Applying Sabermetrics to Academic Otolaryngology

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ABSTRACT

Outcome Objective: Over the past two decades, statisticians have used sabermetrics to predict success of athletes. Using similar principles, we aim to 1) determine baseline publication metrics among academic otolaryngologists 2) determine whether an otolaryngologist’s training predicts academic productivity.

Methods: Publicly available data from departmental websites and Scopus were collected on 1,588 academic otolaryngologists from 99 departments across the United States. Variables included gender, medical school, Alpha Omega Alpha (AOA) membership, PhD degree, residency program, fellowship, number of publications, NIH grants, H-index, region of practice, and professorial rank. Bivariable and multivariable regression analyses were used to predict H-index, professorship, and NIH funding.

Results: Mean number of publications, H-index, and M-index were 40.6 (standard deviation [SD] = 50.7), 18.1 (SD = 19.4), and 0.57 (SD=0.38), respectively. In multivariable analysis, stronger predictors of higher H-index included NIH funding, greater number of years since graduation and higher number of publications (p < 0.0001). Gender, region of practice, medical school type, and AOA were not significant predictors of higher H-index. Predictors of attainment of professorship included region of practice (Pacific [p=0.007] and Southern [p=0.012]), fellowship training (p=0.001), greater number of years since graduation (p<0.0001), PhD degree (p=0.041), AOA (p<0.0001) and higher H-index (p=0.0001). Medical school type and gender did not predict professorship. NIH funding was associated with PhD degree and higher H-index (p<0.0001).

Conclusion: Similar to athletes, physicians have a multitude of quantifiable “stats.” We find several notable predictive factors for academic productivity. These bibliometric data may be readily used as benchmarks for academic otolaryngologists.

INTRODUCTION

• In the 1970’s, an American sports writer and historian named Bill James collected statistical data on baseball players to scientifically analyze a team’s chances of winning or losing. This practice, which he coined sabermetrics, is commonly used today by coaches and sports managers across the United States.

• In academic medicine, career advancement is based on several factors, including clinical volume, advanced training, research productivity, and acquisition of funding.

• Using such data points, sabermetrics principles could be applied to objectively predict success amongst academic faculty.

METHODS

• A list of U.S. Otolaryngology programs was compiled from the Electronic Residency Application Service (ERAS).

• Faculty members were identified from each department’s website as of July 2014. Publicly available data was collected on each faculty member using department websites, state registries, and Scopus database of peer-reviewed literature (Elsevier). The following independent variables were obtained: gender, medical school type, AOA membership, PhD Degree, Residency Program, Fellowship-trained, NIH Grant Recipient, Region of Practice, Number of Publications, H-index*, M-index*, and Professor Rank

• Statistical analysis including bivariable and multivariable regression were performed to determine predictive value of the determined measures.

RESULTS

A. Population Metrics

• Information was collected on 1,588 academic Otolaryngologists from 99 departments across the United States.

Table 1: Demographic characteristics of academic Otolaryngologists

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Gender</th>
<th>Years since medical school graduation (Mean)</th>
<th>Type of Medical School</th>
<th>Fellowship</th>
<th>PhD Degree</th>
<th>AOA Membership</th>
<th>Total Publications</th>
<th>Total Scopus H-index</th>
<th>Total Scopus M-index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>Female</td>
<td>20.1%</td>
<td>Foreign</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>22.0%</td>
<td>18.1 (SD = 19.4)</td>
<td>0.57 (SD=0.38)</td>
</tr>
</tbody>
</table>

B. Geographic Distribution

Figure 1: Geographic distribution of academic Otolaryngologists, showing right-skewed distribution

Table 2: Mean and Quartile (Q) ranges for publication data of academic Otolaryngologists

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Quartile 1</th>
<th>Q2</th>
<th>Quartile 3</th>
<th>Q4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Publications</td>
<td>46.6</td>
<td>9.0</td>
<td>22.5</td>
<td>54.6</td>
</tr>
<tr>
<td>H-index</td>
<td>18.1</td>
<td>5.8</td>
<td>9.16</td>
<td>17.56</td>
</tr>
<tr>
<td>M-index</td>
<td>0.57</td>
<td>0.16</td>
<td>0.83</td>
<td>0.86</td>
</tr>
</tbody>
</table>

C. Publications Metrics

Figure 2: Frequency distribution curve of academic Otolaryngologists by H-index, showing right-skewed distribution

Table 3: Bivariable comparison of faculty characteristics, analyzed by Assistant or Associate Professor vs. Professor.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Assistant/Associate Professor</th>
<th>Professor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>Number of Publications</td>
<td>0.58</td>
<td>0.57</td>
</tr>
<tr>
<td>Total Scopus H-index</td>
<td>11.2 (3.9)</td>
<td>10.4 (9.2)</td>
</tr>
</tbody>
</table>

D. Multivariable Regression Analysis

Table 4: Multivariable Regression Analysis of H-index and Professorship. Statistically significant values are in grey

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>B (SE)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>Female</td>
<td>0.11</td>
</tr>
<tr>
<td>Age (years)</td>
<td>Female</td>
<td>0.89</td>
</tr>
<tr>
<td>H-index</td>
<td>0.61</td>
<td></td>
</tr>
</tbody>
</table>

DISCUSSION and CONCLUSIONS

• Physicians generate significant amounts of data that can be analyzed to reveal important predictors of academic productivity.

• While certain factors are associated with H-index and obtaining professorship on bivariable analysis, these do not always hold true in multivariable analysis.

• “Sabermetric”-type approaches can be used to establish interesting predictive models that may have implications for hiring and tenure status of academic Otolaryngologists.

• This is a preliminary study, and future research is needed to better delineate these factors.

REFERENCES


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• NIH Grant (> 1)

• Scopus H-


• Schumaker RP, Soliman OK, Chen H. Sports Knowledge Management and Data Mining. (2010)

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• http://projectreporter.nih.gov/reporter.cfm

• http://www.alphabeticagroup.org

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