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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)

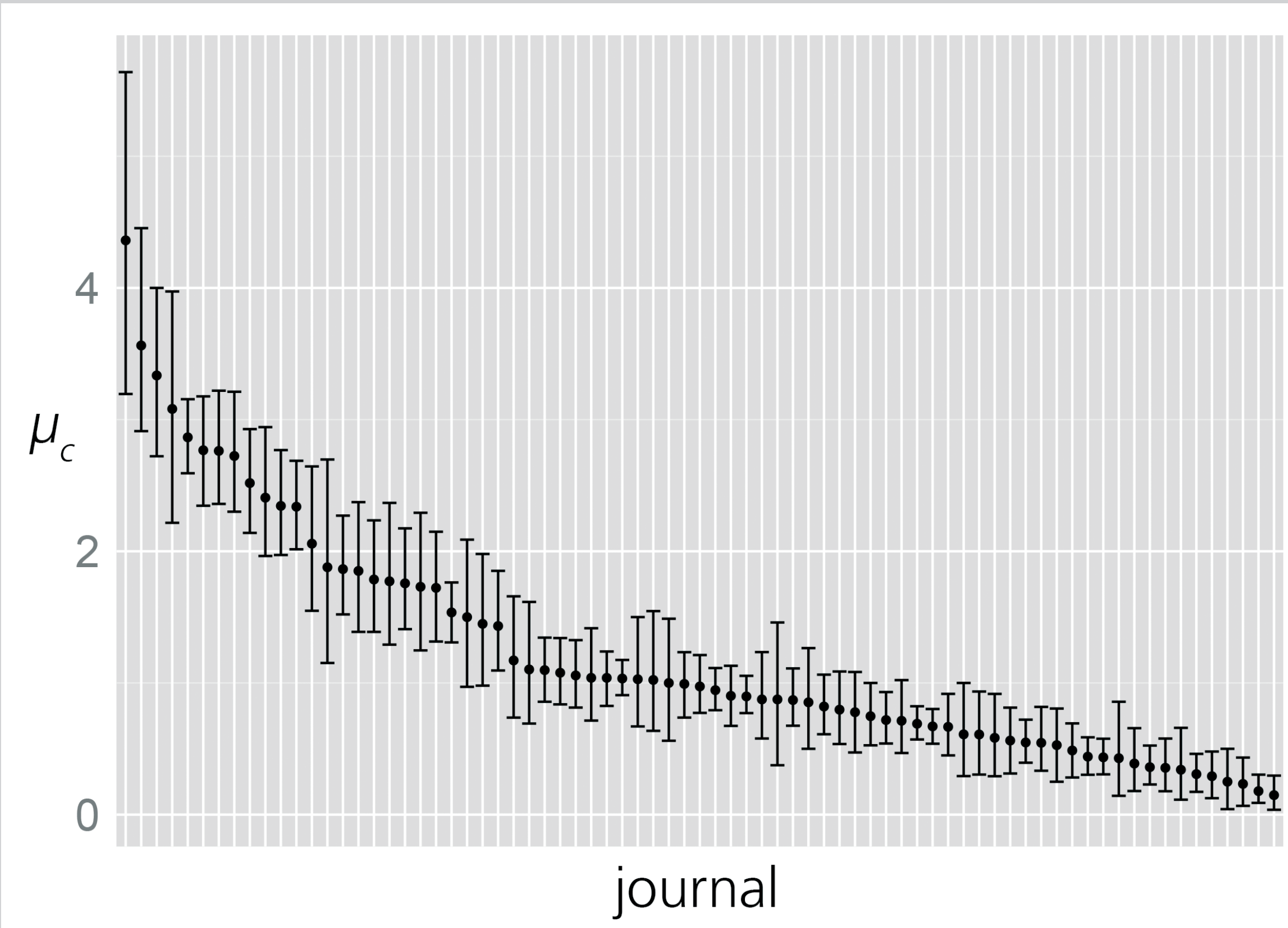


Figure 1: Mean raw citations per journal (data points) and bootstrapped stability intervals for dentistry journals.
Result: Bootstrapping identifies outlying scores. Stability intervals show the effect individual papers have on journal performance.

Indicator	All				≥50	
	Raw		Standardised		mean	SD
	mean	SD	mean	SD		
μ _c	2.321	3.897	1.000	1.679	1.052	1.261
M _c	1.477	2.278	1.000	1.543	1.079	1.471
μ _s	.835	1.107	1.000	1.326	1.053	1.076
M _s	.520	.717	1.000	1.381	1.075	1.297
N _{D10}	.081	.131	1.000	1.625	1.107	1.640
N _{SD10}	.078	.119	1.000	1.536	1.090	1.513

Table 1: Mean indicator values and standard deviations for all journals ("All") and journals publishing 50 or more papers ("≥50").
Result: All indicators are sensitive to sample sizes. N<50 journals have larger variance than N>50 journals.

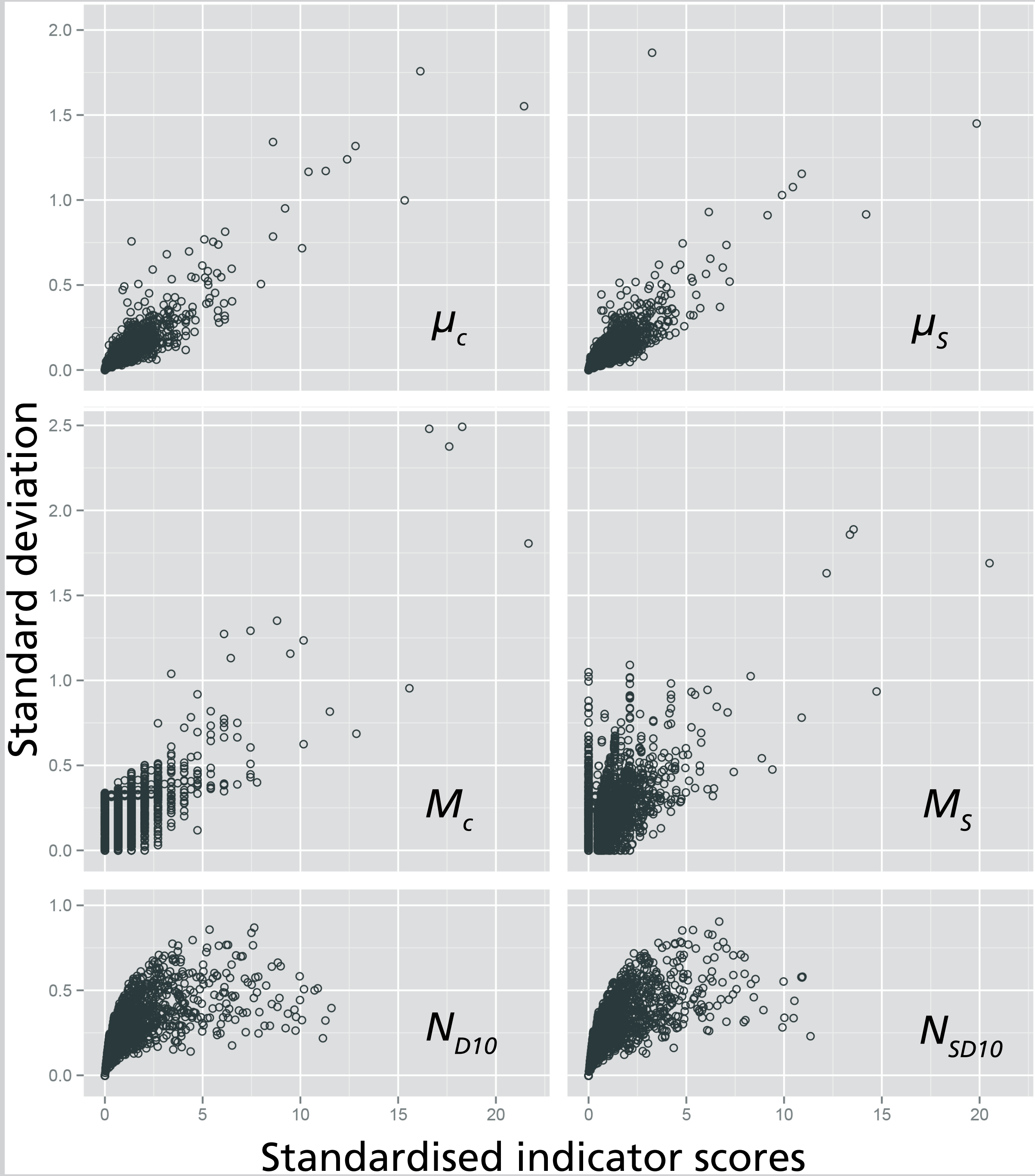


Figure 2: Standard deviation of standardised indicator scores per journal.
Result: Percentile-based indicators outperform mean- and median-based indicators with respect to stability. Median-based indicators perform worse than mean-based.

Indicators

- μ_c and μ_s mean raw and relative citations per paper.
- M_c and M_s median raw and relative citations per paper.
- N_{D10} and N_{SD10} 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.