Use of Early Indicators to Predict Success on COMLEX
Findings from Three COMs

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Classes of 2011–2014
COMLEX Level 1/GPA OMS1

$r = 0.683$
Classes of 2011–2014
COMLEX Level 1/GPA OMS2

$r = 0.746$
OMS1 Curriculum

- Histology
- Gross Anatomy/Embryology
- Neuroanatomy
- Physiology
- Introduction to Clinical Medicine
- Biochemistry
- Behavioral Medicine
- Osteopathic Manipulative Medicine
## OMS1 Course Grades and L1 Means

<table>
<thead>
<tr>
<th>OMS1 Course</th>
<th>A/A-</th>
<th>B+/B/B-</th>
<th>C+/C</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Histology</td>
<td>578 (72)</td>
<td>507 (69)</td>
<td>463 (63)</td>
<td>416 (50)</td>
</tr>
<tr>
<td>Gross/Embryo</td>
<td>600 (70)</td>
<td>534 (70)</td>
<td>474 (66)</td>
<td>428 (55)</td>
</tr>
<tr>
<td>Neuroanatomy</td>
<td>582 (73)</td>
<td>516 (68)</td>
<td>453 (53)</td>
<td>423 (85)</td>
</tr>
<tr>
<td>Physiology</td>
<td>590 (70)</td>
<td>517 (66)</td>
<td>453 (58)</td>
<td>416 (41)</td>
</tr>
<tr>
<td>Intro to Clinical Medicine</td>
<td>550 (80)</td>
<td>502 (74)</td>
<td>455 (62)</td>
<td>451 (54)</td>
</tr>
</tbody>
</table>
OMS2 Curriculum

- Topics in Medicine
- Infectious Diseases and their Etiologic Agents
- Pathology
- Pharmacology
- Immunology
- Psychiatry
- Osteopathic Manipulative Medicine
# OMS2 Course Grades and L1 Means

<table>
<thead>
<tr>
<th>OMS2 Course</th>
<th>Classes of 2007-2014 Mean COMLEX L1 scores (1SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A/A-</td>
</tr>
<tr>
<td>Topics in Medicine</td>
<td>588 (77)</td>
</tr>
<tr>
<td>Infectious Diseases and their Etiologic Agents</td>
<td>585 (71)</td>
</tr>
<tr>
<td>Pathology</td>
<td>555 (74)</td>
</tr>
<tr>
<td>Pharmacology</td>
<td>582 (67)</td>
</tr>
</tbody>
</table>

*N too small to calculate
OMS2 Course Grades and L1 Means

Board scores based on course grade OMSII

Course Title

COMLEX L1
The Intangible Factor

- Faculty outreach via Academic Watch/Warning
- Academic Watch = <75% in one or two courses, encouraged to meet with faculty
- Academic Warning = <75% in ≥ three courses OR <70% in ≥ one course(s), required to meet with faculty or ADAA, follow-up peer tutoring or mtgs with campus counselors as indicated
# Student non-responsiveness to faculty outreach

<table>
<thead>
<tr>
<th>Academic Warning</th>
<th>Responders</th>
<th>Non-responders</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Faculty Outreach</td>
<td>59%</td>
<td>41%</td>
<td>100%</td>
</tr>
<tr>
<td>Failed L1</td>
<td>20%</td>
<td>53%</td>
<td>33%</td>
</tr>
</tbody>
</table>
Conclusions

- Course performance as measured by OMS1 and OMS2 GPA shows 0.683 and 0.746 correlation to COMLEX Level 1 performance
- It is the effort in all courses rather than effort in a single course that impacts the L1 score
- The academically struggling student who does not respond to faculty assistance and guidance may be at a greater risk of failing COMLEX L1
Philadelphia College of Osteopathic Medicine

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Purpose

1. to identify the characteristics that differentiate the academic performance of those who pass vs. those who fail COMLEX I on the first attempt.
2. to create a profile of risk factors for failing COMLEX I
3. to inform the development of an early identification system and remedial program
GPA as Predictor of Test Performance
Single biggest predictor of COMLEX 1 performance

The strongest univariate indicator of Comlex I performance is performance in the PCOM M1-M2 curriculum, reported as GPA or class rank -------- $r = .741$

• However, is there another active, predictive way to look at the progression of a student through pre-med and preclinical education on the path to COMLEX I?
Methods

• Archival records of students were examined related to demographic and academic variables including:
  – undergraduate college grade point average
  – undergraduate science grade point average
  – MCAT-Verbal
  – MCAT-Physical
  – MCAT-Biology
  – MCAT-total scores
Methods

• Registrar’s files provided data on preclinical performance at PCOM (M-1 and M2)

• We reviewed individual student achievement (0-100 point scale) on major course blocks in M-1 and M2 and overall GPA and class rank.
Methods

• Students who failed COMLEX on the first attempt were compared on a variety of variables to students who passed COMLEX on the first attempt

• A randomly selected sample of cohort mates who passed COMLEX were identified

• All data obtained from the Registrar were downloaded from Excel into SPSS 15.0
Methods

• Multivariate analyses were conducted to compare “passes” versus “fail” on specific variables
• Multivariate analyses revealed that these two groups differed overall
• A series of one way ANOVA’s were then conducted on each of the dependent variables to determine where the differences were
Risk factors for COMLEX 1 first time failure

• We then defined each significant variable as a “risk factor” and examined the accumulation of risk factors for relationship to pass or fail on Comlex 1 first-sitting.
Significant “Distal” Variables (before matriculation)

- Maximum MCAT- Physical: 7 or below (failing group mean=7.2)
- Maximum MCAT Biological: 7 or below (failing group mean=7.4)
- GPA Science: 3.1 or below
- Maximum MCAT Total: 22 or below (failing group mean= 22.2)
Significant “Proximal” Variables (after matriculation)

- PCOM Preclinical GPA (79 or below)
- PCOM Class Rank (Quintile = 4.5 or above)
- SPOM Final Grade: 77 or below (failing group mean = 77.7)
- Cell and Tissue Final Grade: 73 or below (failing group mean = 73.2)
- Clinical & Basic Neuroscience Final Grade: 80 or below (failing group mean = 80.1)
Correlation between number of risks and probability of passing

• $r = -0.95.$ $P < 0.001$\quad R squared = 0.9025

• As the number of risk factors increases, the probability of passing decreases.

Conclusion: 90.25% of the differences in probability of passing are attributable to differences in the number of risk factors; the other 9.75% of the variability is attributable to other yet unknown factors.
2010 DO M2 Comprehensive Exam

- 197 content questions corresponding to m1-m2 curricular areas (non-clinical) through Clinical and Basic Neuroscience (term 2).
- 3 screening questions dealing with prep time, timeframe for taking Comlex I, and perception of the helpfulness of the Comprehensive Exam
- **Mandatory** for all M-2 students to sit for exam
- Administered on April 23, 2010.
- Proctors noted those who left in the first hour.
Breakdown

- 264 students sat for the Comp
- Overall mean = 104 out of 197 (53% correct)
- When the group was reduced by eliminating those who left in the first hour (37), the group totaled 227 valid comprehensive scores for analysis
- A small group of students did not sit for Comlex 1 by the time of analysis and reduced the sample further.
What is the relationship between the Comprehensive Exam and COMLEX I scores?

- Pearson Correlational Analysis of all students reveals \( r = +.469 \)
- Coefficient of Determination = .22 meaning that 22% of the variability in COMLEX scores is attributable to Comp Scores; the remaining 78% of the variability is unaccounted for.
Students with something more important to do

• Students who left in the first hour had a mean comprehensive exam score of 49.7 (25%) comparative to the total group which had a mean score of 104 (53%)

• 6 of these students (16%) failed the COMLEX with a mean score of 348.

• 3 of these students did not take COMLEX.
What happens to the relationship when we remove students who left the exam before 1 hour?

Note:
This would mean that if a student left the exam at around one hour they would theoretically have spent 18 seconds per item.

- Pearson Correlational Analysis for only those students who took exam more seriously = +.674
- Coefficient of Determination = meaning that 45% of the variability in COMLEX scores is attributable to Comp Scores; the remaining 55% of the variability is unaccounted for.
COMLEX I score distribution by Comprehensive exam score
Can we predict COMLEX scores from COMP scores?

- In a simple regression analysis with Comp scores as the predictor variable and COMLEX score as the criterion:
  - The regression equation makes a significant prediction beyond chance that Comp scores can significantly predict COMLEX scores.
  - The formula:
    \[ \text{COMLEX Score} = 2.297 \times \text{(COMP score)} + 237.763 \]
Cross-validation

• Data from PCOM Classes of 2013 and 2014
  – Comprehensive exam administered in April, 2011 and April, 2012, respectively

• Class of 2013 (analysis limited to students who spent greater than an hour on the examination)
  – Mean score: 118 (59.9%)
  – Pearson Correlational Analysis (comprehensive exam score and COMLEX 1 score) = +.658
Cross-validation

• Class of 2014 (analysis limited to students who spent greater than an hour on the examination)
  – Mean score: 109 (55.3%)
  – Pearson Correlational Analysis (comprehensive exam score and COMLEX 1 score) = +.505
KCUMB-COM Use of PCOM Cumulative Exam

- 110 student volunteers
- Exam given May 25, 2012
- Mean score: 65.48
- Pearson’s Correlation: $R=0.793$
- Coefficient of Determination: 63%

Sample size: 110
Mean x ($\bar{x}$): 65.483
Mean y ($\bar{y}$): 518.79090909091
Intercept (a): -5.6412563777521
Slope (b): 8.0086765338891
Regression line equation: $y=8.0086765338891x-5.6412563777521$
Administration of comprehensive examination in 2013 (Class of 2015)

• Administered earlier (end of February vs. end of April)

• Used as a formative assessment to guide student study

• Will be correlated to:
  – COMSAE score (end of April, 2013)
  – COMLEX I score
KCUMB
College of Osteopathic Medicine

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Associate Dean for Curricular Affairs
Goal

- Admissions metrics select students who are well-prepared and academically competitive.
- Despite homogeneity in skills and capabilities, there is considerable variability in their performance in medical school.
  - Reflected in grades and board scores.
Questions

- Can we predict who is at risk for poor board performance?
- How soon can we predict?
- How well can we predict?
KCUMB Curriculum Design

- Series of 11 courses, also called sections, that have a significant physical systems focus
- Sections offered sequentially, not concurrently
KCUMB Performance Evaluation

- Typically, one midterm and one final per section
- For our report today, “grade” means total percentage of exam items answered correctly
  - Final grade for section also includes small number of other elements
Distribution of Scores

Mean = 81.72
Std. Dev. = 6.068
N = 240
Performance as Rank

- Measure performance in a section as a rank
  - Performance rated from best to worst, based on exam performance
Spearman Correlation of Ranks Between Adjacent Sections
Another View of Stability

Mean = -0.2317
Std. Dev. = 45.2344
N = 246
Conclusion 1

- A student’s relative performance in our curriculum doesn’t change over time
Question 2

- Do grades predict board performance?
- Use exam score in section as predictor of COMLEX I score
  - Linear regression approach
How Well Do Grades Predict Board Performance?

- R-value of section exams as predictors of COMLEX I
Exam grades are good predictors of COMLEX I performance in our curriculum
For CO2013, exam performance in renal section was best predictor of COMLEX I scores

- Renal section is at end of year 1
- COMLEX I taken one year later

One year in advance, we could predict, with reasonable accuracy, scores on COMLEX I
For CO2013 and CO2014, both exam grades and COMLEX I scores were available.

To identify students at risk, we need prediction metrics *before* students are released to take COMLEX.
Can Predictive Model From One Year Be Applied To The Next?

- Obtain the best-predicting regression equation for CO2013
- Apply the equation to CO2014 data to generate predicted COMLEX I score
- Determine difference between predicted and actual score
Results

Mean = 3.19
Std. Dev. = 59.364
N = 236
Conclusion 3

- It is possible to develop models from one class’ COMLEX performance to predict the next class’ COMLEX performance
  - Prediction of mean performance is very good
  - High level of variability
Implications and Follow-Up Questions

- Students at risk for poor performance on COMLEX I can be identified in their first year
  - Applies only to our curriculum and our students and may not generalize to other institutions
- Can interventions be designed to reduce that risk?
Questions?