



# QUESTION BASED LEARNING WITH SELF-DIRECTED LEARNING LOOPS

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## Disclosures

- Founder and CEO, MedIQ Learning/USMLE-Rx
- Author, McGraw-Hill Education

# Acknowledgments

## **USMLE-Rx**

- John Collins
- Art Guepe
- Emma Underdown

## **Vanderbilt School of Medicine**

- Toufeeq Ahmed
- Pedro Texeira

## **University of Pittsburgh Medical Center**

- Andrew Bilderback

# United States Medical Licensing Examination (USMLE)

- 3 step exam for US medical licensure
- Sponsored by NBME and FSMB
- **Competency-based exam**

# USMLE Step 1

- Typically taken after 2<sup>nd</sup>/3<sup>rd</sup> year
- Preclinical focus
- 40K+ examinees and rising
- Residency application **screening tool**

# USMLE-Rx Qmax

- A leading **competency-based** self-assessment tool for USMLE preparation
- **Question-based learning (QBL)** – Case-based question followed by detailed explanations
- Interlinked with *First Aid for the USMLE Step 1*, *First Aid Flash Facts* (Anki-style flashcards), PubMed, and Wikipedia

Item: 3 of 5  
QID: 2387

Mark

Previous

Next

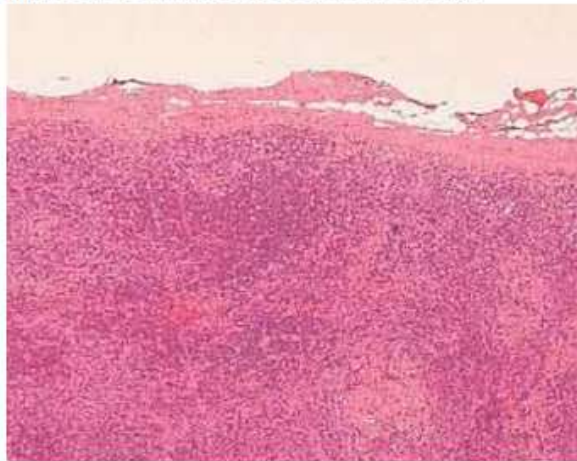
Lab Values

Notes

Calculator

- 1
- 2
- 3
- 4
- 5

A biopsy of a lymph node from a 3-year-old who developed paralytic poliomyelitis following administration of a live attenuated polio vaccine is performed, revealing nodal architecture that lacks germinal centers (shown below).



This patient would likely respond to treatment with which of the following therapies?

- A. Cyclosporine
- B. Regular intramuscular  $\gamma$ -globulin injections
- C. Sargramostim
- D. Tacrolimus
- E. Thrombopoietin

We value your feedback!



80797 : Tao

**The correct answer is B. 55% chose this.**

This patient's histologic section demonstrates a lymph node lacking germinal centers. Activation of the B-lymphocyte response occurs in the follicular zone in the outer cortex of the lymph node. Proliferating B cells form clusters, termed germinal centers, where somatic hypermutation and affinity maturation take place. Lack of germinal centers and the clinical scenario of disease following vaccination with live pathogen suggest a B-lymphocyte immunodeficiency. Thus, the most helpful treatment would be administration of immunoglobulins.

Tacrolimus Cyclosporin Immunosuppressive drug Immunodeficiency Immunosuppression

**A is not correct. 11% chose this.**

Cyclosporine is an immunosuppressant that increases susceptibility to infection and is contraindicated in this patient.

Granulocyte macrophage colony-stimulating factor Monocyte Granulocyte Bone marrow Colony-stimulating factor Bone

**C is not correct. 19% chose this.**

Granulocyte-macrophage colony-stimulating factor (GM-CSF) is used to speed recovery of bone marrow granulocytes and monocytes.

Lymph node B cell Somatic hypermutation Affinity maturation Pathogen Immunodeficiency Antibody Histology Germinal center Vaccination Lymph

Cortex (anatomy) Somatic (biology) Follicular lymphoma

**D is not correct. 11% chose this.**

Like cyclosporine, tacrolimus is an immunosuppressive agent and is not the appropriate treatment for a patient suffering from immunodeficiency.

Cyclosporin Immunosuppression Contraindication

**E is not correct. 4% chose this.**

Used clinically to increase platelet counts, thrombopoietin would not be a useful treatment option for this patient.

Thrombopoietin Platelet

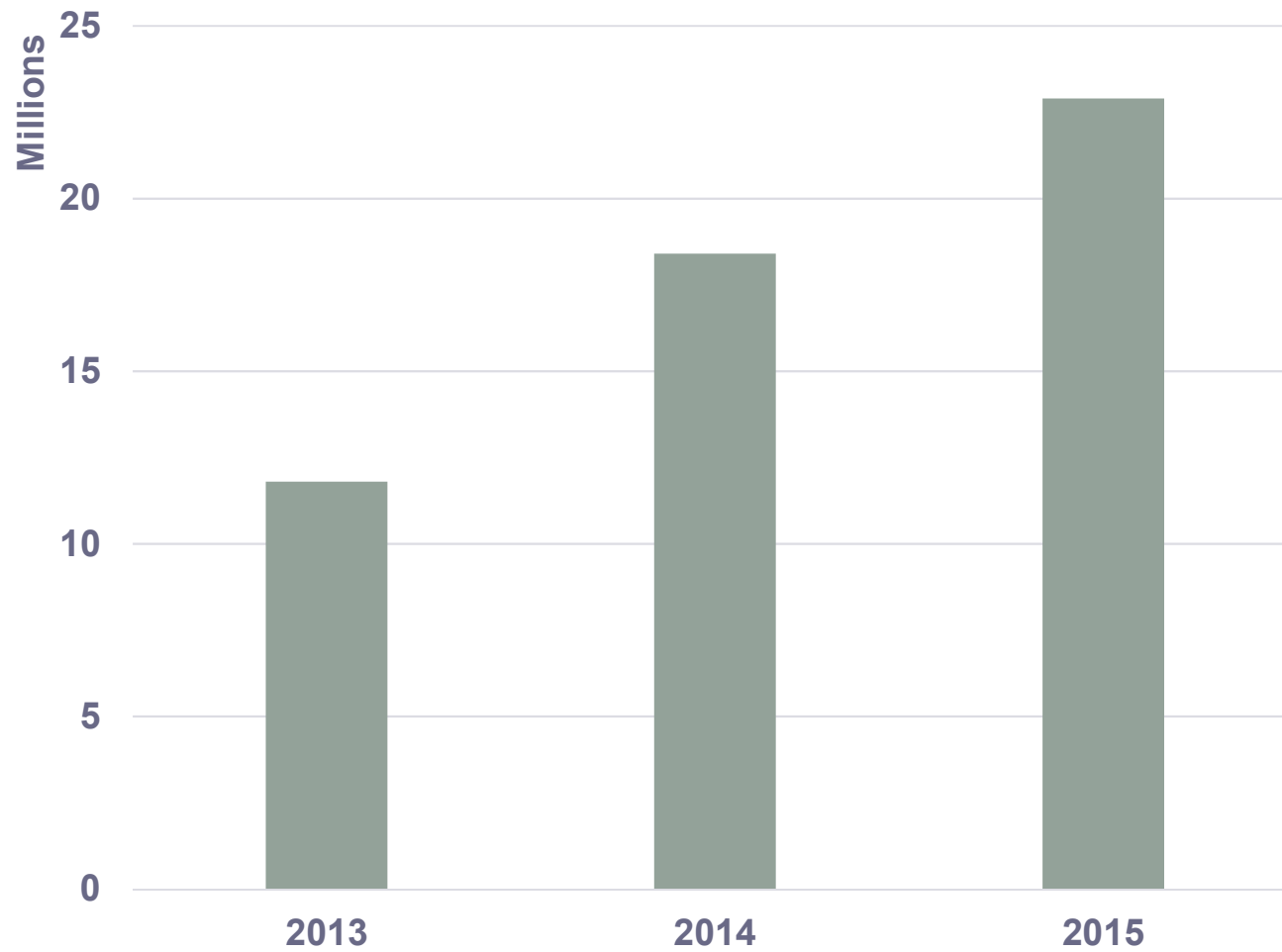
**Bottom Line:**

B-lymphocyte deficiency is apparent histologically by a lack of germinal centers in lymph nodes, and may be treated with immunoglobulin injections.

B cell Histology Lymph node Antibody Germinal center Lymph



# USMLE-Rx Qmax Usage





**34 Million  
Questions**

**FIRST AID**



**150K+ learners**

Opportunity to train  
better learners?

# Building the Master Learner

- Self-determination theory
- Cognitive load theory
- Situated cognition
- **Self-directed learning**

Perspective

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## **Developing the Master Learner: Applying Learning Theory to the Learner, the Teacher, and the Learning Environment**

Daniel J. Schumacher, MD, MEd, Robert Englander, MD, MPH,  
and Carol Carraccio, MD, MA

*Acad Med.* 2013;88:1635-1645

# Self directed learning

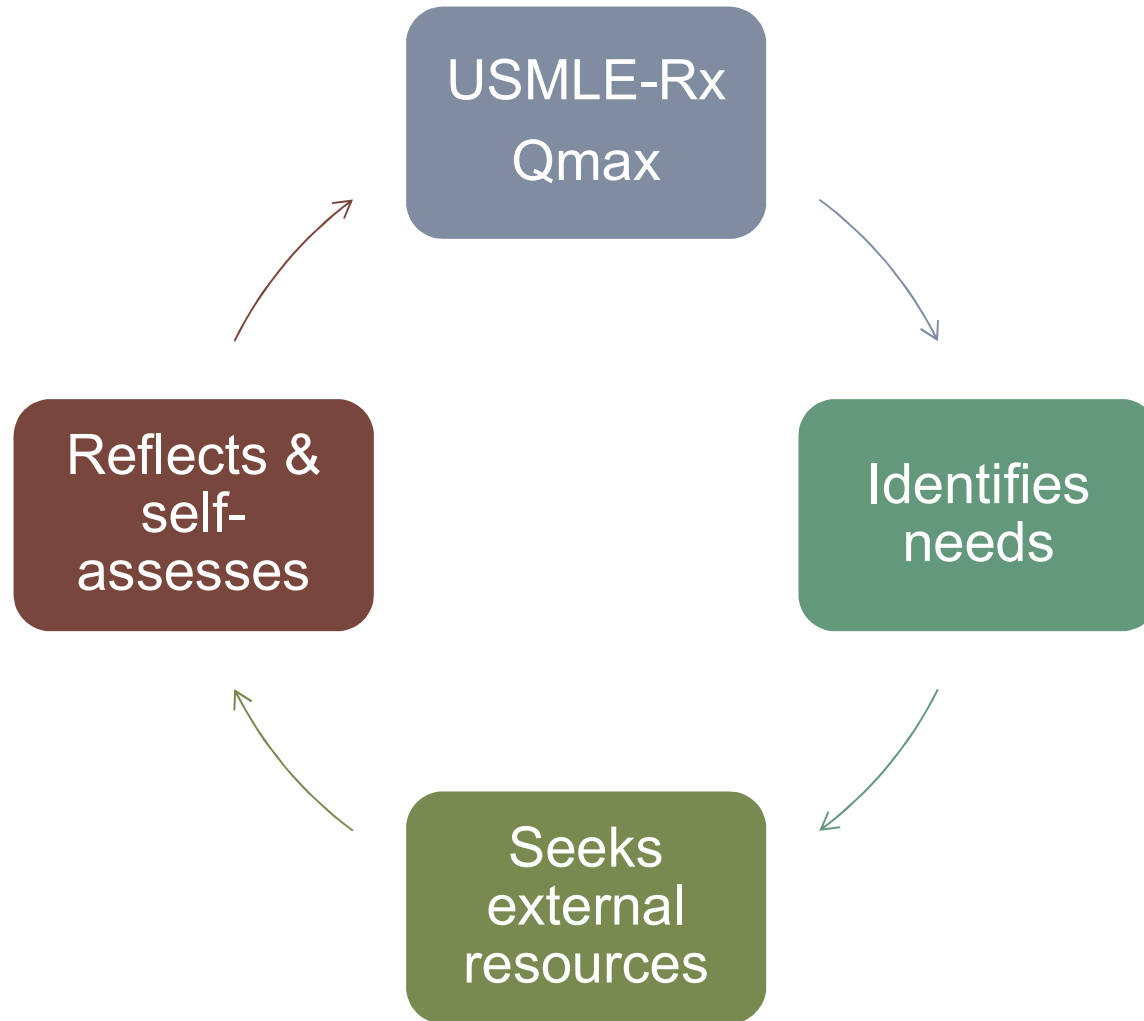
- Learner takes responsibility for learning
- Requires external resources
- Social activity
  - Teachers – guided reflection, self-assessments, learning plans
  - Peers – peer assisted learning, community, peer support

# Liaison Committee on Medical Education

## **6.3 Self-Directed and Life-Long Learning**

The faculty of a medical school ensure that the medical curriculum includes self-directed learning experiences and time for independent study to allow medical students to develop the skills of lifelong learning. Self-directed learning involves medical students' self-assessment of learning needs; independent identification, analysis, and synthesis of relevant information; and appraisal of the credibility of information sources.

# Learning Loop



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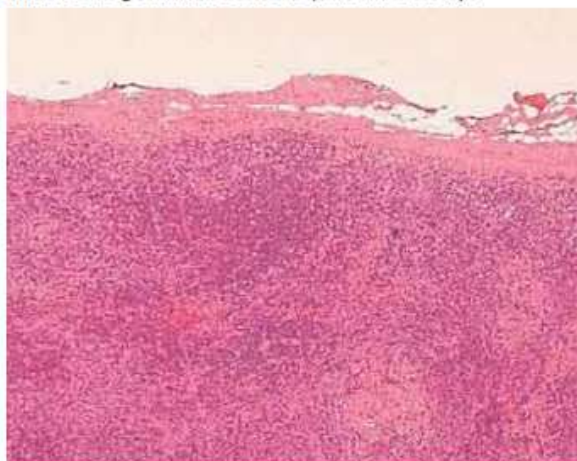
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Thrombopoietin Platelet

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Ciclosporin Immunosuppression Contraindication

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Thrombopoietin Platelet

## THROMBOPOIETIN

X

Wikipedia

PubMed 6

Thrombopoietin (THPO) also known as megakaryocyte growth and development factor (MGDF) is a protein that in humans is encoded by the THPO gene. Thrombopoietin is a glycoprotein hormone produced by the liver and kidney which regulates the production of platelets. It stimulates the production and differentiation of megakaryocytes, the bone marrow cells that bud off large numbers of platelets. Megakaryocytopoiesis is the cellular development process that leads to platelet production. The protein encoded by this gene is a humoral growth factor necessary for megakaryocyte proliferation and maturati...

[Source] Wikipedia: <https://en.wikipedia.org/wiki/Thrombopoietin>

[Genetics](#), [Function and regulation](#), [Therapeutic use](#), [Discovery](#), [See also ...](#)

### Recommended Resources:

1. Kaushansky K (2006). "Lineage-specific hematopoietic growth factors". *N. Engl. J. Med.* **354** (19): 2034–45. doi:10.1056/NEJMra052706. PMID 16687716.
2. "Entrez Gene: THPO thrombopoietin (myeloproliferative leukemia virus oncogene ligand, megakaryocyte growth and development factor)".

# Learning Loop Analysis

- **Aims** – characterize learning loop adoption and associated factors
- Statistical plan
  - User event data for April 2016 captured by Mixpanel
  - Exploratory/descriptive data analysis
  - Bi/multivariate analysis
  - Statistical analysis performed in STATA 13.1

# Descriptive Statistics

- 3159 users reviewed 696K Step 1 Qmax questions
- **1028** users engaged in **5105** learning loops
- = 7 loops/1000 reviewed questions

```
. tabstat loops, s(n mean sd min p25 p50 p75 max) f(%9.2f)
```

variable	N	mean	sd	min	p25	p50	p75	max
loops	1028.00	4.97	10.49	1.00	1.00	2.00	5.00	190.00

**Student type among those who engaged in loops**

```
. tab student_type
```

(min) student_type	Freq.	Percent	Cum.
MD - US Allopathic Medical Student	542	52.72	52.72
DO - US Osteopathic Medical Student	110	10.70	63.42
IMG - US IMG	170	16.54	79.96
IMG - Foreign-born IMG	141	13.72	93.68
Other	65	6.32	100.00
Total	1,028	100.00	

# Bivariate Analysis

Factor	OR (95% CI)	P-value
Incorrect answer	1.7 (1.5-1.9)	<0.001
Foreign-born IMG (vs US MD)	2.9 (1.9-4.4)	<0.001
More difficult questions	1.4 (1.3-1.6)	<0.001
Lower performing student	1.9 (1.4-2.5)	<0.001
Fewer questions done	1.2 (1.0-1.5)	0.071

# Bivariate Analysis

Subject Areas	OR (95% CI)	P-value
Behavioral science	0.6 (0.5-0.8)	0.001
Biochemistry	1.3 (1.1-1.6)	0.010
Epidemiology	0.4 (0.3-0.6)	<0.001
Pharmacology	0.8 (0.7-1.0)	0.019

# Multivariate Analysis

Factor	OR (95% CI)	P-value
Incorrect answer	1.5 (1.3-1.6)	<0.001
Foreign-born IMG (vs US MD)	2.5 (1.6-3.8)	<0.001
More difficult questions	1.3 (1.2-1.4)	<0.001
Fewer questions done	1.2 (1.0-1.5)	0.097
Lower performing student	1.6 (1.2-2.1)	0.001
Behavioral science	0.6 (0.5-0.8)	<0.001
Biochemistry	1.2 (1.0-1.5)	0.045
Epidemiology	0.4 (0.3-0.6)	<0.001
Genetics	0.7 (0.6-1.0)	0.022
Pharmacology	0.8 (0.7-1.0)	0.015

# Conclusions

- Students appear to readily engage in learning loops when presented with the opportunity
- Factors predicting increased learning loop engagement include:
  - Question being incorrectly answered
  - Increased question difficulty
  - Student reviewing fewer questions
  - Student being a lower performer
  - Student being a foreign-born IMG
  - Certain subject categories