

ACR2022
WASHINGTON, DC
April 24-27

American College of Radiology Appropriateness Criteria®: A Bibliometric Analysis of Panel Members



Yale University
School of Medicine



JOHNS HOPKINS
MEDICINE



BROWN
Alpert Medical School



UNIVERSITY
of MARYLAND
SCHOOL OF MEDICINE



Authors

Suryansh Bajaj, MD¹; Tushar Garg, MD²; Bhavya Pahwa³; Mihir Khunte⁴; Dheeraj Gandhi, MD⁵; Ajay Malhotra, MD¹

Affiliations

1. Division of Neuroradiology, Yale School of Medicine, New Haven, CT, USA
2. Division of Vascular and Interventional Radiology, Russell H. Morgan Department of Radiology and Radiological Science, Johns Hopkins School of Medicine, Baltimore, MD, USA
3. University College of Medical Sciences, New Delhi, India
4. Warren Alpert Medical School of Brown University, Providence, Rhode Island, USA
5. Division of Interventional Neuroradiology, University of Maryland, Baltimore, USA



Background

- **The ACR-Appropriateness Criteria (ACR-AC) are currently the most comprehensive national guidelines that aim to guide the providers to use the imaging modalities in the most appropriate and judicious manner and avoid inappropriate utilization of radiological imaging.**
- **The ACR-AC are developed and reviewed by “expert panels with leaders in radiology and other specialties”. The methodology relies on combination of evidence, and, when the data from scientific and technology assessment studies are insufficient, “expert consensus”.**

Purpose

- **Given the importance of ACR-AC in regulatory compliance and clinical decision-making, the aim of this study was to assess the research expertise of panel members involved in the formation of the ACR-AC by looking at their past research productivity and topic-specific publications.**

Methods



We conducted a cross-sectional analysis of all the ACR-AC published in 2021, that included a total of 18 new and 13 revised topics were added to the ACR-AC.



We searched the PubMed database to record the total number of papers (P), the total number of ACR-AC papers (C), the total number of first and non-first author papers relevant to the ACR-AC topic (R) for each listed author in the ACR-AC document. Keywords were systematically selected to search the previously published papers relevant to the ACR-AC topic by including the keywords from the ACR-AC document as well as from all the clinical variants described in the respective AC paper.

Methods

Categorical measures were summarized using rates and/or counts.

Number of papers was analyzed using median and interquartile range as the data was found to be not distributed normally based on the Shapiro Wilk Normality test.

The proportions were calculated by dividing the total number of ACR-AC papers and relevant papers to the total number of papers found on PubMed database for each author.

Logistic regression was used to calculate the normal 95% confidence intervals for each demographic group. Differences between two groups (≥ 5 ACR-AC papers, <5 ACR AC papers) were evaluated using the students t-test.

Univariate followed by multivariate linear regression models were used to identify and confirm correlations and predictive factors for the total number of ACR-AC papers by each unique author.

Results



A total of 34 ACR-AC published in 2021 were included in the study with a total panel strength of 602 members that included 383 different panel members.



The panel strength ranged from the lowest of 12 members to the highest of 22 members with a median strength of 17 members per panel.

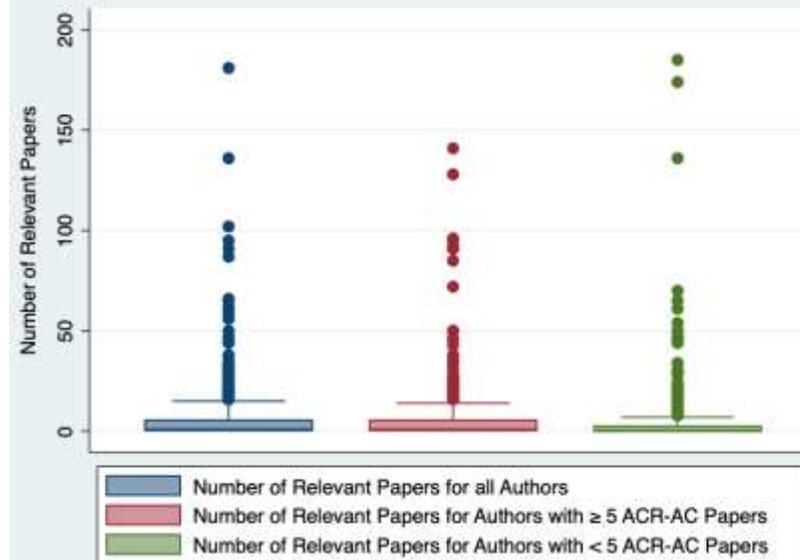
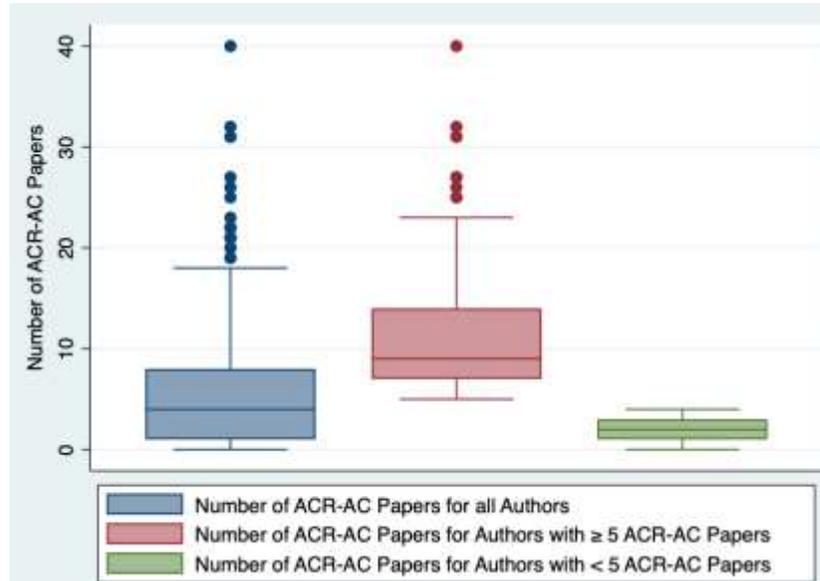


The median total number of PubMed indexed publications for the cohort was found to be 45 (IQR: 24-97, range: 3-359), ACR-AC papers was 4 (IQR: 2-9, range: 1-27) and previously published papers relevant to the ACR-AC topic was 1 (IQR: 0-5, range: 0-96).

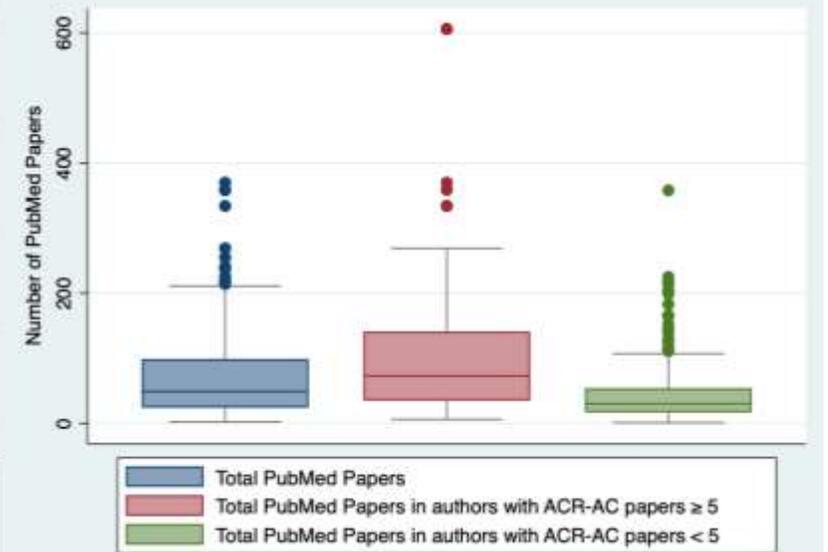
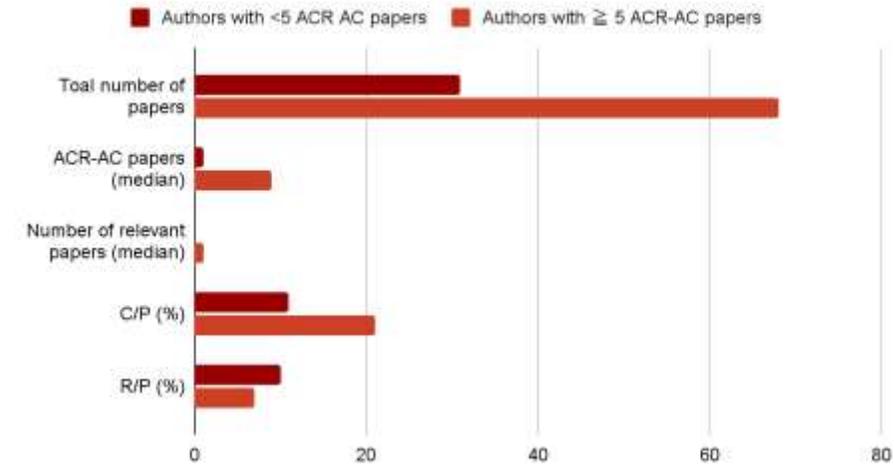
- 
- **68 (17.5%) panel members out of 383 had ≥ 10 previously published ACR-AC papers and 154 (40%) had ≥ 5 published ACR-AC papers.**
 - **44% of the panel members had no previously published paper relevant to the ACR-AC topic.**
 - **16 panels out of 34 (47%) had zero median number of relevant papers with 6 panels (17.6%) having ≥ 5 median number of relevant and 2 (6%) having ≥ 10 median number of relevant papers.**
 - **15 panels (44%) had $>50\%$ of members having zero relevant papers. 10 panels (29.4%) had $<10\%$ of members having ≥ 5 relevant papers and 5 (14.7%) with 0 members having ≥ 5 relevant papers and only 9 panels (26.5%) had $>50\%$ of members having ≥ 5 relevant**

When compared to authors with <5 ACR AC papers (229/374, 60%), authors with ≥ 5 ACR-AC papers (154/374, 40%) had:

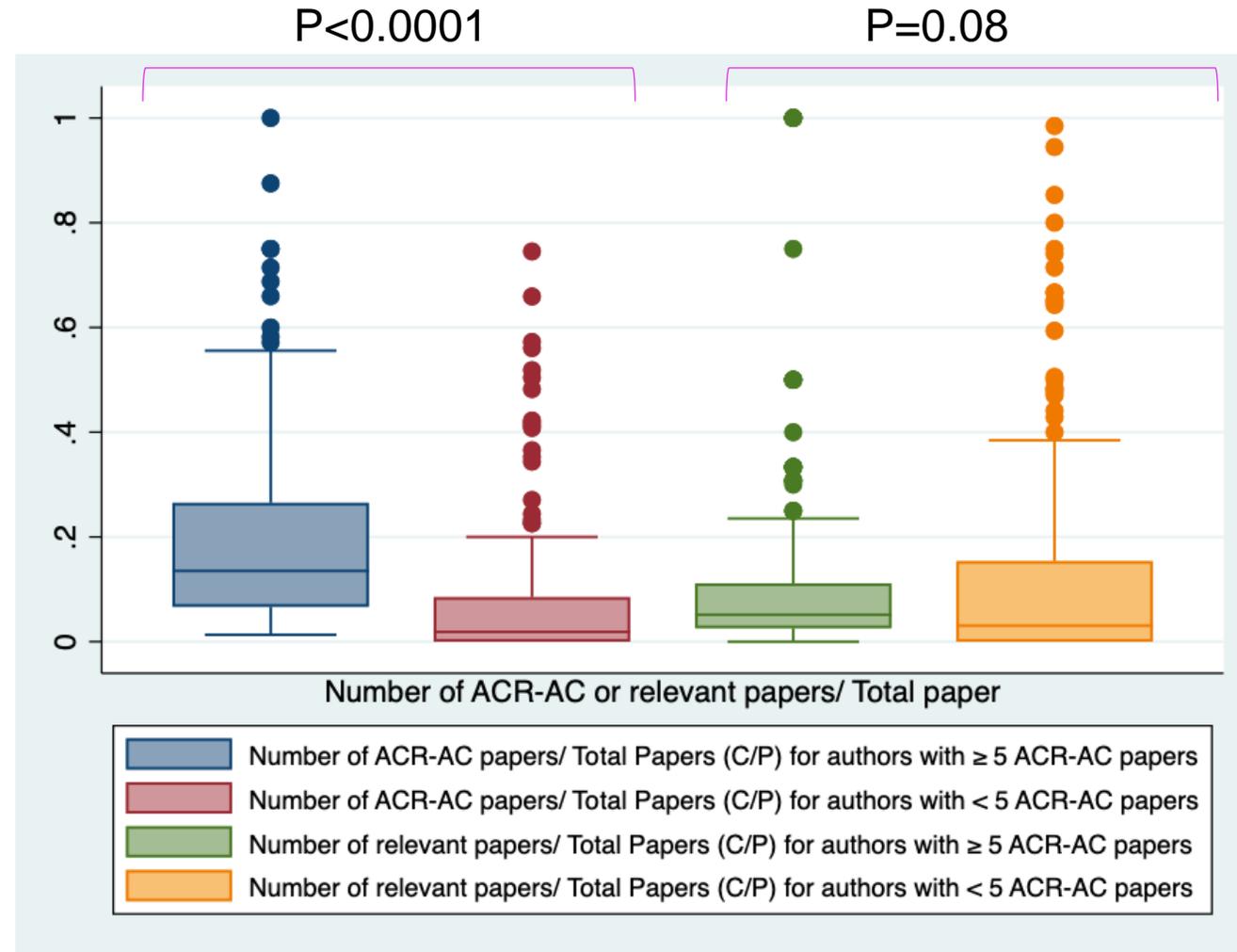
- Higher number of total papers (68, IQR: 36-138, vs 31 IQR: 17-61.5)
- Higher number of ACR-AC papers (9 IQR: 7-14 vs 1 IQR: 1-2)
- Higher number of relevant papers (1, IQR: 0-6 vs 0, IQR: 1-2).



Points scored



- The proportion of total ACR-AC papers by each author to the total number of papers by the author (C/P) was 0.16 (95%CI = 0.15-0.18) and the proportion of relevant papers by the author to the total number of papers (R/P) was 0.08 (95%CI: 0.07-0.10).
- The proportion of the ACR-AC papers (C/P) was higher for authors with ≥ 5 ACR-AC papers (0.21, CI: 0.18-0.24) than authors with < 5 ACR-AC papers (0.11, CI: 0.08-0.13, $p < 0.0001$), however, the proportion of relevant papers per topic (R/P) was higher for authors with < 5 ACR-AC papers (0.10, CI: 0.08-0.12) than authors with ≥ 5 ACR-AC papers (0.07, CI: 0.06-0.09), although this difference was not statistically significant ($p=0.08$).



- 
- **The ACR-AC documents constitute a 16% of the experts' total publications while the relevant publications accounted for 8% of their prior research output.**
 - **These results are further polarized with the experts on more than 5 panels having a higher proportion of ACR-AC publications (21% vs 11%, $p < 0.001$) but a lower proportion of relevant papers (7% vs 10%, $p = 0.08$) than their counterparts on less than 5 panels.**
 - **While the univariate analysis showed a significant association of the total number of previously published papers ($p = 0.0001$) and the number of relevant papers ($p = 0.011$) with the total number of ACR-AC papers, on multivariate linear regression, only the total number of previously published papers had a significant and independent association ($p = 0.0001$).**



Discussion

- **The methodology for creating the ACR-AC is based on the RAND/UCLA guidelines that involve rating the appropriateness of the use of imaging in predefined clinical variants using modified Delphi rounds to reach a consensus recommendation and emphasizes the importance of having diverse panels with members having specific expertise in different aspects of the assigned topic.**
- **These results show that a similar pool of experts is serving on multiple panels which may be a potential source of bias in the development of the AC. Presence of the same providers on different panels can limit the scope of inclusivity of different opinions and judgments, thereby leading to a potential bias.**

Future directions:



In addition to selecting panel members based on their society affiliations or administrative positions, it may be prudent for ACR to consider prior contributions to the specific topic assigned to the panels.



RAND-UCLA criteria recommend that the search strategy used should be documented in the final report to help the reader judge if the literature review is based on adequate body of evidence, this information is not generally included in the ACR-AC. The questionnaire used for the Delphi method iterative process is also recommended to be made public.

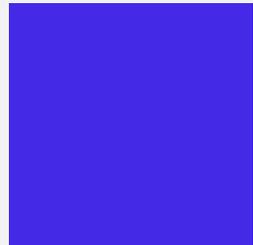


We find that a significant proportion of studies used as evidence are from cohort studies or case series. High-quality systematic reviews, if available, may also be included in the future.

Future directions:



Much of radiology scientific literature focuses on imaging efficacy (imaging acquisition and diagnostic accuracy) and not on effectiveness (patient outcomes and quality of life). Although beyond the scope of this study, we found that ACR-AC often have not even considered or mentioned studies focusing on eventual health outcomes or ultimate societal benefit.



Although not used for defining appropriateness, it may be prudent to at least briefly discuss the relevant cost-analyses given the use of these criteria for regulatory purposes with the intent of reducing low-value imaging.

Conclusion

- **The ACR-AC area helpful aid for physicians to optimize the use of imaging in different clinical scenarios.**
- **The importance of ACR-AC cannot be understated given their national implementation under the medical appropriateness use criteria program.**
- **Our study reviewed the panel composition and provides baseline data that may be useful in building future panel of experts and improving transparency.**