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Conference Paper — Published Version

Altmetrics for German medical research: what leads to research articles achieving policy impact?

Suggested Citation: Lemke, Steffen; Witthake, Anne; Peters, Isabella (2022) : Altmetrics for German medical research: what leads to research articles achieving policy impact?, In: Robinson-Garcia, Nicolas Torres-Salinas, Daniel Arroyo-Machado, Wenceslao (Ed.): Proceedings of the 26th International Conference on Science, Technology and Innovation Indicators (STI 2022), University of Granada, Granada,
https://doi.org/10.5281/zenodo.6912582

This Version is available at:
http://hdl.handle.net/11108/530

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OPEN ACCESS

Citation: Lemke, S., Witthake, A., & Peters, I. (2022). Altmetrics for German medical research: what leads to research articles achieving policy impact?. In N. Robinson-Garcia, D. Torres-Salinas, & W. Arroyo-Machado (Eds.), *26th International Conference on Science and Technology Indicators*, STI 2022 (sti2253). https://doi.org/10.5281/zenodo.6912583

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Altmetrics for German medical research: what leads to research articles achieving policy impact? [1]

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Introduction

For biomedical researchers in Germany, the generally much-debated application of journal-level impact metrics in the evaluation of research productivity often has a particular significance. After all, performance-based allocation of funds has for years been common practice at German medical faculties across the board, often to substantial degrees reverting to journal impact factors to determine the quality of authored publications (Herrmann-Lingen et al., 2014; Krempkow & Schulz, 2012). Many arguments regularly brought up against using impact factors for such micro-level assessments are not medicine-specific and have in recent years been described extensively, e.g., in the *DORA San Francisco Declaration on Research Assessment* (Cagan, 2013) or *Leiden Manifesto* (Hicks et al., 2015). However, there might be further arguments specifically applying to medical science that militate against the use of citation-based metrics for evaluation exercises in this field. For instance, several case studies suggest citation advantages for basic medical research (i.e., studies of basic systems and functions) compared to clinical studies (e.g., clinical trials; Donner & Schmoch, 2020; Ke, 2020; van Eck et al., 2013), which would put certain institutions at a disadvantage due to their individual research focus. In this light, the potential of altmetrics to mitigate such complications related to the use of citation-based indicators is of great interest for the domain of medical research.

An altmetric indicator of particular interest in this regard are mentions of research publications within policy documents, due to their potential use in target-oriented impact measurement (Tahamtan & Bornmann, 2020). Medical guidelines like those published by the *AHRQ*[2], *NICE*[3], or *AWMF*[4] constitute a specific case of such policy documents, and references to research articles within such guidelines could represent an expression of the practical relevance of the

[1] This work is part of project *QuaMedFo*, funded by the German Federal Ministry for Education and Research (grant number 01PU17011D). We thank the German Competence Centre for Bibliometrics (http://www.forschungsinfo.de/Bibliometrie/en/index.php) as well as Altmetric.com (https://altmetric.com) for providing access to bibliometric and altmetric data respectively. We also thank Nicholas Fraser for his contributions to data collection, cleansing, and enrichment.

[2] https://www.ahrq.gov/

[3] https://www.nice.org.uk/

[4] https://www.awmf.org/

cited research, which is otherwise difficult to measure. Furthermore, analyses by Fraser, Bräuer, & Peters (2021) indicate that policy documents might be particularly suitable to highlight especially relevant clinical research, which is typically less well represented in citation-based evaluations. Pallari et al. (2021) recently came to similar conclusions by examining references within lung cancer clinical practice guidelines, finding that they particularly frequently cite research that includes clinical trials and treatments.

This research in progress continues the path of Fraser et al. (2021) by investigating the potential of mentions within policy documents to complement the evaluation of medical research in Germany. More specifically, we aim to characterize recent medical research referenced in policy documents by comparing it with similar research from the same time that did not receive such mentions. Furthermore, we apply a machine learning-based approach to quantitatively assess whether policy documents indeed favour clinical research, as first network-based analyses by Fraser et al. (2021) suggested.

Methods and Data

A list of 5,007 ISSNs and titles indexed in MEDLINE was matched with data from Web of Science[5] (WoS). We excluded all journals categorized as "multidisciplinary sciences", leaving us with 4,442 non-multidisciplinary MEDLINE journals also indexed in WoS.

For these journals we obtained metadata of all articles of either WoS type "article" or "review" that were published between 2012 and 2018, and which involved at least one author affiliated with a research institution from Germany. In total, 334,940 articles fulfilled these criteria.

To determine whether articles had been referenced in policy documents, we queried Altmetric.com for the DOIs of these 334,940 articles, finding that 7,838 (2.34%) articles had received at least one policy document citation. With the explorative goal of finding which specific properties of articles might be associated with higher probabilities of being referenced in policy documents, we compare these 7,838 articles' metadata statistically to those of the parent population of 334,940 articles.

To quantitatively evaluate how frequently which translational stages of medical research get referenced in policy documents, we build on publication metadata labelled by Major, Surkis, & Aphinyanaphongs (2018). Using word2vec, Major et al. (2018) trained word embeddings on MEDLINE abstracts to predict articles' affiliation to one of three translational stages, ranging from stage 1 (i.e., fundamental/basic research) to stage 3 (i.e., larger late-stage clinical trials and population level studies). We used the word embeddings by Major et al. (2018) to label our set of 334,940 articles accordingly, to see whether articles with mentions in policy documents differ from their parent population regarding shares of the three translational stages as predicted by the model.

Preliminary Results & Discussion

To exemplarily illustrate noteworthy differences between the policy-cited articles within our sample and the parent population, Figure 1 compares the shares of the ten most frequent journals among policy-cited articles with the shares the same journals have among the parent population. The results suggest that policy citations might particularly emphasize articles from prominent high impact-journals (*New England Journal of Medicine, Lancet*) and oncology-related journals (*Journal of Clinical Oncology, Annals of Oncology, Lancet Oncology, European Journal of Cancer*), among others.

[5] We rely on bibliometric data from the German Competence Centre for Bibliometrics, which hosts databases based on snapshots of Web of Science.

Figure 1: Shares of journals most frequently cited in policies among the two article groups.

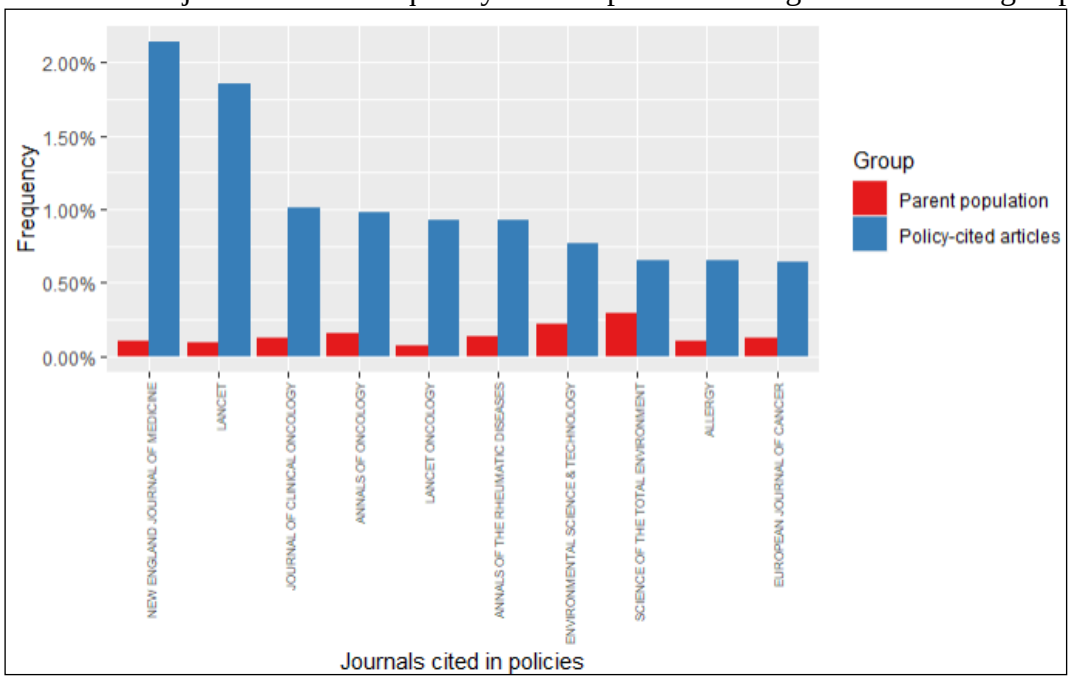
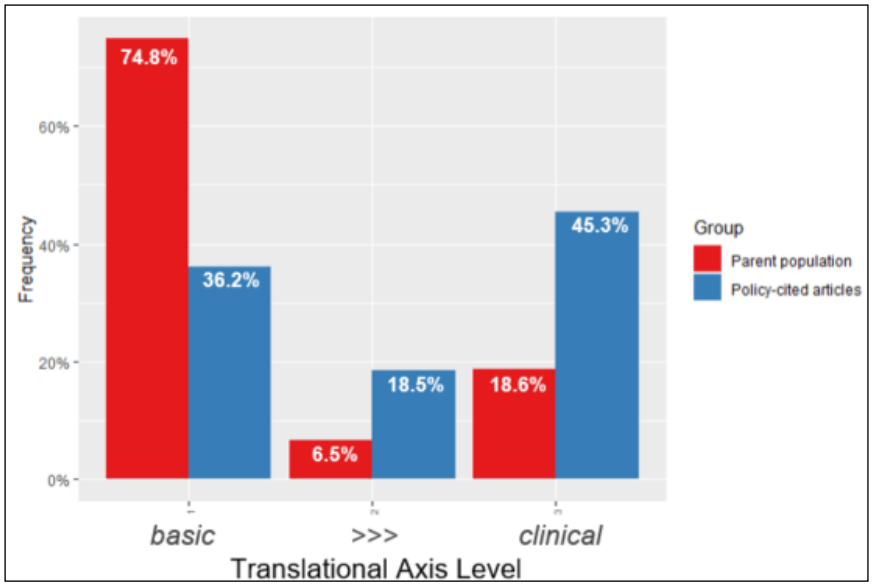


Figure 2 shows the results of the word2vec-based prediction of translational stages for the two groups. The share of articles which are predicted to feature clinical research is considerably higher among policy-cited articles (45.3%) than among the parent population as a whole (18.6%), confirming what Fraser et al. (2021) and Pallari et al. (2021) had concluded from visual inspections of network graphs and reference analysis. This makes policy citations appear as an interesting complement to academic citations, which tend to overemphasize basic research (Donner & Schmoch, 2020; Ke, 2020; van Eck et al., 2013).

Figure 2: Shares of predictions for translational stages among policy-cited articles and their parent population.



One fundamental drawback considering the use of policy citations as altmetric indicators is that coverage of medical research within policy documents overall seems low, with only 2-3% of articles from our sample receiving any policy citation at all. Thus, policy citations will most

likely only be an informative indicator in settings in which analyses can be based upon large samples of available research publications. Another challenge regarding the use of policy citations – both within studies like this one and for 'real world' assessment exercises – results from the diversity of sources that data aggregators like Altmetric.com or *Overton* fetch policy documents from. For instance, the concept of 'policy documents' as tracked by Altmetric.com covers a heterogeneous multitude of sources and document types, ranging from government guidelines over publications from independent think tanks to reports from international development organizations. While the simple API-based approach taken in this study does not differentiate between such different kinds of policy sources, in practical situations differentiation will often be desirable. The lack of best practices and field-tested frameworks for a more differentiated handling of different kinds of policy citations is an aspect that future scientometric research should address. In our own future work, we will expand on characterizing the biomedical literature cited in policy documents regarding further properties, e.g, involved authors, institutions, or specific research fields.

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