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Bootstrapping to evaluate accuracy of citation-based journal indicators

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Motivation

Despite criticism, ranking indicators are in demand. Essential to provide estimates of indicator accuracy, robustness, stability and confidence.

This study uses bootstrapping to test the stability of citation-based journal indicators - recent as well as traditional.

Data

All clinical medicine records in WoS 2012:
34 NSF specialties -> 2,699 journals -> 362,556 records.

2-year citation window
c = raw citations
s = relative citations (specialty standardised)

Figure 1: Mean raw citations per journal (data points) and bootstrapped stability intervals for dentistry journals.

Result: Bootstrapping identifies outlying scores. Stability intervals show the effect individual papers have on journal performance.

Figure 2: Standard deviation of standardised indicator scores per journal.

Result: Percentile-based indicators outperform mean- and median-based indicators with respect to stability. Median-based indicators perform worse than mean-based.

Table 1: Mean indicator values and standard deviations for all journals (“All”) and journals publishing 50 or more papers (“≥50”).

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Raw</th>
<th>Standardised</th>
</tr>
</thead>
<tbody>
<tr>
<td>μc</td>
<td>2.321</td>
<td>3.897</td>
</tr>
<tr>
<td>Ms</td>
<td>1.477</td>
<td>2.278</td>
</tr>
<tr>
<td>μs</td>
<td>0.835</td>
<td>1.107</td>
</tr>
<tr>
<td>Ms</td>
<td>1.477</td>
<td>2.278</td>
</tr>
<tr>
<td>ND10</td>
<td>0.081</td>
<td>0.131</td>
</tr>
<tr>
<td>NSD10</td>
<td>0.078</td>
<td>0.119</td>
</tr>
</tbody>
</table>

All journals have larger variance than N>50 journals.

Indicators

μc and μs mean raw and relative citations per paper.
Mc and Ms median raw and relative citations per paper.
ND10 and NSD10 top decile ratio of raw and relative citations.

Methods

Bootstrapping: Each sample (journal) is resampled 1,000 times, allowing calculation of stability data (95% confidence intervals).

Standardised (mean normalised) indicator scores used for comparison.

Results

See figure- and table-legends.

Further research

Additional indicators and specialty variations.