Does voluntary use of an Asynchronous Tool for Learning Antimicrobials (ATLAS) improve student recall of antimicrobial knowledge?

Conan MacDougall, PharmD, MAS, BCPS-AQ ID
Professor of Clinical Pharmacy
University of California San Francisco School of Pharmacy
Visiting Faculty
Monash University Faculty of Pharmacy and Pharmaceutical Sciences
WHO COMPETENCY FRAMEWORK FOR HEALTH WORKERS’ EDUCATION AND TRAINING ON ANTIMICROBIAL RESISTANCE

“In the human health sector, a major reason given by health workers and students for the misuse of antimicrobials is the lack of understanding and adequate expertise to address AMR (antimicrobial resistance). A key approach to address this challenge and ensure the appropriate use of antimicrobials is to ensure that health workers acquire, through their education and training, the competencies required to prevent and combat AMR.”
### Consensus Antimicrobial Susceptibility Tool (CoAST)

For teaching purposes only. Organism susceptibilities may vary by geographic region and clinical scenario. Therapy should be guided by results of microbiological cultures whenever possible. Patient-specific factors and clinical evidence/experience must be considered in choice of therapy (e.g., site of infection, patient immune status). We love feedback! Link here: [http://iims.ucsf.edu/coast/feedback](http://iims.ucsf.edu/coast/feedback).

#### Spectrum of Activity

<table>
<thead>
<tr>
<th>Drug</th>
<th>Bacteroides fragilis</th>
<th>E. coli</th>
<th>Enterobacter cloacae</th>
<th>Enterococcus faecalis</th>
<th>Enterococcus faecium</th>
<th>Haemophilus influenzae</th>
<th>Klebsiella pneumoniae</th>
<th>Legionella/Chlamydia/Mycoplasma</th>
<th>Moraxella catarrhalis</th>
<th>Proteus mirabilis</th>
<th>Pseudomonas aeruginosa</th>
<th>Staphylococcus aureus</th>
<th>Streptococcus pneumoniae</th>
<th>Streptococcus pyogenes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Azithromycin</td>
<td>30%</td>
<td>100%</td>
<td>95%</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Tobramycin</td>
<td>90%</td>
<td>0%</td>
<td>0%</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Vancomycin</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
</tbody>
</table>


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Tools for Enhancing Long-term Recall

• Elaborative interrogation
• Formation into schema (chunking)
Table 2. Scores on Delayed Assessment by Relation to Content Delivery Method

<table>
<thead>
<tr>
<th>Year</th>
<th>AL-Related Items</th>
<th>TL-Related Items</th>
<th>Difference (95% CI)</th>
<th>p-value</th>
<th>Effect size (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Years</td>
<td>75.3</td>
<td>70.4</td>
<td>4.9 (3.5 - 6.1)</td>
<td>&lt;0.0001</td>
<td>0.34 (0.19-0.49)</td>
</tr>
<tr>
<td>2013</td>
<td>72.3</td>
<td>68.2</td>
<td>4.1 (2.4 - 5.7)</td>
<td>&lt;0.0001</td>
<td>0.45 (0.20-0.70)</td>
</tr>
<tr>
<td>2014</td>
<td>76.7</td>
<td>73.7</td>
<td>2.9 (1.1 - 4.8)</td>
<td>&lt;0.0001</td>
<td>0.24 (-0.02-0.49)</td>
</tr>
<tr>
<td>2015</td>
<td>78.6</td>
<td>73.3</td>
<td>5.2 (3.2 - 7.1)</td>
<td>&lt;0.001</td>
<td>0.38 (0.12-0.64)</td>
</tr>
</tbody>
</table>

Abbreviations: AL=active-learning; TL=traditional lecture; CI=confidence interval
Tools for Enhancing Long-term Recall

• Retrieval practice
• Contrasting effects
• Interleaved practice

HOW TO DO IT

Put away your class materials, and write or sketch everything you know. Be as thorough as possible. Then, check your class materials for accuracy and important points you missed.

Take as many practice tests as you can get your hands on. If you don’t have ready-made tests, try making your own and trading with a friend who has done the same.

You can also make flashcards. Just make sure you practice recalling the information on them, and go beyond definitions by thinking of links between ideas.
ATLAS Beta-lactams Spectrum of Activity Module
P3 abx PCOL unit (N=117)

In-class β-lactam PCOL session 1
ATLAS explained & use encouraged
↓
1 day

In-class β-lactam PCOL session 2
↓
14 days

Midterm exam including β-lactams (Short-term, ST)
↓
96 days

Beginning of next unit review assessment (Medium-term, MT)

<table>
<thead>
<tr>
<th></th>
<th>ST score</th>
<th>MT score</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Any Access</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes (86%; 101/117)</td>
<td>108.4</td>
<td>22.6</td>
</tr>
<tr>
<td>No (14%; 11/117)</td>
<td>86.3</td>
<td>21.4</td>
</tr>
<tr>
<td>Difference (95% CI)</td>
<td>22.1</td>
<td>1.3</td>
</tr>
<tr>
<td>(32.0 – 12.2)</td>
<td>(3.3 – -0.7)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Access &gt;24h before exam</strong></th>
<th>ST score</th>
<th>MT score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes (57%; 67/117)</td>
<td>108.1</td>
<td>22.7</td>
</tr>
<tr>
<td>No (43%; 49/117)</td>
<td>101.6</td>
<td>22.0</td>
</tr>
<tr>
<td>Difference (95% CI)</td>
<td>6.5</td>
<td>0.7</td>
</tr>
<tr>
<td>(12.8 – 0.3)</td>
<td>(2.1 - -0.8)</td>
<td></td>
</tr>
</tbody>
</table>
Increase in score per session: 1.1 (0.34 – 1.85)
Increase in score per session: 0.82 (0.27 – 1.37)
Cumulative GPA: 24.3 (19.5 – 29.1)

Short-term Assessment Score

Short-term Assessment Score

p<0.001 for interaction
Increase in score per session: 2.41 (0.99 - 3.81)
Increase in score per session: 0.83 (-0.46 - 2.12)
Increase in score per session: -0.11 (-0.75 - 0.53)
Increase in score per session: 0.14 (0.04 – 0.32)

Increase in score per session: 0.21 (0.01 – 0.43)

Increase in score per session: 0.20 (-0.01 – 0.41)

Cumulative GPA: 1.22 (-0.38 – 2.82)

p=0.55 for interaction
Limitations & Effect Sizes

• Limitations
  • Short-term assessment included other material
  • Durations of access not available
  • Assessments of recall, not application

• Effect sizes ($\eta^2$)
  • ST, any use (GPA-adjusted): 0.19 (medium - Cohen’s $d \sim 0.5$)
  • ST, total use attempts (GPA-adjusted): 0.07 (small - Cohen’s $d \sim 0.2$)
  • ST, total use attempts (low GPA category): 0.38 (large - Cohen’s $d \sim 1.0$)
  • MT, non-cram use attempts (GPA-adjusted): 0.03 (small - Cohen’s $d < 0.2$)
Conclusions & Future Directions

• Use of online practice platform improved recall
  • + short-term outcomes
  • + lower-performing students
  • + non-cram use

• Future:
  • Expanded tool
  • Application outcomes
  • Longer-term recall

http://tiny.ucsf.edu/atlas

ATLAS: Asynchronous Tool for Learning AntimicrobialS

The ATLAS (Asynchronous Tools for Learning AntimicrobialS) Project
The goal of the ATLAS Project is to help a wide spectrum of learners increase their understanding of antimicrobial use and infectious diseases management so that we all can become better stewards of this precious resource.

ATLAS is a set of interactive online modules that give learners an opportunity to test their knowledge of antimicrobials or learn new content through focused modules used evidence-based instructional methods.

All modules are currently in beta testing phase and should be used for teaching purposes only not as a sole component of clinical care.

Practice Modules
Modules focusing on practice and self-assessment of content provided through other resources.

1. NEW Expanded Spectrum of Activity Module
   Interactive exercises and quizzes for developing knowledge of antimicrobial spectrum of activity. Now covering 3D antibiotics!
   NOTE: opens in new browser window/tab. May need to turn popup blockers off. Takes 2-3 seconds to load.

2. Beta-lactams Spectrum of Activity Exercises
   Interactive exercises for learning spectrum of activity for beta-lactams.
   NOTE: opens in new window, ensure pop-up blockers are disabled.

3. Consensus Antimicrobial Spectrum Tool (CoAST)