

AAIM Perspectives

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Supplementing the Subinternship: Effect of E-Learning Modules on Subintern Knowledge and Confidence



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INTRODUCTION

Most students entering an internal medicine residency complete both a core clerkship and a subinternship in internal medicine. Traditionally, the core clerkship is more structured at both the school and national levels compared with the subinternship, with only one-third of subinternship directors acknowledging a formal curriculum.¹ Some institutions utilize the Alliance for Academic

Internal Medicine (AAIM) Internal Medicine Subinternship Curriculum first published in 2002 by the Clerkship Directors in Internal Medicine and revised in 2018.^{2,3} Even prior to Coronavirus disease 2019 (COVID-19)-related changes in the learning environment, creating supplemental flipped classroom material was becoming more commonplace.⁴ Asynchronous learning approaches allow for spaced learning from introduction of concepts to application, active processing, and improved material retention.⁵⁻⁹ Evidence supporting the efficacy of this curriculum and adjunctive online resources during the subinternship is lacking.¹⁰

Medical education may be forever changed as a result of the COVID-19 pandemic, given the concerns around medical student safety in the clinical environment, which significantly limits in-person didactics and medical student clinical experiences. An online collection of educational videos may help fill the void created by decreased clinical exposure and experiences during the third- and fourth-year clinical clerkships. The purpose of this study was to deliver brief high-yield online electronic modules (e-modules) covering 5 core

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internal medicine conditions and to assess their ability to improve subintern knowledge and comfort.

METHODS

Participants, Study Design, and Intervention

Students completing an internal medicine subinternship at the 4 participating institutions (University of Chicago Pritzker School of Medicine, University of Colorado School of Medicine, Johns Hopkins University School of Medicine, and Virginia Commonwealth University School of Medicine) during the 2018-2019 academic year were included in the study. Schools were chosen to represent students from across the United States. The primary outcomes were twofold: (1) absolute percentage of knowledge improvement pre- to post-rotation within study arms and (2) absolute percentage of knowledge improvement pre- to post-rotation between study arms. Secondary outcomes included comfort recognizing symptoms/signs of, ordering diagnostic tests for, and managing 5 core medical conditions. Students were block randomized to receive the usual curriculum (control) or the intervention curriculum such that all students completing the subinternship during a given 4-week rotation within the same institution were similarly randomized. The usual curriculum consisted of experiential learning within the internal medicine subinternship clinical learning environment, while the intervention curriculum consisted of 5 asynchronous e-module video lectures in addition to experiential learning. The 5 e-module videos were created by 2 authors (JB, AN), ranged in duration from 10 to 18 minutes, and achieved learning objectives that map to the AAIM Subinternship Curriculum 2.0. The authors chose topics highly relevant to hospital medicine: congestive heart failure (CHF), diabetes mellitus (DM), deep venous thrombosis/pulmonary embolism (DVT/PE), gastrointestinal bleeding (GIB), and chronic obstructive pulmonary disease (COPD). Viewing the e-modules was not required and authors were unable to track viewing at the individual participant level. During the first week of the rotation, all students

received an e-mail link to the pre-rotation survey (Qualtrics platform [Provo, Utah]; [Appendix A](#)) that assessed medical knowledge and comfort recognizing and treating the 5 conditions represented in the e-module videos. For medical knowledge assessments, students completed the same 10 questions (2 per condition) chosen from and content-mapped to the Society Hospital of Medicine SPARK Edition 1 (9 of 10) and the American College of Physicians Medical Knowledge Self-Assessment Program (MKSAP) 17 (1 of 10) question banks. Comfort level was rated on a 5-point Likert scale (1 = very uncomfortable; 5 = very comfortable). Upon completion of the rotation, students were sent an e-mail link to the post-rotation survey (Qualtrics; [Appendix B](#)), which contained the same knowledge and comfort questions as the pre-rotation survey in addition to questions assessing usefulness of, and satisfaction with, the e-modules. A reminder e-mail was sent 1 week later to encourage survey completion. The final survey, which was identical to the post-rotation survey, was sent to the same pool of participants 5 months into their intern year. This final survey remained open from

November 2019 until February 2020, and was timed so participants could better identify knowledge or management gaps after experiencing a portion of the intern year of residency. All authors agreed on the survey content and design.

Student participation and survey responses were reviewed after grade determination to ensure that responses did not affect the summative grade. Students could opt out of having their responses used for research purposes. This study was approved by each member school's institutional review board.

Statistical Analysis

Pre-rotation exposure to the 5 medical conditions was expressed as <6 or ≥ 6 patients, while comfort level was characterized as comfortable (comfortable and very comfortable) or uncomfortable (unsure, uncomfortable, and very uncomfortable). Four sets of descriptive statistics were used to measure frequency, percentages, medians, and interquartile ranges for pre- and post-rotation survey items stratified by control and intervention groups. Chi-squared/Fisher's Exact tests were run comparing binary survey responses (comfortable/uncomfortable; <6 or ≥ 6). A pre-/post-rotation comparison of scores for the knowledge-based

PERSPECTIVES VIEWPOINTS

- Few internal medicine subinternships have a formal curriculum.
- E-lectures were created for common hospitalized conditions including congestive heart failure, diabetes mellitus, deep venous thrombosis/pulmonary embolism, gastrointestinal bleeding, and chronic obstructive pulmonary disease, allowing for repeated student viewing at multiple institutions.
- Students with e-lecture access did not demonstrate improved knowledge or comfort-level scores compared with the control group upon completing the subinternship or during the intern year.

questions was run using signed rank tests comparing the percentage of correct answers between pre- and post-surveys stratified by control and intervention groups. Mean change in percent correct from the pre- to post-survey was also compared between control and intervention groups using a *t* test. Lastly, separate chi-squared and Fisher's Exact tests were run on the pre-rotation group (including those who did not complete a post-rotation survey), comparing survey responses related to comfort as well as knowledge question scores (correct/incorrect) among subinterns who cared for <6 patients or ≥6 patients with any of the 5 conditions prior to the subinternship experience. All analyses were performed using SAS 9.4 (SAS Institute, Cary, NC).

RESULTS

During the 2018-2019 academic year, 250 students completed an internal medicine subinternship across the 4 participating medical schools. Overall, 171 of 250 students (68.4%) completed the pre-rotation survey, 97 of 250 (38.8%) completed the post-rotation survey, and 24 of 250 (9.6%) completed the intern survey. Seventeen of 171 (9.9%) of the pre-rotation, 4 of 97 (4.1%) of the post-rotation, and 1 of 24 (4.2%) of the interns elected not to have their survey answers used for research purposes. Two student responses were excluded due to inability to verify study arm. Only pre- and post-rotation surveys were included in the final pre/post-comparison analyses, given the low intern survey response rate.

Primary Outcomes: Knowledge Assessment

The control group answered a mean of 50.9% of the pre-rotation and 53.9% of the post-rotation knowledge questions correctly ($P = .295$), while the intervention group answered 49.2% and 50.6%, respectively ($P = .544$; [Table](#)). There was no statistically significant difference in percentage of mean correct knowledge question improvement when comparing the control and intervention groups prior to and after the rotation (3.0% vs 1.4%, respectively, $P = .695$; [Table](#)). No additional knowledge improvement was noted pre-rotation to post-rotation within the intervention group, within the control group, or when comparing the intervention and control groups.

Secondary Outcomes: Pre-Post Student Self-Assessment

Prior to starting the rotation, 72.7% vs 42.2% (control vs intervention) of students were comfortable managing CHF, 68.2% vs 93.8% (control vs intervention) were comfortable recognizing symptoms and signs of COPD, and 52.2% vs 79.2% (control vs intervention) were comfortable ordering and interpreting diagnostic tests for GIB (all $P < .05$; data not shown). There were no other significant differences in comfort between the intervention and control groups in the pre-rotation survey and no significant differences were noted in the post-rotation survey. Comfort was ≥78% in all post-rotation modular topics (control and intervention).

If a student had cared for 6 or more patients with any of the 5 medical conditions prior to starting their subinternship, they were significantly more comfortable managing each of those conditions, compared with students caring for fewer than 6 patients prior to starting the subinternship ([Figure 1](#)). Students caring for 6 or more patients prior to starting the subinternship were significantly more comfortable recognizing symptoms and signs for CHF and DM, as well as ordering and interpreting diagnostic tests for CHF, DM, and GIB. Pre-rotation student test knowledge was significantly higher for students caring for 6 or more patients vs students caring for fewer than 6 patients for only one knowledge question (diabetes mellitus type 2, 98% vs 80%; $P = .0004$).

In the post-rotation survey, students rated which learning method most improved their knowledge and clinical skills during their subinternship. Students overwhelmingly ranked personal patient experience (56/92; 60.9%) number 1, compared with 9 of 92 (9.8%) choosing e-learning ([Figure 2](#)). More students ranked personal patient and co-intern patient experiences (62/92; 67.4% and 64/92; 69.6%, respectively) in their top 3 learning methods compared with 4 alternative learning options. Forty-three percent of the pre-rotation students preferred online learning over alternative learning modalities. Upon completion of the subinternship, 58% somewhat/strongly agreed that the e-module cases were useful, while 54% were somewhat/very satisfied with the experience. Half of the students would probably/definitely like e-module learning on other rotations, while 52% probably/definitely would recommend the e-module cases to their colleagues.

Table 1 Pre/Post-Rotation Knowledge Scores (% Correct)

Study Arm	n	Pre Score Mean	Pre Score Median	Post Score Mean	Post Score Median	Control Mean % Change	Intervention Mean % Change	P Value
Control	23	50.9%	50.0%	53.9%	50.0%			.295
Intervention	48	49.2%	50.0%	50.6%	50.0%			.544
Total	71					3.0%	1.4%	.695

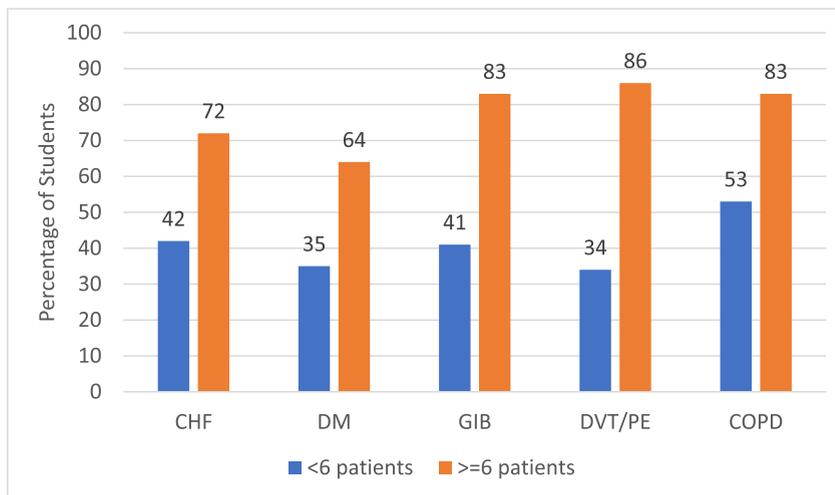


Figure 1 Pre-rotation comfort managing conditions based on prior exposure (% , all $P < .002$).

Video Statistics

Links to the 5 e-modules were sent to 138 students. YouTube video total views and average time spent were tracked: COPD 142 views with average time spent 5:10 minutes (of 16:31-minute total video time), CHF 85 views with average time spent 6:35 minutes (of 17:41-minute total video time), GIB 74 views with average time spent 5:58 minutes (of 12:02-minute total video time), DVT/PE 73 views with average time spent 6:19 minutes (of 14:17-minute total video time), and DM 59 views with average time spent 5:36 minutes (of 10:01 minute total video time).

though 48% of subinterns ranked online learning as their preferred learning method pre-rotation, they overwhelmingly rated direct patient care and co-intern patient observation as modalities that contribute the most to improved knowledge and clinical skills during the subinternship. Slightly more than one-half of the students felt the e-learning modules were useful, were satisfied with the experience, and would use similar modules on other clinical rotations. While knowledge improvement did not reach statistical significance, e-modules could still benefit students that learn best using this modality or may have identified a deficiency in a specific topic.

DISCUSSION

In this multi-institutional study, 5 common inpatient-based e-modules did not improve subintern knowledge or comfort compared with the control group. Even

Students that had previously cared for 6 or more patients with any of the 5 medical conditions often felt significantly more comfortable recognizing signs and symptoms of, ordering and interpreting diagnostic tests for, and managing these conditions. Those students had

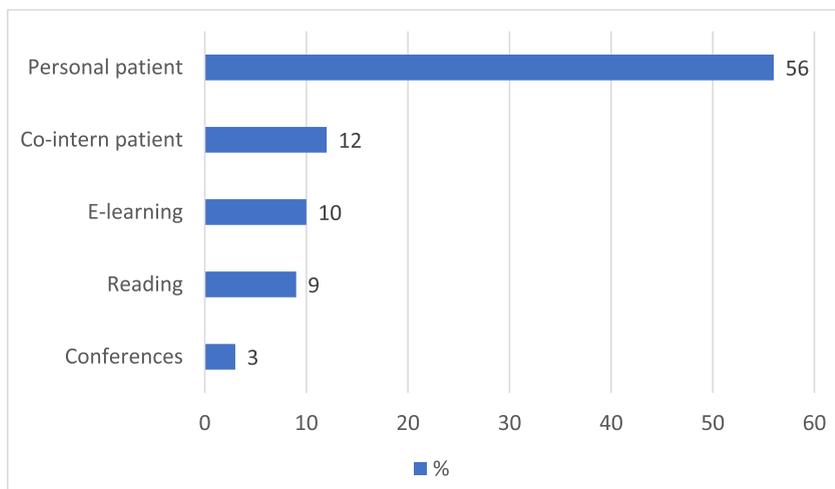


Figure 2 Students ranking learning method #1 (%).

significantly higher pre-rotation scores on only 1 of 10 knowledge-based questions (the single MKSAP question). While this observation may be random or related to the test question content, one must be aware of a possible Dunning-Kruger effect.¹¹ It is unclear whether prior exposure to the 5 medical conditions led to higher-level aspects of the Kirkpatrick learning evaluation model, such as behavior change or improvement in patient care outcomes.¹² Regardless, these results emphasize the importance of maximizing clinical exposure during both the third and fourth years of medical school, even during a pandemic. Students likely gained skills and attitudes as well as clinical knowledge through experiential learning by caring for multiple patients with each condition that were not directly measured in our study, but were reflected in their significant comfort recognizing and managing these conditions through direct exposure.

The subinterns in the study placed a high value on direct patient care and observational experiences. Clerkship directors, faculty, and residents should be cognizant of this important finding. Historically, multiple factors have competed with bedside learning, including, but not limited to, duty hour rules, time constraints, competing conferences and administrative responsibilities, lack of physician confidence, and patient volume and turnover.¹³ The COVID-19 pandemic created additional obstacles to the bedside experience. Many schools have not permitted students to care for COVID-19-positive patients or those under investigation for COVID-19. Other restrictions include not seeing patients in the emergency department, virtual team rounding, and fewer opportunities for ad hoc teaching from team members due to a lack of shared workspace and less frequent bedside rounds with resident or attending physicians. This shift creates both a challenge and an opportunity for medical education leaders to create novel teaching approaches to enhance the potentially shortened or otherwise limited clinical experience.

Limitations

Intervention group e-module viewing was not required or tracked, so there is no guarantee that every student watched the e-modules, nor any way to track the pace and frequency of viewing per student. For most medical schools, the internal medicine subinternship is offered most months of an academic year. Students performing their subinternship later in the year may have additional fourth-year clinical experiences compared with those completing an earlier subinternship, which could affect knowledge and comfort responses. Similarly, varied alternative learning experiences between students within and across institutions both prior to and during the fourth year of medical school may affect survey responses. The post-rotation and intern survey response rates were significantly lower than the pre-rotation response rate,

potentially preventing the identification of meaningful, statistically significant differences between intervention and control groups. Similarly, this analysis only included students that completed the pre- and post-rotation surveys, which may have affected pre to post comparisons of outcomes. Survey knowledge assessment items were designed to target practicing physicians rather than medical students; however, this limitation should have affected both groups equally. Given that the pre- and post-rotation knowledge test questions were the same, it is unclear why the intervention student knowledge scores did not improve. One possible explanation is that intervention students did not watch the videos or only partially watched them. Although unable to track average viewing time spent per individual, given that the overall average video view times were one-third to one-half the complete video duration, it may at least partially explain a lack of significant knowledge score improvement. Students also may have watched these videos at double speed, given most videos were viewed in roughly half of the duration.

CONCLUSIONS

Although overall well-accepted, 5 e-learning modules did not improve subintern knowledge or comfort in 5 commonly encountered medical conditions. Students placed high value on experiential learning through personal and co-intern patient care. Educators need to develop and implement innovative strategies to get students back to the bedside. E-learning and remote learning have increased exponentially during the recent pandemic and will likely continue to play an important part in multiple facets of learning. Clerkship directors, subinternship directors, and teaching faculty must collaborate to create innovative e-learning curricula that are engaging, interactive, meaningful, longitudinal, complementary to direct patient care, and ideally, improve patient care.

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The Society of Hospital Medicine and the American College of Physicians permitted use of SPARK and MKSAP questions, respectively.

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APPENDIX A. PRE-SUBINTERNSHIP SURVEY

Start of Block: Default Question Block

Q1 Please mark how many hospitalized patients (not in clinic or ED) you have managed for the following disorders.

When answering, count the only patient if you provided management of the active condition (eg, if a patient had an exacerbation of COPD, then that counts. If the patient had a primary diagnosis of cellulitis and COPD was stable, then do not count.)

	None	1-5	6-10	11-15	16+
Acute decompensated heart failure					
Diabetes mellitus Type 2 (active changes in insulin regiment)					
Acute gastrointestinal bleeding					
Acute deep vein thrombosis/pulmonary embolus					
Acute exacerbation of COPD					

Q2 Please rate your comfort in managing the following conditions in a hospitalized patient.

	Very uncomfortable	Uncomfortable	Comfortable	Very Comfortable
Acute decompensated heart failure				
Diabetes mellitus Type 2 (active changes in insulin regiment)				
Acute gastrointestinal bleeding				
Acute deep vein thrombosis/pulmonary embolus				
Acute exacerbation of COPD				

Q3 Please rank which resource you use for management of patients who are hospitalized with "acute decompensated heart failure" (1 = use the most; 4 = use the least).

Please drag to rank position

- UpToDate
- DynaMed
- Review Articles
- Textbook

Q4 Please rank which resource you use for management of patients who are hospitalized with "Diabetes Mellitus Type 2 (active changes in insulin regiment)" (1 = use the most; 4 = use the least).

Please drag to rank position

- UpToDate
- DynaMed
- Review Articles
- Textbook

Q5 Please rank which resource you use for management of patients who are hospitalized for "acute gastrointestinal bleeding" (1 = use the most; 4 = use the least).

Please drag to rank position

- UpToDate
- DynaMed
- Review Articles
- Textbook

Q6 Please rank which resource you use for management of patients who are hospitalized for "acute deep vein thrombosis/pulmonary embolus" (1 = use the most; 4 = use the least).

Please drag to rank position

- UpToDate
- DynaMed
- Review Articles
- Textbook

Q7 Please rank which resource you use for management of patients who are hospitalized for "acute exacerbation of COPD" (1 = use the most; 4 = use the least).

Please drag to rank position

- UpToDate
- DynaMed
- Review Articles
- Textbook

Q8 Please rate your comfort recognizing symptoms and signs of the following:

Very uncomfortable Somewhat uncomfortable Unsure Somewhat comfortable Very comfortable

Acute decompensated heart failure
 Hyperglycemia
 Acute exacerbation of COPD
 Acute DVT/PE
 Acute gastrointestinal bleed

Q9 Please rate your comfort ordering and interpreting diagnostic tests of the following:

Very uncomfortable Somewhat uncomfortable Unsure Somewhat comfortable Very comfortable

Acute decompensated heart failure
 Hyperglycemia
 Acute exacerbation of COPD
 Acute DVT/PE
 Acute gastrointestinal bleed

Q10 A 62-year-old man with a history of cirrhosis presents to the hospital with hematemesis. He reports that the first episode occurred 6 hours ago and he has since had 2 more episodes. While in the emergency department, he passes a large melanic stool. He has no chest or abdominal pain, but he does report dizziness when standing. His cirrhosis is secondary to hepatitis C infection and past alcohol use and has been complicated by ascites. Esophagogastroduodenoscopy performed 1 year ago showed large esophageal varices. He was prescribed propranolol at the time, but he stopped using it after the initial prescription ran out.

On physical examination, his supine blood pressure is 108/50 mm Hg and his pulse rate is 114 beats per minute. On standing, his blood pressure drops to 80/40 mm Hg and his heart rate increases to 130 beats per minute. His temperature is 36.67°C (98°F), respiratory rate is 16 breaths per minute, and oxygen saturation is 94% on room air. He has scleral icterus and a mildly distended, nontender abdomen.

Initial laboratory test results:

Hemoglobin = 8.6 g/dL (baseline 10 g/dL a month before) (reference range 13.8-17.2 g/dL)

Platelet count = $75 \times 103/\mu\text{L}$ (reference range 150-450 $\times 103/\mu\text{L}$)

International normalized ratio = 1.4 (reference range 0.8-1.2)

Serum urea nitrogen = 30 mg/dL (reference range 6-23 mg/dL)

Creatinine = 1.0 mg/dL (reference range 0.7-1.2 mg/dL)

Bedside ultrasonography shows perihepatic ascites, but there is not a pocket large enough to safely perform a paracentesis.

Two large-bore peripheral intravenous catheters are placed and intravenous fluids are started. The patient is started on an intravenous proton-pump inhibitor and octreotide. Gastroenterology is consulted for esophagogastroduodenoscopy.

Which other intervention would be most likely to benefit this patient now?

- Transjugular intrahepatic portosystemic shunt
- Transfusion of platelets
- Placement of central venous catheter
- Administration of recombinant factor VIIa
- Administration of intravenous ceftriaxone

Q11 A 58-year-old woman presents to the emergency department with a 1-week history of bloody bowel movements. She reports that for the last 3 months her bowel habits alternate between diarrhea and constipation with ribbon-like stools. Initially her bowel movements were streaked with blood, but now bright red blood fills the toilet. Her history is notable for atrial fibrillation and hypertension. She takes warfarin, lisinopril, and acetaminophen as needed for pain. She has no family history of gastrointestinal malignancy. Screening colonoscopy at age 50 years was without abnormality.

On physical examination, her temperature is 36.67°C (98°F), blood pressure is 95/55 mm Hg, pulse rate is 98 beats per minute, respiratory rate 18 breaths per minute, and oxygen saturation is 98% on room air. Her abdomen is soft with normoactive bowel sounds. Rectal examination reveals hemorrhoids with blood on digital examination. The rest of the examination findings are normal.

Laboratory test results:

Hemoglobin = 9.3 g/dL (reference range 12.1-15.1 g/dL)

Mean corpuscular volume = 80 mm³ (reference range 80-97 mm³)

International normalized ratio = 1.8 (reference range 0.8-1.2)

Appropriate intravenous access is obtained and isotonic fluids are administered. Warfarin is discontinued, coagulopathy is reversed, and blood products are prepared.

Which of the following is the most appropriate next step in this patient's care?

- Perform CT of the abdomen and pelvis
- Perform colonoscopy
- Substitute aspirin for warfarin to treat atrial fibrillation
- Obtain tagged red blood cell scan
- Perform flexible sigmoidoscopy

Q12 A 65-year-old woman is admitted to the general medical ward with painful erythema of the right leg. She has a history of obesity, hypertension, type 2 diabetes mellitus, and tobacco dependence. She has chills and subjective fever, but no nausea, vomiting, or diarrhea. Her home medications are lisinopril, 20 mg daily; metformin, 500 mg twice daily; and glyburide, 5 mg twice daily. She has never used insulin. In the emergency department, she received ceftriaxone, 1 g intravenously, and regular insulin, 8 units subcutaneously, after a blood glucose value of 380 mg/dL was documented.

On arrival to the ward, her temperature is 38.28° C (100.9°F), blood pressure is 158/87 mm Hg, pulse rate is 94 beats per minute, respiratory rate is 18 breaths per minute, and oxygen saturation is 97% on room air. Her weight is 160 kg. She is alert and is in no acute distress. She is requesting food. There is exquisitely tender erythema and mild edema from the dorsum of the right foot midway to the knee, with no drainage. The left lower extremity is normal.

Laboratory test results:

White blood cell count = 14,000/ μ L (reference range 4500-11,000/ μ L)

Hemoglobin A1c = 9.1% (reference range 4.0%-5.6%)

Repeated capillary blood glucose = 345 mg/dL (reference range 70-99 mg/dL)

Renal function, normal

Blood glucose measurements have been ordered 4 times daily, with meals and at bedtime.

Which of the following is the most appropriate initial inpatient glycemic control regimen for this patient?

- Continue the home regimen
- Continue the home regimen; add sliding scale insulin lispro subcutaneously with each meal
- Continue metformin at the home dosage; increase the glyburide dosage to 10 mg orally twice daily
- Discontinue the home regimen; add sliding-scale insulin lispro subcutaneously with each meal or every 6 hours if taking nothing by mouth
- Discontinue the home regimen; add insulin glargine, 24 units subcutaneously each evening, and insulin lispro, 8 units subcutaneously, plus additional sliding-scale insulin with each meal

Q13 A 74-year-old woman is evaluated in the emergency department for several hours of altered mental status. She is from out of state and is visiting with relatives. One of her young relatives was recently ill with gastrointestinal symptoms. The patient developed anorexia 3 days ago and vomiting 2 days ago. She has been unable to tolerate any liquid or solid foods for the last 24 hours. Medical history is significant for type 2 diabetes mellitus, hypertension, hyperlipidemia, and hypothyroidism. Medications are aspirin, lisinopril, glimepiride, levothyroxine, and atorvastatin. Her last dose of medications was 48 hours ago.

On physical examination, her temperature is 37.5°C (99.5°F), blood pressure is 115/65 mm Hg, and pulse rate is 95/min. She is arousable but confused. Mucous membranes are dry. Her neck is supple. Cardiac examination reveals no murmurs. Her chest is clear to auscultation. Bowel sounds are present, and mild tenderness to palpation is noted throughout the abdomen. There is no rebound or guarding. There are no focal neurologic deficits.

Laboratory studies are pending.

Which of the following is the most likely cause of this patient's altered mental status?

- Cerebrovascular accident
- Hypoglycemia
- Hypothyroidism
- Statin toxicity

Q14 A 56-year-old woman with locally advanced pancreatic cancer presents with acute-onset shortness of breath, pleuritic chest pain, and palpitations. She reports that she was feeling very well and was cooking when the symptoms started suddenly; they were so severe that she asked her husband to call 911.

Upon arrival to the emergency department, the patient is in severe distress. Her temperature is 36.56°C (97.8°F), blood pressure is 80/40 mm Hg, pulse rate is 116 beats per minute, respiratory rate is 37 breaths per minute, and oxygen saturation is 92% on a nonrebreather mask. Examination of the lungs reveals tachypnea with use of accessory muscles to breathe, but she otherwise has adequate air entry bilaterally with no wheezing, rhonchi, or signs of pleural effusion. Her extremities are cold and clammy. Cardiovascular examination reveals a regular pulse, a normal S1, increased intensity of the pulmonary component of S2, jugular venous distention with a jugular venous pressure of 11 cm H₂O, and positive hepatjugular reflux. No murmurs or gallops are heard. Findings on abdominal and neurologic examination are normal.

The patient is emergently intubated and connected to mechanical ventilation. Resuscitation with normal saline is also initiated.

Arterial blood gases on room air:

pH = 7.49 (reference range 7.35-7.45)

Carbon dioxide = 30 mm Hg (reference range 35-45 mm Hg)

Bicarbonate = 24 mEq/L (reference range 21-28 mEq/L)

PO₂ = 49 mm Hg (reference range 80-100 mm Hg)

A portable chest x-ray study shows decreased vascular markings in both lungs, but no other evident abnormalities. Computed tomography (CT) angiogram of the chest with protocol for pulmonary embolism reveals an embolus causing total obstruction of the left branch of the pulmonary artery.

Which of the following is the most appropriate next step prior to administering thrombolytic therapy?

- Echocardiography
- Electrocardiography
- Serum troponin
- CT of the brain
- No further studies

Q15 A 63-year-old man is evaluated in the emergency department for significant shortness of breath and pleuritic anterior chest pain of 48 hours duration. Three days ago he completed a 12-hour flight from Asia to the United States. Medical history is otherwise unremarkable and he takes no medications.

On physical examination, he is in mild respiratory distress. He is afebrile, blood pressure is 135/87 mm Hg, pulse rate is 108 beats per minute, and

respiration rate is 18 breaths per minute. Oxygen saturation breathing ambient air is 94%. The remainder of the physical examination is unremarkable.

Electrocardiography shows nonspecific ST- and T-wave changes. Echocardiography shows normal right ventricular function. CT angiography of the chest demonstrates multiple pulmonary artery filling defects in the distal branches of the right pulmonary artery consistent with pulmonary embolism.

Which of the following is the most appropriate next step in management?

- Catheter-directed thrombolysis
- Inpatient anticoagulation
- Outpatient anticoagulation
- Systemic thrombolysis

Q16 An 82-year-old man with known chronic heart failure is admitted to the hospital with an acute exacerbation of his heart failure that requires treatment with intravenous diuretics. In addition to heart failure, his medical history is notable for atrial fibrillation. Prior to admission, he was taking warfarin, metoprolol, and furosemide. His symptoms of congestion and lower-extremity edema improve and his regimen is successfully transitioned to an oral diuretic. Echocardiography reveals a left ventricular ejection fraction >50%.

At the time of discharge, his blood pressure is 118/74 mm Hg, and pulse rate is 70 beats per minute.

Laboratory test results at discharge:

Serum creatinine = 0.9 mg/dL (reference range 0.7-1.3 mg/dL)

Serum potassium = 4.1 mEq/dL (reference range 3.5-5.0 mEq/L)

In addition to his previous medications, which of the following should you recommend initiating upon discharge to reduce his risk of mortality?

- No new medications
- Candesartan
- Sacubatril/valsartan
- Spironolactone
- Digoxin

Q17 A 69-year-old man presents with a 2-week history of progressive fatigue, shortness of breath, and intermittent, left-sided, sharp chest pain. His medical history includes moderate chronic obstructive pulmonary disease, hypertension, diabetes mellitus, and coronary artery disease (status post myocardial infarction with subsequent heart failure and a left ventricular ejection fraction of 20%

following his index myocardial infarction). He has had no fevers, chills, or cough productive of sputum. Since his myocardial infarction 2 years ago, he has been taking aspirin, lisinopril, atorvastatin, metoprolol, and furosemide (40 mg orally twice a day). His ejection fraction has improved to 40% over the last 2 years while on treatment.

On physical examination, his temperature is 37°C (98.6°F), blood pressure is 95/65 mm Hg, pulse rate is 95 beats per minute, respiratory rate is 26 breaths per minute, and oxygen saturation is 88% on room air. His peak flow is 180 L/min, which is 35% of his predicted normal value. He has a regular heart rate with an S3 noted, jugular venous pressure of 12 cm, diffuse wheezing bilaterally on lung auscultation, and bilateral lower-extremity edema with warm extremities.

He is treated with nebulized albuterol, ipratropium, empiric intravenous ceftriaxone, and furosemide for questionable lung infiltrates suggestive of possible pneumonia vs pulmonary edema on a preliminary interpretation of chest radiograph.

Laboratory test results:

Troponin T = 0.04 ng/mL (reference range <0.01 ng/mL)

N-terminal prohormone brain natriuretic peptide = 1400 pg/mL (reference range <900 pg/mL)

After admission to the hospital, the patient's wheezing and shortness of breath begin to improve, but he still has some dyspnea and swelling in his legs. His urine output is noted to be 1500 mL over a 6-hour period (net negative 700 mL over the 6-hour period after intake of 800 mL).

Which of the following is the best next step in this patient's management?

- Discontinue nebulized albuterol, ipratropium, and ceftriaxone, but continue intravenous furosemide 20 mg intravenously twice a day
- Discontinue nebulized albuterol, ipratropium, and ceftriaxone, but continue intravenous furosemide 40 mg intravenously twice a day
- Discontinue nebulized albuterol, ipratropium, ceftriaxone, and furosemide and monitor the patient's clinical status
- Continue nebulized albuterol, ipratropium, ceftriaxone, and furosemide 40 mg intravenously twice a day
- Continue nebulized albuterol, ipratropium, and ceftriaxone, but hold any further diuretic therapy

Q18 A 76-year-old woman presents with a dry cough and 5 days of progressive dyspnea on exertion. She has chronic obstructive pulmonary disease

with a baseline forced expiratory volume in the first second (FEV1) of 1.2 L (30% predicted) on 4 L of home oxygen. She has more than a 100 pack-year cigarette smoking history but has not smoked in many years. She lives with her son, who assists with meal preparation and housework, but she remains able to perform all activities of daily living. She reports adherence to a stable home medication regimen, which includes tiotropium and budesonide/formoterol metered dose inhalers; prednisone, 15 mg daily; and sertraline.

On physical examination, her temperature is 37.44°C (99.4°F), pulse rate is 96 beats per minute, respiratory rate is 25 breaths per minute, blood pressure is 164/81 mm Hg, and oxygen saturation is 90% on 4 L of oxygen. She is a cachectic-appearing woman with tachypnea, visibly increased work of breathing, and inability to speak in full sentences. Examination of the lungs demonstrates globally decreased breath sounds, prolonged expiratory phase, and absence of wheezes. Tachycardia with a regular rhythm is noted on cardiovascular examination, and there is no evidence of congestive heart failure. Her mental status is drowsy, but she is arousable and oriented to person and place.

Laboratory test results:

Serum chemistry panel, normal peripheral leukocyte count, normal

Arterial blood gas (while on 4 L of oxygen):

pH = 7.28 (reference range 7.35-7.45)

pCO₂ = 79 mm Hg (reference range 35-45 mm Hg)

PaO₂ = 95 mm Hg (reference range 80-100 mm Hg)

Oxygen saturation = 93%

Bicarbonate = 35 mEq/L (reference range 21-28 mEq/L)

Testing for common respiratory viral pathogens detects the presence of respiratory syncytial virus. Chest x-ray study shows flattened diaphragms bilaterally without consolidation or other abnormality.

Which of the following is the most appropriate next step in this patient's management?

- Intubation and invasive mechanical ventilation
- Initiation of noninvasive positive pressure ventilation
- Naloxone test dose with drip if test dose is successful
- Initiation of high-flow nasal oxygen
- 100% nonrebreather mask

Q19 A 68-year-old man presents to the emergency department with 4 days of progressive dyspnea on exertion and increased sputum production. He has chronic obstructive pulmonary disease with a baseline FEV1 of 1.4 L (45% predicted) on 3 L of home oxygen. He has more than a 100-pack-year cigarette smoking history, but he has been successfully abstinent from cigarettes for 6 months. He lives alone and remains able to perform all activities of daily living. He is adherent to a stable home medication regimen, which includes tiotropium and budesonide/formoterol metered dose inhalers, transdermal nicotine patches, and mirtazapine.

On physical examination, his temperature is 36.83°C (98.3°F), pulse rate is 92 beats per minute, respiratory rate is 22 breaths per minute, blood pressure is 134/71 mm Hg, and oxygen saturation is 92% on 3 L of oxygen. He weighs 132 lb. He can speak in full sentences. Lung examination demonstrates diffuse expiratory wheezing and prolonged expiratory phase. Tachycardia with a regular rhythm is noted on cardiovascular examination, and there is no evidence of congestive heart failure.

Laboratory test results:

Serum chemistry panel, normal

Peripheral leukocyte count, normal

Arterial blood gas (while on 3 L of oxygen):

pH = 7.48 (reference range 7.35-7.45)

pCO₂ = 35 mm Hg (reference range 35-45 mm Hg)

PaO₂ = 95 mm Hg (reference range 80-100 mm Hg)

Oxygen saturation = 93%

Bicarbonate = 32 mEq/L (reference range 21-28 mEq/L)

Testing for common respiratory viral pathogens detects the presence of rhinovirus. Chest x-ray

study shows flattened diaphragms bilaterally without consolidation or other abnormality

Which of the following are the most appropriate agent and treatment duration for this patient's acute exacerbation of chronic obstructive pulmonary disease?

- Prednisone, 40 mg orally daily for a 5-day course
- Methylprednisolone, 60 mg intravenously every 12 hours for 2 days, then prednisone, 40 mg orally daily for a 5-day course
- Dexamethasone, 5 mg intravenously every 12 hours for a 5-day course
- Methylprednisolone, 125 mg intravenously for 1 dose, followed by 30 mg intravenously daily for a 14-day course
- Hydrocortisone, 100 mg intravenously every 8 hours for a 7-day course

Q20 Do you prefer online learning over other learning modalities (eg, lecture, reading, conferences)?

- Yes
- No

Q21 What medical school are you attending?

- Johns Hopkins University
- Medical College of Virginia
- University of Chicago
- University of Colorado

Q23 May we use your responses for research purposes?

- Yes
- No

Q24 Please enter your name. This is only to track your responses over time. Your name will only be seen by the research coordinator and will not be given to the clerkship director or coordinator).

End of Block: Default Question Block

APPENDIX B. POST-SUBINTERNSHIP SURVEY

Start of Block: Default Question Block

Please mark how many hospitalized patients (not in clinic or ED) you have managed for the following disorders.

When answering, only count the patient if you provided management of the active condition (eg, if a patient had an exacerbation of COPD, then that counts. If the patient had a primary diagnosis of cellulitis and COPD was stable, then do not count.)

	None	1-5	6-10	11-15	16+
1. Acute decompensated heart failure					
2. Diabetes mellitus Type 2 (active changes in insulin regiment)					
3. Acute gastrointestinal bleeding					
4. Acute deep vein thrombosis/ pulmonary embolus					
5. Acute exacerbation of COPD					

Please rate your comfort in managing the following conditions in a hospitalized patient.

	Very Uncomfortable	Uncomfortable	Comfortable	Very Comfortable
6. Acute decompensated heart failure				
7. Diabetes mellitus Type 2 (active changes in insulin regiment)				
8. Acute gastrointestinal bleeding				
9. Acute deep vein thrombosis/pulmonary embolus				
10. Acute exacerbation of COPD				

Please rank which resource you use for management of patients who are hospitalized with "acute decompensated heart failure" (1 = use the most; 4 = use the least).

	1	2	3	4
11. UpToDate				
12. DynaMed				
13. Review articles				
14. Textbook				

Please rank which resource you use for management of patients who are hospitalized with "Diabetes Mellitus Type 2 (active changes in insulin regiment)" (1 = use the most; 4 = use the least).

	1	2	3	4
15. UpToDate				
16. DynaMed				
17. Review articles				
18. Textbook				

Please rank which resource you use for management of patients who are hospitalized for "acute gastrointestinal bleeding" (1 = use the most; 4 = use the least).

	1	2	3	4
19. UpToDate				
20. DynaMed				
21. Review articles				
22. Textbook				

Please rank which resource you use for management of patients who are hospitalized for "acute deep vein thrombosis/pulmonary embolus" (1 = use the most; 4 = use the least).

	1	2	3	4
23. UpToDate				
24. DynaMed				
25. Review articles				
26. Textbook				

Please rank which resource you use for management of patients who are hospitalized for "acute exacerbation of COPD" (1 = use the most; 4 = use the least).

	1	2	3	4
27. UpToDate				
28. DynaMed				
29. Review articles				
30. Textbook				

During your Sub-I, how many patients did you see with the following conditions?

	0	1-3	4-7	8-10	>10
31. CHF					
32. Hyperglycemia					
33. COPD					
34. DVT/PE					
35. GI bleed					

Please rate your comfort recognizing symptoms and signs of the following:

	Very Uncomfortable	Somewhat Uncomfortable	Unsure	Somewhat Comfortable	Very Comfortable
36. CHF					
37. Hyperglycemia					
38. COPD					
39. DVT/PE					
40. GI bleed					

Please rate your comfort ordering and interpreting diagnostic tests of the following:

	Very Uncomfortable	Somewhat Uncomfortable	Unsure	Somewhat Comfortable	Very Comfortable
41. CHF					
42. Hyperglycemia					
43. COPD					
44. DVT/PE					
45. GI bleed					

46. A 62-year-old man with a history of cirrhosis presents to the hospital with hematemesis. He reports that the first episode occurred 6 hours ago and he has since had 2 more episodes. While in the emergency department, he passes a large melanic stool. He has no chest or abdominal pain, but he does report dizziness when standing. His cirrhosis is secondary to hepatitis C infection and past alcohol use and has been complicated by ascites. Esophago-gastroduodenoscopy performed 1 year ago showed large esophageal varices. He was prescribed

propranolol at the time, but he stopped using it after the initial prescription ran out.

On physical examination, his supine blood pressure is 108/50 mm Hg and his pulse rate is 114 beats per minute. On standing, his blood pressure drops to 80/40 mm Hg and his heart rate increases to 130 beats per minute. His temperature is 36.67°C (98°F), respiratory rate is 16 breaths per minute, and oxygen saturation is 94% on room air. He has scleral icterus and a mildly distended, nontender abdomen.

Initial laboratory test results:

Hemoglobin = 8.6 g/dL (baseline 10 g/dL a month before) (reference range 13.8-17.2 g/dL)

Platelet count = $75 \times 10^3/\mu\text{L}$ (reference range 150-450 $\times 10^3/\mu\text{L}$)

International normalized ratio = 1.4 (reference range 0.8-1.2)

Serum urea nitrogen = 30 mg/dL (reference range 6-23 mg/dL)

Creatinine = 1.0 mg/dL (reference range 0.7-1.2 mg/dL)

Bedside ultrasonography shows perihepatic ascites, but there is not a pocket large enough to safely perform a paracentesis.

Two large-bore peripheral intravenous catheters are placed and intravenous fluids are started. The patient is started on an intravenous proton-pump inhibitor and octreotide. Gastroenterology is consulted for esophagogastroduodenoscopy.

Which other intervention would be most likely to benefit this patient now?

- Transjugular intrahepatic portosystemic shunt
- Transfusion of platelets
- Placement of central venous catheter
- Administration of recombinant factor VIIa
- Administration of intravenous ceftriaxone

47. A 58-year-old woman presents to the emergency department with a 1-week history of bloody bowel movements. She reports that for the last 3 months her bowel habits alternate between diarrhea and constipation with ribbon-like stools. Initially her bowel movements were streaked with blood, but now bright red blood fills the toilet. Her history is notable for atrial fibrillation and hypertension. She takes warfarin, lisinopril, and acetaminophen as needed for pain. She has no family history of gastrointestinal malignancy. Screening colonoscopy at age 50 years was without abnormality.

On physical examination, her temperature is 36.67°C (98°F), blood pressure is 95/55 mm Hg, pulse rate is 98 beats per minute, respiratory rate 18 breaths per minute, and oxygen saturation is 98% on room air. Her abdomen is soft with normoactive bowel sounds. Rectal examination reveals hemorrhoids with blood on digital examination. The rest of the examination findings are normal.

Laboratory test results:

Hemoglobin = 9.3 g/dL (reference range 12.1-15.1 g/dL)

Mean corpuscular volume = 80 mm³ (reference range 80-97 mm³)

International normalized ratio = 1.8 (reference range 0.8-1.2)

Appropriate intravenous access is obtained and isotonic fluids are administered. Warfarin is discontinued, coagulopathy is reversed, and blood products are prepared.

Which of the following is the most appropriate next step in this patient's care?

- Perform CT of the abdomen and pelvis
- Perform colonoscopy
- Substitute aspirin for warfarin to treat atrial fibrillation
- Obtain tagged red blood cell scan
- Perform flexible sigmoidoscopy

48. A 65-year-old woman is admitted to the general medical ward with painful erythema of the right leg. She has a history of obesity, hypertension, type 2 diabetes mellitus, and tobacco dependence. She has chills and subjective fever, but no nausea, vomiting, or diarrhea. Her home medications are lisinopril, 20 mg daily; metformin, 500 mg twice daily; and glyburide, 5 mg twice daily. She has never used insulin. In the emergency department, she received ceftriaxone, 1 g intravenously, and regular insulin, 8 units subcutaneously, after a blood glucose value of 380 mg/dL was documented.

On arrival to the ward, her temperature is 38.28°C (100.9°F), blood pressure is 158/87 mm Hg, pulse rate is 94 beats per minute, respiratory rate is 18 breaths per minute, and oxygen saturation is 97% on room air. Her weight is 160 kg. She is alert and is in no acute distress. She is requesting food. There is exquisitely tender erythema and mild edema from the dorsum of the right foot midway to the knee, with no drainage. The left lower extremity is normal.

Laboratory test results:

White blood cell count = 14,000/ μL (reference range 4500-11,000/ μL)

Hemoglobin A1c = 9.1% (reference range 4.0%-5.6%)

Repeated capillary blood glucose = 345 mg/dL (reference range 70-99 mg/dL)

Renal function, normal

Blood glucose measurements have been ordered 4 times daily, with meals and at bedtime.

Which of the following is the most appropriate initial inpatient glycemic control regimen for this patient?

- Continue the home regimen
- Continue the home regimen; add sliding scale insulin lispro subcutaneously with each meal
- Continue metformin at the home dosage; increase the glyburide dosage to 10 mg orally twice daily
- Discontinue the home regimen; add sliding-scale insulin lispro subcutaneously with each meal or every 6 hours if taking nothing by mouth
- Discontinue the home regimen; add insulin glargine, 24 units subcutaneously each evening, and insulin lispro, 8 units subcutaneously, plus additional sliding-scale insulin with each meal

49. A 74-year-old woman is evaluated in the emergency department for several hours of altered mental status. She is from out of state and is visiting with relatives. One of her young relatives was recently ill with gastrointestinal symptoms. The patient developed anorexia 3 days ago and vomiting 2 days ago. She has been unable to tolerate any liquid or solid foods for the last 24 hours. Medical history is significant for type 2 diabetes mellitus, hypertension, hyperlipidemia, and hypothyroidism. Medications are aspirin, lisinopril, glimepiride, levothyroxine, and atorvastatin. Her last dose of medications was 48 hours ago.

On physical examination, her temperature is 37.5°C (99.5°F), blood pressure is 115/65 mm Hg, and pulse rate is 95/min. She is arousable but confused. Mucous membranes are dry. Her neck is supple. Cardiac examination reveals no murmurs. Her chest is clear to auscultation. Bowel sounds are present, and mild tenderness to palpation is noted throughout the abdomen. There is no rebound or guarding. There are no focal neurologic deficits.

Laboratory studies are pending.

Which of the following is the most likely cause of this patient's altered mental status?

- Cerebrovascular accident
- Hypoglycemia
- Hypothyroidism
- Statin Toxicity

50. A 56-year-old woman with locally advanced pancreatic cancer presents with acute-onset shortness of breath, pleuritic chest pain, and palpitations. She reports that she was feeling very well and was cooking when the symptoms started suddenly; they were so severe that she asked her husband to call 911.

Upon arrival to the emergency department, the patient is in severe distress. Her temperature is 36.56°C (97.8°F), blood pressure is 80/40 mm Hg, pulse rate is 116 beats per minute, respiratory rate is 37 breaths per minute, and oxygen saturation is 92% on a nonrebreather mask. Examination of the lungs reveals tachypnea with use of accessory muscles to breathe, but she otherwise has adequate air entry bilaterally with no wheezing, rhonchi, or signs of pleural effusion. Her extremities are cold and clammy. Cardiovascular examination reveals a regular pulse, a normal S1, increased intensity of the pulmonary component of S2, jugular venous distention with a jugular venous pressure of 11 cm H₂O, and positive hepatjugular reflux. No murmurs or gallops are heard. Findings on abdominal and neurologic examination are normal.

The patient is emergently intubated and connected to mechanical ventilation. Resuscitation with normal saline is also initiated.

Arterial blood gases on room air:

pH = 7.49 (reference range 7.35-7.45)

Carbon dioxide = 30 mm Hg (reference range 35-45 mm Hg)

Bicarbonate = 24 mEq/L (reference range 21-28 mEq/L)

PO₂ = 49 mm Hg (reference range 80-100 mm Hg)

A portable chest x-ray study shows decreased vascular markings in both lungs but no other evident abnormalities. CT angiogram of the chest with protocol for pulmonary embolism reveals an embolus causing total obstruction of the left branch of the pulmonary artery.

Which of the following is the most appropriate next step prior to administering thrombolytic therapy?

- Echocardiography
- Electrocardiography
- Serum troponin
- CT of the brain
- No further studies

51. A 63-year-old man is evaluated in the emergency department for significant shortness of breath and pleuritic anterior chest pain of 48 hours duration. Three days ago he completed a 12-hour flight from Asia to the United States. Medical history is otherwise unremarkable and he takes no medications.

On physical examination, he is in mild respiratory distress. He is afebrile, blood pressure is 135/87 mm Hg, pulse rate is 108/min, and respiration

rate is 18/min. Oxygen saturation breathing ambient air is 94%. The remainder of the physical examination is unremarkable.

Electrocardiography shows nonspecific ST- and T-wave changes. Echocardiography shows normal right ventricular function. CT angiography of the chest demonstrates multiple pulmonary artery filling defects in the distal branches of the right pulmonary artery consistent with pulmonary embolism.

Which of the following is the most appropriate next step in management?

- Catheter-directed thrombolysis
- Inpatient anticoagulation
- Outpatient anticoagulation
- Systemic thrombolysis

52. An 82-year-old man with known chronic heart failure is admitted to the hospital with an acute exacerbation of his heart failure that requires treatment with intravenous diuretics. In addition to heart failure, his medical history is notable for atrial fibrillation. Prior to admission, he was taking warfarin, metoprolol, and furosemide. His symptoms of congestion and lower-extremity edema improve and his regimen is successfully transitioned to an oral diuretic. Echocardiography reveals a left ventricular ejection fraction >50%.

At the time of discharge, his blood pressure is 118/74 mm Hg, and pulse rate is 70 beats per minute.

Laboratory test results at discharge:

Serum creatinine = 0.9 mg/dL (reference range 0.7-1.3 mg/dL)

Serum potassium = 4.1 mEq/dL (reference range 3.5-5.0 mEq/L)

In addition to his previous medications, which of the following should you recommend initiating upon discharge to reduce his risk of mortality?

- No new medications
- Candesartan
- Sacubatril/valsartan
- Spironolactone
- Digoxin

53. A 69-year-old man presents with a 2-week history of progressive fatigue, shortness of breath, and intermittent, left-sided, sharp chest pain. His medical history includes moderate chronic obstructive pulmonary disease, hypertension, diabetes mellitus, and coronary artery disease (status post myocardial infarction with subsequent heart failure and a left ventricular ejection fraction of 20% following his index myocardial infarction). He has had

no fevers, chills, or cough productive of sputum. Since his myocardial infarction 2 years ago, he has been taking aspirin, lisinopril, atorvastatin, metoprolol, and furosemide (40 mg orally twice a day). His ejection fraction has improved to 40% over the last 2 years while on treatment.

On physical examination, his temperature is 37°C (98.6°F), blood pressure is 95/65 mm Hg, pulse rate is 95 beats per minute, respiratory rate is 26 breaths per minute, and oxygen saturation is 88% on room air. His peak flow is 180 L/min, which is 35% of his predicted normal value. He has a regular heart rate with an S3 noted, jugular venous pressure of 12 cm, diffuse wheezing bilaterally on lung auscultation, and bilateral lower-extremity edema with warm extremities.

He is treated with nebulized albuterol, ipratropium, empiric intravenous ceftriaxone, and furosemide for questionable lung infiltrates suggestive of possible pneumonia vs pulmonary edema on a preliminary interpretation of chest radiograph.

Laboratory test results:

Troponin T = 0.04 ng/mL (reference range <0.01 ng/mL)

N-terminal prohormone brain natriuretic peptide = 1400 pg/mL (reference range <900 pg/mL)

After admission to the hospital, the patient's wheezing and shortness of breath begin to improve, but he still has some dyspnea and swelling in his legs. His urine output is noted to be 1500 mL over a 6-hour period (net negative 700 mL over the 6-hour period after intake of 800 mL).

Which of the following is the best next step in this patient's management?

- Discontinue nebulized albuterol, ipratropium, and ceftriaxone, but continue intravenous furosemide 20 mg intravenously twice a day
- Discontinue nebulized albuterol, ipratropium, and ceftriaxone, but continue intravenous furosemide 40 mg intravenously twice a day
- Discontinue nebulized albuterol, ipratropium, ceftriaxone, and furosemide and monitor the patient's clinical status
- Continue nebulized albuterol, ipratropium, ceftriaxone, and furosemide 40 mg intravenously twice a day
- Continue nebulized albuterol, ipratropium, and ceftriaxone, but hold any further diuretic therapy

54. A 76-year-old woman presents with a dry cough and 5 days of progressive dyspnea on exertion. She has chronic obstructive pulmonary disease with a baseline FEV1 of 1.2 L (30% predicted) on 4

L of home oxygen. She has more than a 100 pack-year cigarette smoking history but has not smoked in many years. She lives with her son, who assists with meal preparation and housework, but she remains able to perform all activities of daily living. She reports adherence to a stable home medication regimen, which includes tiotropium and budesonide/formoterol metered dose inhalers; prednisone, 15 mg daily; and sertraline.

On physical examination, her temperature is 37.44°C (99.4°F), pulse rate is 96 beats per minute, respiratory rate is 25 breaths per minute, blood pressure is 164/81 mm Hg, and oxygen saturation is 90% on 4 L of oxygen. She is a cachectic-appearing woman with tachypnea, visibly increased work of breathing, and inability to speak in full sentences. Examination of the lungs demonstrates globally decreased breath sounds, prolonged expiratory phase, and absence of wheezes. Tachycardia with a regular rhythm is noted on cardiovascular examination, and there is no evidence of congestive heart failure. Her mental status is drowsy, but she is arousable and oriented to person and place.

Laboratory test results:

Serum chemistry panel, normal peripheral leukocyte count, normal

Arterial blood gas (while on 4 L of oxygen):

pH = 7.28 (reference range 7.35-7.45)

pCO₂ = 79 mm Hg (reference range 35-45 mm Hg)

PaO₂ = 95 mm Hg (reference range 80-100 mm Hg)

Oxygen saturation = 93%

Bicarbonate = 35 mEq/L (reference range 21-28 mEq/L)

Testing for common respiratory viral pathogens detects the presence of respiratory syncytial virus. Chest x-ray study shows flattened diaphragms bilaterally without consolidation or other abnormality.

Which of the following is the most appropriate next step in this patient's management?

- Intubation and invasive mechanical ventilation
- Initiation of noninvasive positive pressure ventilation
- Naloxone test dose with drip if test dose is successful
- Initiation of high-flow nasal oxygen
- 100% nonrebreather mask

55. A 68-year-old man presents to the emergency department with 4 days of progressive dyspnea on

exertion and increased sputum production. He has chronic obstructive pulmonary disease with a baseline FEV1 of 1.4 L (45% predicted) on 3 L of home oxygen. He has more than a 100-pack-year cigarette smoking history, but he has been successfully abstinent from cigarettes for 6 months. He lives alone and remains able to perform all activities of daily living. He is adherent to a stable home medication regimen, which includes tiotropium and budesonide/formoterol metered dose inhalers, transdermal nicotine patches, and mirtazapine.

On physical examination, his temperature is 36.83°C (98.3°F), pulse rate is 92 beats per minute, respiratory rate is 22 breaths per minute, blood pressure is 134/71 mm Hg, and oxygen saturation is 92% on 3 L of oxygen. He weighs 132 lb. He can speak in full sentences. Lung examination demonstrates diffuse expiratory wheezing and prolonged expiratory phase. Tachycardia with a regular rhythm is noted on cardiovascular examination, and there is no evidence of congestive heart failure.

Laboratory test results:

Serum chemistry panel, normal

Peripheral leukocyte count, normal

Arterial blood gas (while on 3 L of oxygen):

pH = 7.48 (reference range 7.35-7.45)

pCO₂ = 35 mm Hg (reference range 35-45 mm Hg)

PaO₂ = 95 mm Hg (reference range 80-100 mm Hg)

Oxygen saturation = 93%

Bicarbonate = 32 mEq/L (reference range 21-28 mEq/L)

Testing for common respiratory viral pathogens detects the presence of rhinovirus. Chest x-ray study shows flattened diaphragms bilaterally without consolidation or other abnormality.

Which of the following are the most appropriate agent and treatment duration for this patient's acute exacerbation of chronic obstructive pulmonary disease?

- Prednisone, 40 mg orally daily for a 5-day course
- Methylprednisolone, 60 mg intravenously every 12 hours for 2 days, then prednisone, 40 mg orally daily for a 5-day course
- Dexamethasone, 5 mg intravenously every 12 hours for a 5-day course

- Methylprednisolone, 125 mg intravenously for 1 dose, followed by 30 mg intravenously daily for a 14-day course
- Hydrocortisone, 100 mg intravenously every 8 hours for a 7-day course

56. The e-learning core cases were useful.

- Strongly disagree
- Somewhat disagree
- Neither agree nor disagree
- Somewhat agree
- Strongly agree

57. How satisfied were you with the e-learning cases?

- Not satisfied
- Somewhat dissatisfied
- Neutral
- Somewhat satisfied
- Very satisfied

Which learning method improved your knowledge and clinical skills the most during your Sub-I (1 = most; 6 = least).

	1	2	3	4	5	6
58. E-learning cases						
59. Personal patient						
60. Co-intern patient						
61. Conference						
62. Reading						
63. Other						

64. Would you like to have e-learning cases on other rotations?

- Never
- Probably not
- Neutral
- Probably
- Definitely

65. Would you recommend e-learning cases to colleagues?

- Never
- Probably not
- Neutral
- Probably
- Definitely

66. May we use your responses for research purposes?

- Yes
- No

- What school are you attending?

Johns Hopkins University School of Medicine

University of Chicago School of Medicine

University of Colorado School of Medicine

Virginia Commonwealth University School of Medicine

- Please enter your name (this is for only tracking purposes and will not be revealed to clerkship directors)

Please enter your personal e-mail for us to contact you when you enter residency.

End of Block: Default Question Block