# Longitudinal Exposure to Basic Microbiology Concepts as Part of a Newly-Implemented Organ System-Based Medical Student Curriculum: Assessment of Need and Proof of Concept


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## RATIONALE/NEED

- The East Carolina University Brody School of Medicine has implemented a significantly redesigned medical student year 1 (M1) and 2 (M2) curriculum and calendar with primary goals of integration of content and earlier completion allowing students to sit for the United States Medical Licensing Examination (USMLE) Step 1 examination in March and transition to clinical clerkships in April rather than in June.
- Curriculum directors along with medical students and a learning specialist constructed a revised curriculum which consolidated and integrated content previously covered during the M2 year for presentation during the end of the M1 year (Block 3) and during an abbreviated M2 year (Block 4).
- During discussions as part of the course redesign, students and faculty members expressed concern about the completion of the microbiology course in Block 3, over 8 months from when students will take the USMLE Step 1 examination. It was proposed that weekly microbiology "case of the week" modules be constructed, focusing on critical, relevant, high-yield topics discussed that week.

## METHODS / DESCRIPTION

- As a proof of concept, a set of microbiology teaching modules presented with a pretest and a posttest were constructed using the learning management system Blackboard.
- The proof of concept implementation included:
  - A pretest:
    - It could be taken only one time
    - Neither an indication of correct/incorrect answers nor a grade were displayed.
    - Completion of the pre-test was required to view and progress to the teaching modules.
  - Five teaching modules, including cardiovascular, renal, pulmonary, nervous system, and gastrointestinal topics were presented
    - Each module included clinical scenario-focused questions and, upon completion of the module, answers and teaching points for each question were displayed.
  - A posttest became available after all teaching modules were completed
    - It could be taken only once.
    - Upon completion, a score was displayed and answers and teaching points were provided.
- Pretest and posttest scores were compared.
- A formal survey was distributed to students to:
  - Gauge the utility of weekly microbiology modules relevant to that week's topic.
  - Determine satisfaction with the construct of the modules.
  - Identify areas in need of improvement.
- To encourage participation, bonus points were given to student's score of the Pathology National Board of Medical Examiners Pathology Subject Examination Subject examination score for
  - Completion of all elements of the proof-of-concept content.
  - Completion of a survey designed and administered using Google Documents forms module.

## RESULTS

**Figure 1. Construct: Instructions to Students**

**Infectious Disease Systems-Based ID Mini Cases: High-Yield Questions**

**Instructions:**

1. **Pre-Test:**
 - Take Pre-Test: you must complete all questions to progress to the "Modules" section.
  - Click "OK" in the bottom right-hand corner to proceed.
  - Click "Course Documents" tab in left column to enter modules
 - You will not receive feedback about your answers at this juncture.
 - Once Pre-Test is complete, modules will be visible in "Course Documents" field.

2. **Modules**
 - N = 5: Cardiac, Renal, Pulmonary, Nervous System, Gastrointestinal
 - Enter each module and answer the practice questions and review the feedback.
  - Click "OK" in the bottom right-hand corner to see your score and review key teaching points.
 - You may review modules as many times as you want.
 - You must complete each of the five modules before you can take the Post-Test

3. **Post-Test**
 - Post-Test folder becomes available after you have completed each of the 5 modules.
 - Answer the Post-Test questions for each module; please be sure to complete the entire test.
 - One attempt is allowed.
 - Answers and explanations will be displayed.

**Figure 2. Participation in Modules and Survey**

- Module Participation: 73 / 76 = 96.0%
- Survey Participation: 75 / 76 = 98.7%

**Figure 3. Pretest and Posttest Evaluations: Example**

Question 7 — 10 out of 10 points

A veteran presents at the ECU physician outpatient due to right upper quadrant pain. He reports that the pain has been going on for the past year. He has several blood transfusions back in the 1950s when he was injured during his military missions. He has no recent travel history. He denies smoking and drinking. However, he endorses a history of IV drug use. He also reports that he has a history of hiring prostitutes before. On exam, patient appeared jaundiced and hepatomegaly was noted. No splenomegaly appreciated. Lab shows elevated AST and ALT. Liver biopsy shows significant lymphocytes presents. What is the most likely causative agent for his RUQ pain?

Selected Answer: Hepatitis C virus

Answers:
- Epstein-Barr virus
- Hepatitis B virus
- Hepatitis C virus
- Cytomegalovirus

Response Feedback: Patient has chronic hepatitis (>6 months) with a history of blood transfusion prior to 1992. This is a classic presentation of hepatitis C infection. In addition, biopsy of hepatitis C shows lymphocytes (vs. hepatitis B shows eosinophilic (pinkish color) finely granular "ground glass" appearance after H&E staining. CMV and EBV can both cause hepatosplenomegaly. However, the classic blood transfusion history and the biopsy result suggest hepatitis C.

**Figure 4. Question and Teaching Points: Cardiovascular Module**

Question 2 — 10 out of 10 points

An autopsy of a 50-year-old male was performed. During the autopsy, a dilated thoracic aorta was noted. Severe inflammation and necrosis of the vasa vasorum was observed. This pattern is consistent with which of the following?

Selected Answer: Tertiary Syphilis

Answers:
- A. Coxsackie virus
- B. Primary Syphilis
- C. Secondary Syphilis
- D. Tertiary Syphilis

Response Feedback: Tertiary syphilis causes **vasa vasorum inflammation and necrosis (endoarteritis obliteratans)** → leading to **thoracic aneurysm** → leading to aortic insufficiency (aortic regurgitation).

**Figure 5. Question and Teaching Points: Central Nervous System Module**

Question 1 — 10 out of 10 points

An 18-year-old college student is admitted to the hospital because of high fever, headache, and skin rash. He has no history of any medical problem and does not take any medications. He does not use tobacco, alcohol or illicit drugs. He denies any recent travels. His temperature was 103°F, BP 100/70mmHg, pulse 120. On exam, his skin shows petechial rash on his torso, extremities, palms, and soles. His neck is stiff, and he also shows signs of lethargy and photophobia. The patient died shortly after being admitted. In the autopsy report, hemorrhagic destruction of both adrenal glands was noted. Which is the most likely pathogen that is responsible for the symptoms and death of this patient?

Selected Answer: D. *Neisseria meningitidis*

Answers:
- A. Enterovirus
- B. Herpes simplex virus
- C. *Naegleria fowleri*
- D. *Neisseria meningitidis*
- E. *Toxoplasma gondii*

Response Feedback: ***Neisseria meningitidis*** can cause meningitis as well as Waterhouse-Friderichsen syndrome.
**Meningitis** is often characterized by photophobia, neck stiffness, and lethargy.
**Waterhouse-Friderichsen syndrome** is characterized by DIC, petechia, hypotensive shock, and infarction of the adrenal gland.
are highly susceptible for *Neisseria* infections and should alert test takers to include *Neisseria* infections in the differential**College students**

**Figure 6. Pretest vs. Posttest Scores**


**Figure 7. Relationship to Schedule**

SECTION 1 – CARDIOVASCULAR / RENAL

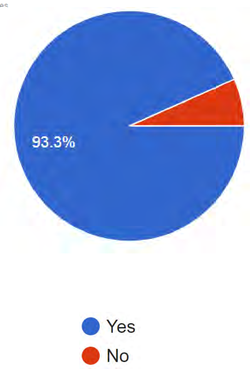
| | Monday 08-27-18 | Tuesday 08-28-18 | Wednesday 08-29-18 | Thursday 08-30-18 | Friday 08-31-18 |
|---|---|---|---|---|---|
| 8:00 | 8:00-8:50 TC QUIZ 3 (30 Questions Max) | 8:00-8:50 2S04 Pharm 13 | 8:00-8:50 2S04 Pharm 14 | 8:00-8:50 2S04 Pharm 15 | 8:00-8:50 2S04 Pharm 16 |
| 8:30 | | Hypertension 3 | Hypertension 4 | Local Anesthetics | Anti-Arrhythmics 1 |
| 9:00 | 9:00-9:50 2S04 Med – Renal 6 | 9:00-9:50 2S04 Path – Renal 4 | 9:00-9:50 2S04 Path – Renal 6 | 9:00-9:50 2S04 Med – Renal 7 | 9:00-9:50 2S04 Med – Renal 8 |
| 9:30 | Hypertension | Glomerular Disease - Nephritic | Tubulointerstitial Disease | Glomerular | Non-Glomerular |
| 10:00 | 10:00-10:50 2S04 Path – Renal 3 | 10:00-10:50 2S04 Path – Renal 5 | 10:00-11:30 6 rooms Ethics 12 | 10:00-10:50 2S04 Path – Renal 7 | 10:00-10:50 2S04 Path – Renal 9 |
| 10:30 | Glomerular Disease - Nephrotic | RPGN & Systemic Disease Affecting Kidneys | | Neoplasia and Cysts | Renal Vascular Disease |
| 11:00 | 11:00-12:20 2S04 Psych 9 | 11:00-12:20 2S04 Psych 10 | | 11:00-11:50 2S04 Path – Renal 8 Urinary Tract: Ureter, Bladder, Urethra | 11:00-11:50 2S04 Psych 11 |
| 11:30 | Schizophrenia Spectrum & Other Psychotic Disorders | Bipolar and Related Disorders | | | Depressive Disorders |
| 12:00 | | | LUNCH | LUNCH | LUNCH |
| 12:30 | LUNCH | LUNCH | | | |
| 1:00 | | | 1:00-4:00 SL Pharm Sim LAB (With Pre-Reading and On-Line Quiz) 2 Rooms - (40 pah per student group) | 1:00-4:00 FoM PBL 3 Small Groups | |
| 1:30 | | 1:30-3:30 2S04 Doc2 4 PDR | | | |
| 2:00 | | | | | |
| 2:30 | Hold for Autopsy Experience | | | | |
| 3:00 | | | | | |
| 3:30 | | | | | |
| 4:00 | | | | | |
| 4:30 | | | | | |

Med. Cases of the Week: Case A / Case B — ID Cases of the Week: Case A / Case B

**Figure 8. Survey Results: Implementation**

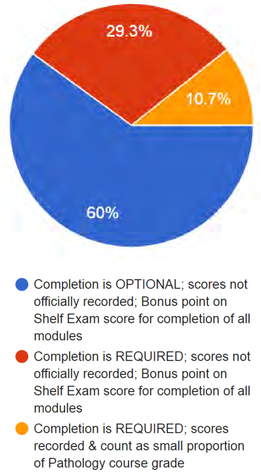
A weekly microbiology "case of the week" module should be implemented for each of the 26 weeks of Block 4:

75 responses




How should student interaction with the modules be implemented?

75 responses




## CONCLUSIONS

- This proof-of-concept study was undertaken to gauge the utility and desirability of reviewing key microbiology course materials during an organ system-focused curriculum.
- To assess the effectiveness of the presentation of such materials, the design of the proof-of-concept included a pretest, a set of five teaching modules, and a posttest, with the pretest and posttest assessing knowledge and application of knowledge regarding the module content.
- Excellent participation by students in trial.
- After analyzing pretest and posttest data along with survey data, we have drawn the following conclusions about the proof-of-concept microbiology modules:
  1) The modular format is an effective mechanism to disseminate the microbiology content as reflected in the 22.5-point improvement from pretest to posttest.
  2) There is a need for longitudinal exposure to microbiology content and concepts during the M2 year as seen in the 93.3% approval rate gathered from the participating students.
  3) Students responded positively to the modules as their feedback included descriptive phrases such as "very helpful", "covering high yield topics", "great content and format," and "would like more of them."
- These findings provide justification to expand the microbiology modules across each of the 26 weeks of Block 4 of the Brody M2 curriculum for the 2018-2019 school year.
- As a response to preference expressed by the majority of the participating students, these modules, upon implementation, will become a required assignment that provides bonus points on the Pathology NBME Subject (Shelf) Examination after completion of all of the modules.
  - Multiple suggestions for topics were received as port of the survey and they will be considered for inclusion
- A survey will be administered to students after the completion of this expanded set of modules to gauge effectiveness and to seek suggestions for improvement.
- These findings are supportive and inspirational to the potential development of other "Case of the Week" modules in courses, also affected by the curriculum change, hoping to provide a longitudinal exposure of their content in an organ-system based fashion.

## References


1. Burrows S, Moore K, Arriaga J, Paulaitis G, Lemkau HL. Developing an "Evidence-Based Medicine and Use of the Biomedical Literature" component as a longitudinal theme of an outcomes-based medical school curriculum: year 1. *Journal of the Medical Library Association*. 2003;91(1):34-41.