# Identifying Subtypes of Medical Students' Performance Assessment Results Using a Latent Class Quadratic Growth Analysis (LCQGA)

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## Abstract

This study identified two subgroups in medical students' acquisition of basic science knowledge to allow the school to target support services. The first started better prepared and continued to grow, but their growth slowed down. The second started lower, exhibited lower growth, but continued to grow at the same pace.

## Introduction

Passing Step 1 of the United States Medical Licensure Examination (USMLE) is a major milestone for medical students. Understanding students' growth patterns in the application of basic science knowledge and identifying students in danger of failing USMLE Step 1 so that they can receive the educational support they need to be successful is an important goal for medical educators.[1]

Individual differences in preparation, learning styles, and growth patterns make it difficult to meet students' learning needs. Diagnosing student growth trajectories on progress assessments of basic science knowledge over the first two years of medical school is crucial for providing them the educational support they need to pass USMLE Step1. The goal of this study is to identify if there are groups of students with different patterns of growth in basic science knowledge.

## Method

We assessed 183 medical students at six time points throughout the first two years of medical school using a progress test[2] developed by the National Board of Medical Examiners Customized Assessment Services (CAS).[3] We used Latent Class Growth Analysis (LCGA)[4] to identify different groups of students based on the intercept (starting point), linear slope (growth rate) and quadratic growth (change in growth) over the six progress tests, controlling for the students' Medical College Admissions Test (MCAT) total score and their Underrepresented Minority (URM) status.

## Results

The results of the analysis indicated that, after controlling for MCAT scores and URM, the students' growth trajectories were not homogeneous ($p > .01$) and a model with two groups of students with different trajectories better fit the data. The first group included 100 students and the second 83 students. Students in the first group had relatively higher initial mean percent correct (37.696, $p < .001$) and positive rate of change (7.076, $p < .001$), but this linear growth slowed down (i.e., the coefficient for the quadratic term is -0.352, $p < .001$). Students in the second group had a relatively lower starting point (35.197, $p < .001$) and a smaller yet positive rate of change (i.e., 4.260, $p < .001$), but had no significant sign of slowing down ($p > .05$).

## Closure

The results suggest that students can be partitioned into two groups, based on their growth trajectories in basic science knowledge as measured by tests developed by the NBME CAS Program. Given that they were controlled, these differences in growth trajectories cannot be explained by MCAT scores or URM status. Both groups of students grew significantly in their performance, but the larger group started higher and grew at a faster rate, with their growth rate eventually slowing. The second group started a few percentage points lower, grew somewhat slower, and their growth rate continued across the six exams. Additional predictive analytics research can be done when USMLE Step 1 exam results are available. Since these students are in the first class of a new and very innovative curriculum implemented at our medical school and have not yet taken

the USMLE Step 1; we do not know how successful the groups will be. However, we believe that identifying these groups of students based on their growth patterns is useful in tailoring the curriculum and our services to their needs. It will also allow the school to better prepare and integrate our services for our future cohort.

Reference


1. Thadani RA, Swanson DB, Galbraith, RM A Preliminary Analysis of Different Approaches to Preparing for the USMLE Step 1. Academic Medicine: 2000,75(10)S40–S42.

2. Van Der Vlueten CPM, Verwijnen GM, Wijnen WHFW. Fifteen years of experience with progress testing in a problem-based learning curriculum. Medical Teacher 1996;18:2;103-9.

3. National Board of Medical Examiners. Customized Assessment Services (CAS) program. http://www.nbme.org/schools/cas.html. Accessed April 21, 2018.

4. Jung T, Wickrama KAS. An introduction to latent class growth analysis and growth mixture modeling. *Soc Personal Psychol Compass*. 2008;2(1):302-317. doi:10.1111/j.1751-9004.2007.00054.x