *MedEdPORTAL* and elsewhere in the medical education literature. We used the case of Gerald Moore, for example, which can be found among a collection of cases published in *MedEdPORTAL*.³⁹ The remaining cases were developed to train patient navigators at one of our affiliated hospitals, and we have not been permitted to reproduce them here. Appendix J contains guidance for selecting alternative cases. We were not involved in the casting or training of our standardized patients, and the sexual orientation and gender identity of those who portrayed our cases were not known. However, our simulation center routinely makes efforts to match the sexual orientation and gender identity of the standardized patient to the role being portrayed in a case. The practice session took place in the same classroom space as the other sessions but could easily be adapted to a more clinically authentic setting. We elected to have students interview the patients in groups for the purpose of efficiency (given a significant time constraint). We also noted that interviewing in groups made the experience less intimidating for students with limited clinical experience. The

session could easily be adapted to allow students to interview patients one-on-one. A debriefing period immediately followed the practice session, giving students the opportunity to discuss the experience and challenges they had encountered.

Evaluation

Students completed pre- and postcourse surveys (Appendices K and L) immediately prior to the first session and immediately following the last session, respectively. The surveys measured the effectiveness of the curriculum in two domains. We assessed students' self-reported confidence in meeting course objectives using a four-point Likert scale and assessed acquisition of knowledge related to LGBTQ health using five multiple-choice or true/false questions. The precourse survey included free-response items that asked students to identify their goals in taking the course as well as any previous training or experience they might have had working with LGBTQ individuals. Students were not asked to disclose their own sexual orientation or gender identity but were not discouraged from doing so. Students assigned themselves a unique identifier at the beginning of the course. This identifier was used on both surveys to track changes in survey responses across the course. Our evaluation strategy was approved by the Colorado Multiple Institutional Review Board.

Data Analysis

Data from three semesters were pooled for the purpose of analysis. Temporal changes in student performance across the three semesters were not assessed. Responses to the self-confidence items were converted to a numeric scale (1 = *strongly disagree*, 4 = *strongly agree*). Responses to the five knowledge questions were converted to a numeric score (percentage correct) for each question and for all combined. Responses for which valid pre- and postcourse responses could not be matched were excluded from further analysis. Means and 95% confidence intervals for pre- and postcourse responses and scores were calculated using R (version 3.5.1, R Foundation). Paired-samples *t* tests (also performed in R) were used to determine statistical significance between pre- and postcourse responses. Bonferroni corrections were applied where appropriate to account for multiple comparisons.

We also performed a subgroup analysis based upon students' reports of previous training or experience working with LGBTQ individuals to examine potential confounding effects. Means and 95% confidence intervals for pre- and postcourse responses were calculated for each subgroup (previous experience vs. no previous experience). Statistical significance was determined

with paired-samples *t* tests using R, again applying a Bonferroni correction to account for multiple comparisons.

Results

A total of 49 students enrolled in the course from the spring semester of 2016 through the fall semester of 2017. Course enrollment varied from 14-19 students per semester. All were first- or second-year students in the School of Medicine's MD program. We actively recruited from the School of Medicine's PA program, but scheduling differences between the MD and PA programs made it difficult for PA students to attend, and no PA students participated. Among those who enrolled, 20 (41%) reported having no previous training or experience working with LGBTQ individuals. Ten (20%) reported having such experience in the non-health care setting, while 15 (31%) reported experience working with LGBTQ individuals in a health care setting. Four (8%) reported previous experiences working with LGBTQ individuals in both health care and non-health care settings.

Self-Confidence

Of the 49 students, 42 provided valid ratings of self-confidence in meeting course objectives on both the pre- and postcourse surveys. The remaining seven either were not present on the first or last day of the course (three), withdrew after the first session (one), or chose not to provide a rating for one or more objectives (three). Three responses fell outside the range of the forced-choice Likert scale and were discarded.

Table 1 summarizes the pre- and postcourse self-confidence ratings for seven items directly related to the course objectives. During the precourse survey, students almost exclusively disagreed (a rating of 1 or 2) that they felt capable of meeting any of the seven objectives. Following the course, students nearly exclusively agreed (a rating of 3 or 4) that they felt capable of meeting all objectives. The increase in self-reported confidence was statistically significant ($p < .01$) for all seven objectives.

Knowledge Acquisition

Forty students provided responses to all five of the knowledge acquisition questions on both the pre- and postcourse surveys. Nine were excluded due to the reasons described above.

Table 2 summarizes students' total scores (percentage correct) on the knowledge portion of the survey, as well as the percentage of correct responses for each question. Average total score on the knowledge acquisition portion of the survey improved only minimally, from 42% to 51% ($p = .036$). When we examined the questions independently, we did observe more

Table 1. Self-Confidence in Meeting Course Objectives (n = 42)

Course Objective	M (95% CI) ^a		p
	Precourse	Postcourse	
Participant feels equipped to:			<.01
Sensitively/effectively elicit information about sexual behavior. ^b	2.66 (2.50-2.82)	3.41 (3.23-3.60)	<.01
Sensitively/effectively elicit information about sex anatomy and gender identity. ^b	2.41 (2.25-2.58)	3.46 (3.29-3.63)	<.01
Articulate health needs for LGB patients. ^b	2.22 (2.06-2.38)	3.56 (3.41-3.71)	<.01
Articulate health needs for transgender patients.	2.00 (1.82-2.18)	3.50 (3.35-3.65)	<.01
Summarize primary care recommendations for LGB patients.	2.10 (1.95-2.24)	3.45 (3.30-3.60)	<.01
Summarize primary care recommendations for transgender patients.	1.86 (1.73-1.98)	3.43 (3.28-3.58)	<.01
Identify resources in the community for LGBT patients.	2.26 (2.07-2.45)	3.45 (3.29-3.62)	<.01

^aRated on a 4-point Likert scale (1 = *strongly disagree*, 4 = *strongly agree*).

^bn = 41 (a response to this item fell outside the range of the forced-choice Likert scale and was discarded).

substantial improvement in performance on the question related to culturally sensitive terminology (from 73% to 90%, *p* = .036).

Subgroup Analysis

Table 3 summarizes the results of our subgroup analysis based upon students’ reports of previous training or experience working with LGBTQ individuals at the time of the precourse survey. Students in both groups (no previous experience vs. any previous experience) reported similar ratings of self-confidence in meeting course objectives. The increase in self-confidence between the pre- and postcourse surveys remained statistically significant (*p* ≤ .01) in both groups of students for each of the seven measures. The minimal improvement in average score for the knowledge acquisition portion of the survey was similar among the two subgroups and consistent with the combined performance of all respondents.

Discussion

Our elective 10-hour LGBTQ health curriculum significantly improved students’ self-confidence in their ability to sensitively and effectively elicit information about sexual behavior, sex anatomy, and gender identity from sexual and gender minority patients; summarize health needs and primary care recommendations for LGBTQ patients; and identify resources in the community providing support to LGBTQ individuals. There remained a significant increase in self-confidence even among students who reported previous training or experience working

with LGBTQ individuals, demonstrating that the curriculum remains useful for students with a wide variety of previous experience.

The poor performance on the knowledge acquisition questions was disappointing. Our students were at an early stage of their medical education and may have performed better if they had more foundational medical knowledge and clinical experience. Few studies have evaluated similar interventions among preclinical medical students. Many have relied on qualitative methods or students’ self-reported attitudes and confidence. One intervention among second-year medical students at the University of California, San Francisco, demonstrated a statistically significant increase in knowledge related to LGBTQ relationships and access to health care, in addition to improved attitudes and willingness to provide care.²² The overall magnitude of the change was small (0.57 on a 5-point scale). The same intervention failed to demonstrate significant change in 12 of its 16 survey items.²²

We also recognize that the format of our knowledge acquisition questions was suboptimal and that the questions we used probably did not reflect the most important learning objectives from each session. We continued to use these questions throughout multiple iterations of the course to maintain a consistent evaluation strategy. We would recommend reevaluating these questions if assessing knowledge acquisition is an important goal for future programs.

We have gone to great lengths to ensure that most of our materials are readily generalizable; however, there are some activities that may be challenging to implement in some settings. For the panel discussion with LGBTQ community members, we relied on local LGBTQ advocacy organizations for assistance with recruiting panelists. These organizations have been tremendously helpful in identifying people willing to discuss and answer sensitive questions but may not exist in some

Table 2. Performance on Knowledge Acquisition Questions (n = 40)

Question/Topic	M (95% CI) ^a		p
	Precourse	Postcourse	
Culturally sensitive terminology	73% (58%-87%)	90% (81%-99%)	.036
Gender-affirming hormone therapy	51% (35%-67%)	75% (61%-89%)	.096
LGBT-related health risks	31% (16%-45%)	43% (27%-58%)	.999
Primary care recommendations	13% (2%-23%)	18% (6%-30%)	.999
Barriers to accessing care	40% (25%-55%)	33% (18%-47%)	.999
Average score, all questions	42% (35%-48%)	51% (45%-57%)	.036

^aPercentage of correct responses.

Table 3. Performance Among Participants With and Without Previous Training/Experience

Objective/Question	Any Previous Experience ^a			No Previous Experience ^b		
	\bar{x} (Pre)	\bar{x} (Post)	<i>p</i>	\bar{x} (Pre)	\bar{x} (Post)	<i>p</i>
Participants feel equipped to: ^c						
Elicit information about sexual behavior.	2.68	3.52	<.01	2.63 ^d	3.25 ^d	.01
Elicit information about sex anatomy and gender identity.	2.44	3.52	<.01	2.38 ^d	3.38 ^d	<.01
Articulate health needs for LGB patients.	2.33 ^e	3.67 ^e	<.01	2.06	3.41	<.01
Articulate health needs for transgender patients.	2.04	3.56	<.01	1.94	3.41	<.01
Summarize primary care recommendations for LGB patients.	2.00	3.52	<.01	2.24	3.35	<.01
Summarize primary care recommendations for transgender patients.	1.80	3.44	<.01	1.94	3.41	<.01
Identify community resources.	2.40	3.52	<.01	2.06	3.35	<.01
Average score, all knowledge acquisition questions. ^f	42%	50%	.031	41%	51%	.095

Abbreviation: \bar{x} , sample mean.

^a*n* = 25 for ratings of self-confidence, *n* = 24 for knowledge acquisition questions.

^b*n* = 17 for ratings of self-confidence, *n* = 16 for knowledge acquisition questions.

^cConfidence ratings are based on 4-point Likert scale (1 = *strongly disagree*, 4 = *strongly agree*).

^d*n* = 16 (a response to this item fell outside the range of the forced-choice Likert scale and was discarded).

^e*n* = 24 (a response to this item fell outside the range of the forced-choice Likert scale and was discarded).

^fValues represent percentage of correct responses to knowledge acquisition questions.

communities. We have included guidance for recruiting panelists in the instructions for this session. Invoking the assistance of LGBTQ-friendly providers in the community may also be helpful.

The second challenge to generalizability comes from the standardized patient session. We are fortunate at the University of Colorado to have access to excellent clinical simulation resources, but we recognize that access to similar resources may not be available at other institutions. We also recognize that the use of standardized patients is the costliest aspect of implementing our curriculum and may be a limiting factor. However, there is some flexibility in how this session can be implemented to minimize cost. For example, we chose to hold the standardized patient practice sessions in a classroom instead of in more clinically authentic spaces on campus. We chose to have our students interview standardized patients in small groups instead of individually, reducing the amount of time and the number of patients needed. We also reused cases that were already being used for similar purposes elsewhere in our health system. This saved us the expense of training the standardized patients but limited our control over case selection and casting of standardized patients.

Our evaluation strategy was limited by the elective nature of the course. Students were self-selected, and it is likely that our students entered the course with more prior experience with LGBTQ individuals and more positive attitudes toward such individuals than the general population of medical students at our institution. This seems to be supported by the finding that 59% of our students reported previous training or experience working with LGBTQ individuals at the start of the course. However, we would have expected prior experience to bias confidence ratings toward higher precourse ratings and lower overall improvement

in ratings across the course, and this effect was not seen. We suspect that those with previous LGBT-related experience likely entered the course with a better understanding of the nuances and challenges of working with this diverse population.

We hope that the work presented here will result in an increase in the number of required hours devoted to LGBTQ health in the preclinical curriculum at the University of Colorado and at other institutions. Integrating new material into the required curriculum is challenging when it means the elimination of hours devoted to other topics. The curriculum remains optional for preclinical medical students at the University of Colorado, though we continue to look for opportunities to integrate these activities into our required curriculum. The curriculum could easily be shortened by separating the cultural sensitivity content from the health-related content, allowing the former to be made required while continuing to offer the latter as elective content.

Appendices

- A. Session 1 Slides - Terms and Terminology.pptx
- B. Session 1 Handout - Inclusive Communication.docx
- C. Session 1 Handout - Terms and Terminology Role-Plays.docx
- D. Session 2 Slide Set 1 - Health Disparities.pptx
- E. Session 2 Slide Set 2 - Adult LGBT Health.pptx
- F. Session 2 Discussion Guide - Adult LGBT Health Care Cases.docx
- G. Session 2 Handout - Adult LGBT Health Care Cases.docx
- H. Session 3 Slides - Caring for LGBTQ Youth.pptx
- I. Session 4 Instructions - Patient Panel.docx
- J. Session 5 Instructions - Group Role-Play.docx

K. Precourse Survey.docx

L. Postcourse Survey.docx

All appendices are peer reviewed as integral parts of the Original Publication.

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Ethical Approval

The Colorado Multiple Institutional Review Board approved this study.

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