Evidence Based Changes in a Pipeline Special Masters Program

Colleen Talbot, PhD\textsuperscript{1,2} and Christina Goode, PhD\textsuperscript{2}
Western University of Health Sciences
\textsuperscript{1}College of Osteopathic Medicine of the Pacific
\textsuperscript{2}Graduate College of Biomedical Sciences
Special Masters Programs

• Complete additional science coursework and demonstrate ability to perform at the graduate level
  - *new graduate GPA*

• Gain the opportunity to request current LORs from graduate or medical school faculty

• Gain skills and confidence that will prepare for success in professional school

• Earn an additional credential (residencies)
WesternU MSMS Program

**Vision:** The MSMS program is designed to assist individuals from *diverse* backgrounds in gaining acceptance to professional schools with the ultimate goal of increasing the number of health-professionals in underserved areas.
Mission Fit

• Underrepresented in Medicine (URiM)
• Low SES
• Educational: first generation college students
• HRSA indicators such as address in HPSA
But....

- Metrics are still the primary consideration for most health professions programs
- URiMs and first-generation college students often have a significant achievement gap which leads to lower matriculation numbers
### URiM Student Matriculation In Medical School (Entering Class 2011)

<table>
<thead>
<tr>
<th>URiM Admissions Data</th>
<th>Allopathic Medical Colleges</th>
<th>Osteopathic Medical Colleges</th>
<th>COMP Number (% of total)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number (% of total)</td>
<td>Number (% of total)</td>
<td></td>
</tr>
<tr>
<td>Applicants</td>
<td>7636 (17.4%)</td>
<td>1682 (11.3%)</td>
<td>375 (9.5%)</td>
</tr>
<tr>
<td>Matriculants</td>
<td>3220 (16.7%)</td>
<td>356 (6.5%)</td>
<td>13 (3.7%)</td>
</tr>
</tbody>
</table>

Note: All of these numbers may vary as categories change over different application cycles.
The WesternU MSMS Program

MSMS Admissions
MSMS Alumni Performance in WU-COMP
## MSMS Pre-DO Students

<table>
<thead>
<tr>
<th>Cohort</th>
<th>Total Applicants</th>
<th>MSMS Matriculants % Mission Fit</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSMS 2011</td>
<td>~100</td>
<td>12/19 (67%)</td>
</tr>
<tr>
<td>MSMS 2012</td>
<td>~150</td>
<td>12/25 (48%)</td>
</tr>
<tr>
<td>MSMS 2013</td>
<td>216</td>
<td>10/23 (44%)</td>
</tr>
<tr>
<td>MSMS 2014</td>
<td>283</td>
<td>15/20 (75%)</td>
</tr>
<tr>
<td>MSMS 2015</td>
<td>233</td>
<td>19/22 (86%)</td>
</tr>
<tr>
<td>MSMS 2016</td>
<td>266</td>
<td>17/19 (89%)</td>
</tr>
<tr>
<td>MSMS 2017</td>
<td>278</td>
<td>17/19 (89%)</td>
</tr>
</tbody>
</table>
In August 2009, only 4.12% of the total COMP student body (all 4 years) were URiM, the lowest of any of the 9 colleges at WesternU. By August 2015, that percentage had almost doubled, increasing to 8%.

<table>
<thead>
<tr>
<th>Entering DO Class</th>
<th># Incoming COMP URiM enrollment</th>
<th># URiMs matriculating from MSMS</th>
<th>% of total incoming URiM matriculants from MSMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>13</td>
<td>5</td>
<td>38%</td>
</tr>
<tr>
<td>2012</td>
<td>11</td>
<td>3</td>
<td>27%</td>
</tr>
<tr>
<td>2013</td>
<td>18</td>
<td>1</td>
<td>6%</td>
</tr>
<tr>
<td>2014</td>
<td>28</td>
<td>9</td>
<td>32%</td>
</tr>
<tr>
<td>2015</td>
<td>25</td>
<td>11</td>
<td>44%</td>
</tr>
<tr>
<td>2016</td>
<td>26</td>
<td>11</td>
<td>42%</td>
</tr>
</tbody>
</table>
### GPA / MCAT 18-20 21-23 24-26 27-29 30-32 33+ Totals

<table>
<thead>
<tr>
<th>GPA / MCAT</th>
<th>18-20</th>
<th>21-23</th>
<th>24-26</th>
<th>27-29</th>
<th>30-32</th>
<th>33+</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.80-4.00</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>3.60-3.79</td>
<td>2</td>
<td>1</td>
<td>6</td>
<td>1</td>
<td></td>
<td></td>
<td>10</td>
</tr>
<tr>
<td>3.40-3.59</td>
<td>1</td>
<td>7</td>
<td>7</td>
<td>4</td>
<td></td>
<td></td>
<td>19</td>
</tr>
<tr>
<td>3.20-3.39</td>
<td>3</td>
<td>8</td>
<td>8</td>
<td>9</td>
<td>3</td>
<td></td>
<td>31</td>
</tr>
<tr>
<td>3.00-3.19</td>
<td>2</td>
<td>5</td>
<td>7</td>
<td>3</td>
<td>5</td>
<td></td>
<td>22</td>
</tr>
<tr>
<td>2.80-2.99</td>
<td>1</td>
<td>10</td>
<td>10</td>
<td>4</td>
<td>1</td>
<td></td>
<td>26</td>
</tr>
<tr>
<td>2.60-2.79</td>
<td>2</td>
<td>9</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>18</td>
</tr>
<tr>
<td>2.40-2.59</td>
<td>1</td>
<td>5</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td>20</td>
</tr>
<tr>
<td>2.20-2.39</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>2.40-2.59</td>
<td>2</td>
<td>4</td>
<td>2</td>
<td></td>
<td>1</td>
<td></td>
<td>9</td>
</tr>
<tr>
<td>Totals</td>
<td>9</td>
<td>39</td>
<td>34</td>
<td>18</td>
<td>8</td>
<td>2</td>
<td>110</td>
</tr>
</tbody>
</table>

**A typical incoming pre-medical MSMS student**:

- MCAT between 21-26
- overall UG GPA between 3.0 and 3.4
- science GPA around 3.2

**Overall UG GPA**

**Science GPA**
Placement of MSMS Graduates

• To date, of 176 students, only 5 have not graduated from the MSMS program.
  o Of these, one started a PhD program in 2016 and two are attending foreign medical schools.

• **94% of MSMS graduates** have matriculated to a professional school (DO/MD, DMD/DDS, OD, PA)

• A total of **116 MSMS graduates** have matriculated to medical school, 109 at COMP
Performance in medical school is highly correlated (P < 0.001) with their MSMS program GPA

- Average program GPA for pre-DO is ~3.4
- Current program cut-off is an MSMS program GPA ≥ 3.1

Class rank after pre-clinical coursework;
DO Classes 2015 - 2019*
N = 82
MSMS Student Performance in COMP

Performance in medical school is not correlated (P = 0.71) with their (old) MCAT\(^1\)

Class rank after pre-clinical coursework; DO Classes 2015 - 2019*
N = 82
MSMS Alumni Residencies

Data from students in MSMS 2011 - 2013 cohorts (DO Classes of 2015-2017)

• 32 of 44 (72.7%) graduating MSMS students have gone into one of the primary care fields.
• 23 of the group matched into an ACGME or military residency
• 16 (36%) matched into their first choice residency
• An additional 14 (32% of total) matched into their top 3
• 6 (13%) were not initially matched and scrambled for placement
National Data

- URiMs take **longer to graduate**
  - 37% of students in 19 formal deceleration programs were URiM with the proportion of total URM students in these decelerated programs ranging from 0-43% (mean 10.5%)\(^2\)
  - AAMC data from the 1995 matriculating class showed that African-Americans had 4- and 10-year completion rates of 60.6% and 90.0% respectively\(^3\)
- **Attrition** for academic reasons is particularly prevalent amongst URiM students with AAMC data showing 6.7% attrition for African-American students, 3.4% attrition for Hispanic students compared to 0.9% for White students\(^3\)
MSMS Alumni Decelerations

- MSMS URiM alumni have taken longer to graduate
  - 22% of URiMs from the MSMS program have decelerated
    - 50% of African American (with 10% attrition)
    - 10.5% Hispanic and Pacific Islander (with no attrition)
  - Educational disadvantages can result in deceleration
    - 22% of non-URiM MSMS alumni have decelerated; many come from educationally disadvantaged backgrounds
URiMs and the Boards (USMLE)

• 49% of African-American examinees (1986-1988) failed Step 1 boards compared to 12% whites

• >90% ultimately pass

• 48.5% of students in a national cohort who failed their first attempt Step 1 were URiM

• Analysis of USMLE Step 1 first-time takers (n = 11,279) shows that the mean score was 210 ± 18 for white students, 187 ± 22 for African-American students and 196 ± 18 for Hispanic/Latino
MSMS Alumni and COMLEX Level 1

- 66 MSMS alumni have taken COMLEX Level 1 (DO Classes 2015 – 2018)
  - 24% were URiM
- Average score: 463 ± 73
- 14 students (21%) failed their first attempt; only 2 were URiM (both African-American)
URiMs and the Boards (COMP)

DO 2015 – DO 2017 classes 1st attempt COMLEX Level 1

- 7 URiM MSMS
- 38 non-URiM MSMS
- 36 other COMP URiM
- 515 non-MSMS non-URiM

% 1st time fail

Mean ± SEM
Data Driven Changes to the MSMS Program

MSMS Admissions
Curriculum Changes
## MSMS pre-DO students

<table>
<thead>
<tr>
<th>Cohort</th>
<th>Total Applicants</th>
<th>MSMS matriculants % Mission Fit</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSMS 2011</td>
<td>~100</td>
<td>12/19 (63%)</td>
</tr>
<tr>
<td>MSMS 2012</td>
<td>~150</td>
<td>12/25 (48%)</td>
</tr>
<tr>
<td>MSMS 2013</td>
<td>216</td>
<td>10/23 (44%)</td>
</tr>
</tbody>
</table>
2011-2013 MSMS Application and Selection

- MSMS 2011-2013 (cohorts 1-3) applicants self-identified as “disadvantaged” and provided an essay
- Service commitment and involvement was used for selection
- After cohort 3 (MSMS 2013) more objective selection criteria were used including federal assistance, and HPSA address
## MSMS pre-DO students

<table>
<thead>
<tr>
<th>Cohort</th>
<th>Total Applicants</th>
<th>MSMS matriculants % Mission Fit</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSMS 2011</td>
<td>~100</td>
<td>12/19 (63%)</td>
</tr>
<tr>
<td>MSMS 2012</td>
<td>~150</td>
<td>12/25 (48%)</td>
</tr>
<tr>
<td>MSMS 2013</td>
<td>216</td>
<td>10/23 (44%)</td>
</tr>
<tr>
<td>MSMS 2014</td>
<td>283</td>
<td>15/20 (75%)</td>
</tr>
<tr>
<td>MSMS 2015</td>
<td>233</td>
<td>19/22 (86%)</td>
</tr>
<tr>
<td>MSMS 2016</td>
<td>266</td>
<td>17/19 (86%)</td>
</tr>
<tr>
<td>MSMS 2017</td>
<td>278</td>
<td>17/19 (89%)</td>
</tr>
</tbody>
</table>
• A total of 55 students matriculated to COMP from cohorts 1-3 and **49%** were identified as URiM and/or mission fit

• From MSMS 2014-2016, 54 students matriculated to COMP and **87%** were objectively identified as URiM and/or mission fit

• **Short term MSMS goal met:** to assist individuals from diverse backgrounds in gaining acceptance to professional schools
Data Driven Changes to MSMS Curriculum

- Intrusive advising and success plans (MSMS 2016)
- Expanded use of Osmosis (MSMS 2017)
- Longitudinal, cumulative exams (MSMS 2017)
- Physiology course added as requirement (MSMS 2017)
- Team-based learning (MSMS 2016)
- Using research to increase critical thinking skills (MSMS 2016)
MSMS Student Performance in COMP

![Graph showing the relationship between MSMS Program GPA and Relative COMP Class Rank (preclinical course work). The graph includes a regression line and an $R^2$ value of 0.5097.](image-url)
Data Driven Changes to MSMS Curriculum

- Intrusive advising and success plans (MSMS 2016)
- Expanded use of Osmosis (MSMS 2017)
- Longitudinal, cumulative exams (MSMS 2017)
- Physiology course added as requirement (MSMS 2017)
- Team-based learning (MSMS 2016)
- Using research to increase critical thinking skills (MSMS 2016)
• MSMS performance correlates with relative rank in medical school.
• Medical school performance correlates with performance on the COMLEX Level 1
• However, MSMS graduates consistently underperform on the COMLEX Level 1
Data Driven Changes to MSMS Curriculum

- Intrusive advising and success plans (MSMS 2016)
- Required use of Osmosis (MSMS 2017)
- Longitudinal, cumulative exams (MSMS 2017)
- Physiology course added as requirement (MSMS 2017)
- Team-based learning (MSMS 2016)
- Using research to increase critical thinking skills (MSMS 2016)
Performance by Semester (Pre-Clinical)

Performance relative to peers decreases after 1st semester:

- 1st semester: Anatomy, Cell, Molecular and Biochemistry
- 2nd semester: Microbiology, some Immunology

<table>
<thead>
<tr>
<th>Class Rank</th>
<th>N</th>
<th>1st sem rank</th>
<th>1st yr rank</th>
<th>preclinical rank</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>106</td>
<td>81</td>
<td>81</td>
</tr>
</tbody>
</table>

N: Number of students
Data Driven Changes to MSMS Curriculum

- Intrusive advising and success plans (MSMS 2016)
- Expanded use of Osmosis (MSMS 2017)
- Longitudinal, cumulative exams (MSMS 2017)
- Physiology course added as requirement (MSMS 2017)
- Small group learning (MSMS 2016)
- Using research to increase critical thinking skills (MSMS 2016)
Summary

• Changes have improved selection and admission of mission-fit students, thus meeting the goal of increasing diversity at WesternU-COMP

• Data indicates that performance of MSMS graduates in COMP is similar to comparative cohorts nationwide

• Changes have been implemented to improve longitudinal learning and critical thinking skills
References

1. Goode CA and Talbot, C, J Best Pract Health Prof Divers 2016, 9:1198
2. McGrath, B and McQuail, D., Medical Teacher 2004, 26:6, 510
3. AAMC AIB 2007;7(2)
This program would not be considered a traditional grade enhancement program

<table>
<thead>
<tr>
<th></th>
<th>Average Program GPA</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>All premedical MSMS graduates 2010-2015</td>
<td>3.40 ± 0.21 (118)</td>
<td>2.65 - 3.97</td>
</tr>
<tr>
<td>Premedical MSMS graduates (mission fit)</td>
<td>3.44 ± 0.22 (82)</td>
<td>2.65 - 3.97</td>
</tr>
<tr>
<td>Premedical MSMS graduates (not mission fit)</td>
<td>3.33 ± 0.18 (36)</td>
<td>2.86 - 3.76</td>
</tr>
</tbody>
</table>

GPA for courses (2010-2016) – remediation grades are not included

<table>
<thead>
<tr>
<th>ISAC</th>
<th>MCBL</th>
<th>PBS</th>
<th>Micro</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.04 ± 0.51</td>
<td>2.91 ± 0.47</td>
<td>3.05 ± 0.51</td>
<td>2.95 ± 0.47</td>
</tr>
</tbody>
</table>
National Data Decelerations

• URiMs take longer to graduate
  o 25% of URiMs take more than 4 years to graduate compared to 10% of non-URiMs
  o Educational disadvantages can result in increasing time to graduation due to deceleration

• Attrition for academic reasons is particularly prevalent amongst URiM students with data showing 6.7% attrition for African-American students, 3.4% attrition for Hispanic students compared to 0.9% for White students