

Pharmacology as a continuum: a model for spaced repetition, vertical and horizontal integration

Jennifer Cleveland, PharmD. Joanne Greenawald, M.D., Renée J. LeClair, Ph.D.
Virginia Tech Carilion School of Medicine



Virginia Tech Carilion
School of Medicine

Rationale:

The pharmacology content at Virginia Tech Carilion School of Medicine (VTC SOM) is horizontally integrated across problem-based learning (PBL) and large group sessions. Historically, large group sessions focused on organ-based specific pharmacology, whereas PBL included all pharmacology presented in the featured case. This integrated approach rapidly exposed students to numerous pharmacological agents, but the student-led PBL forum appeared ineffective at addressing mechanism of action, dosing and side effects of all drugs in the case. Incidental drugs that were not directly related to the pathological focus or organ were often included in PBL cases, making the case more realistic, but the learning task more diffuse and frustrating. Despite efforts to reinforce content in several curricular locations, data from the AAMC graduate questionnaire (GQ) and the performance on individual Block exams indicated a need to reevaluate delivery of pharmacology. Based on this need, we have restructured the delivery across the M1 and M2 years.

Example week in the M1 curriculum				
Monday	Tuesday	Wednesday	Thursday	Friday
Pulmonary Consolidation session	ABCs of ABGs	Overview of cardio vascular system	Anatomy of the external heart	PBL Cases Pulmonary hypertension
PBL Cases	Respiratory physiology lab	PBL Cases	Anatomy of the internal heart	
			Heart dissection	Keith's Wrap-up

Historic PBL Learning objective:

Discuss the reason prescribed, mechanism of action, and relevant drug information (as identified on the VTC Drug Fact Sheet) for all pharmacologic agents presented in this case.

Drugs in the case:

Fluticasone/Salmeterol, Albuterol; Omeprazole/sodium bicarbonate; Montelukast; Prednisone; Erythromycin; Sulfonamides ;Midazolam; amoxicillin/clavulanate; tiotropium; omalizumab

Updated PBL Learning objective:

Describe the mechanism of action of Beta-2 agonists and describe the rationale for utilizing a short acting beta agonist (SABA) vs. a long acting beta agonist (LABA). Discuss the mechanism of action of fluticasone/salmeterol.

Using the asthma care quick reference, (https://www.nhlbi.nih.gov/files/docs/guidelines/asthma_qrg.pdf), relate the mechanisms of action of montelukast and tiotropium to asthma severity. What is the mechanism of action of Omalizumab and when would it be used?

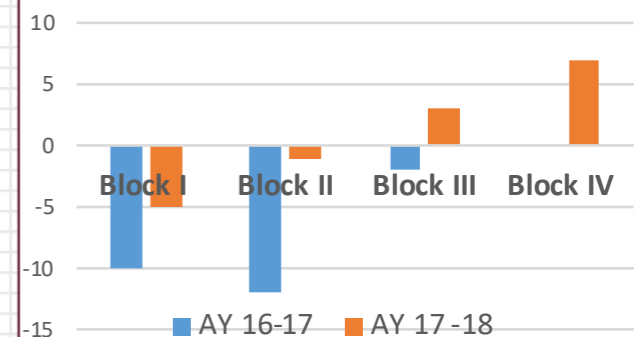
Drugs focused on:

Fluticasone/salmeterol, montelukast, tiotropium, omalizumab, amoxicillin/clavulanate

Results:

To date, student performance on pharmacology content on Block NBME exams has improved dramatically. (Block I up 5 points, Block II up 11 points and Block III 5 points when compared to exam performance metrics AY 16 -17). GQ data from this student cohort has not been collected.

NBME exam performance



Elements of the New Organizational Structure

Coordinated

Delivery across Basic Science and PBL to allow students to explore the use of use of drugs in **clinical scenarios**

Identified

Drugs related to the content being presented in **basic science** and wrote **specific objectives** to highlight key aspects of the drug in **PBL**

Enhanced

Exposure through **spaced repetition** by repeated inclusion in PBL cases

Assessed

Through both **NBME** and **Integrated Clinical Exam**

Discussion:

The restructure of pharmacology across curricular elements allowed both students and faculty to focus on important aspects of a specific drug, reducing the stress and often extraneous nature of exploring all drugs in a PBL case. This modification has positively **increased student performance** and **perception** of pharmacology delivery. In addition to the restructure, VTC SOM has also recruited a **full-time Pharmacist** to over see delivery. In summary, integrated curricular design requires elegant coordination across elements and in this case, we have been successful in focusing the student learning on relevant content and enhanced overall performance.