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Characterizing the Scholarly Impact of Cardiothoracic Surgical Research Using the National Institutes of Health Relative Citation Ratio: An Analysis of 992 Surgeons and 46,153 Publications

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INTRODUCTION

- Scholarly impact has traditionally been assessed by journal impact factor, career publication count, total citation count, or H-index (the maximum value *h* such that a researcher has *h* publications each with at least *h* citations).
- Traditional metrics do not account for inherent differences in research subject and are often biased by a researcher's career duration.
- **The National Institutes of Health (NIH) recently developed the relative citation ratio (RCR), calculated as citations for a given article benchmarked to NIH-funded publications in the same field and published during the same time period** (Hutchins et al, *PLoS Biol* 2016).

AIM

- Characterize the scholarly impact of academic cardiothoracic (CT) surgeons and their research using the RCR metric.

METHODS

- Using a database of academic CT surgeons on faculty at accredited U.S. CT surgery training hospitals (Wang et al, *Ann Thorac Surg* 2020), RCR was calculated using the publicly-available NIH iCite database for all 46,153 distinct articles published by 992 CT surgeons since 1980, the earliest year included in the iCite database.
- **RCR 1.0 for a given publication indicates equal impact compared to an NIH-funded publication in the same field, while RCR 2.0 represents twice the impact.**
- Professional history, publications, and NIH funding were recorded from publicly-available online sources.
- Data were analyzed using the Mann-Whitney or Kruskal-Wallis test, with $p<0.05$ indicating statistical significance.

RESULTS

RCR at nth percentile:	99.9	99	95	90	80	70	60	50	40	30	20	10
Publications by CT surgeons	46.5	12.6	5.0	3.3	2.0	1.4	1.0	0.7	0.5	0.3	0.2	0.0
Publications by Cardiac Surgeons	52.2	12.7	5.0	3.3	2.0	1.3	1.0	0.7	0.5	0.3	0.2	0.0
Publications by Thoracic Surgeons	44.9	14.3	5.7	3.8	2.3	1.6	1.1	0.8	0.6	0.4	0.2	0.1
Publications by Congenital Surgeons	27.9	9.3	4.2	2.9	1.9	1.3	1.0	0.7	0.5	0.3	0.2	0.0

Table 1. Relative citation ratio (RCR) among 46,153 distinct articles published by cardiothoracic (CT) surgeons is presented at various percentile ranks, with an overall median RCR of 0.7. Sub-analysis is performed by subspecialty type.

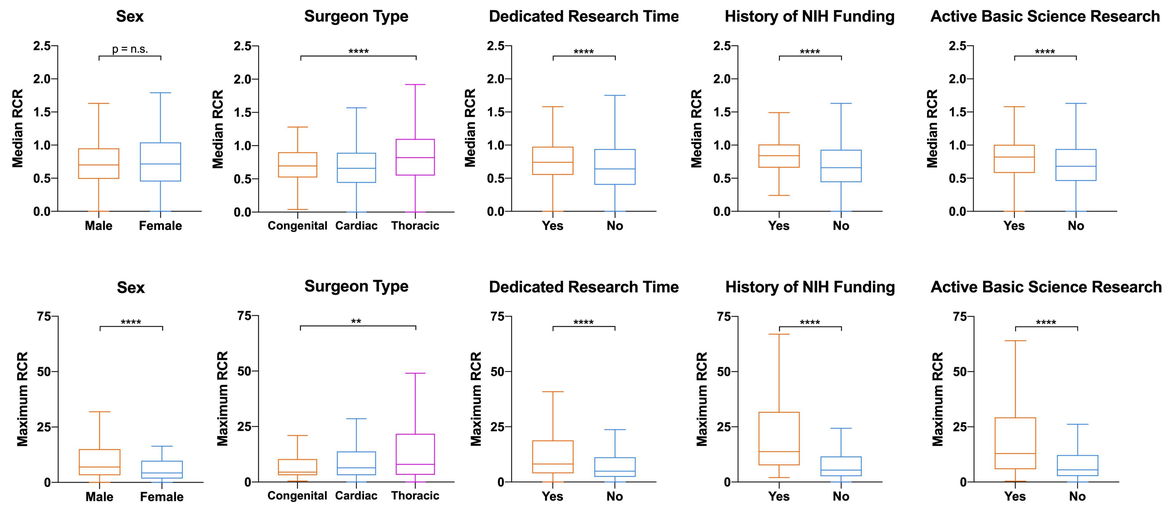

Figure 1. Median and maximum relative citation ratio (RCR) may differ significantly by a surgeon's sex, subspecialty, research training, history of NIH funding, and type of research pursued. Boxes represent interquartile range, and middle lines represent median. ** indicates $p<0.01$, **** indicates $p<0.0001$, n.s. indicates not statistically significant.

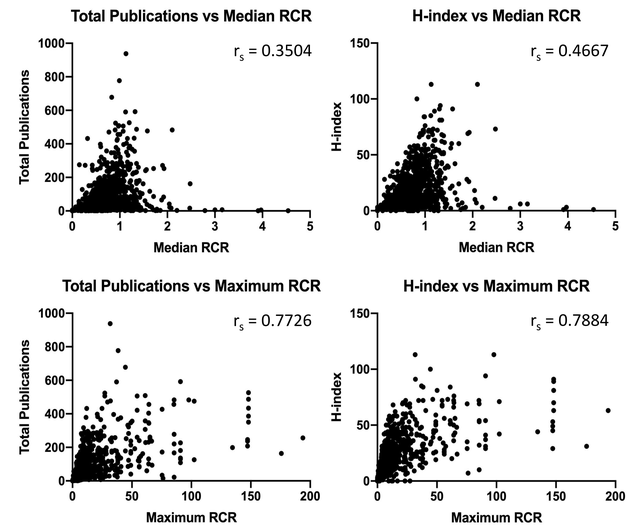

Figure 2. Median and maximum relative citation ratio (RCR) represent distinct metrics of research impact compared to total publications and H-index. r_s indicates Spearman correlation.

CONCLUSIONS

- **The NIH-supported RCR is a powerful article-level and field-normalized metric for evaluating the scholarly impact of CT surgery research.**
- **RCR provides a new perspective on research impact that is distinct from both career publication count and H-index.**
- **Thoracic surgeons, surgeon scientists actively engaged in basic science research, and those with dedicated research training and a history of NIH funding exhibited research with greater impact. Women have a similar median RCR but lower maximum RCR than men, revealing a disparity in high-impact research output.**

REFERENCES

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