


What's driving dermatology? Contribution title analysis of the largest German Dermatology Congress 2019

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Robert Kaczmarczyk , Felix King, Tilo Biedermann and Alexander Zink 

Abstract

Background: Every two years, German-speaking dermatologic specialist groups gather in Berlin to share the latest developments at Germany's largest dermatologic conference, the Annual Meeting of the Germany Society of Dermatology (DDG). Because this conference has a lasting effect on dermatologic practice and research, understanding what is moving the specialist groups means understanding what is driving dermatology in Germany.

Methods: We used word network analysis to compile and visualize the information embedded in the contribution titles to the DDG Annual Meeting in 2019. We extracted words, contributing cities and inter-connections. The data was standardized, visualized using network graphs and analyzed using common network analysis parameters.

Results: A total of 5509 words were extracted from 1150 contribution titles. The most frequently used words were “therapy”, “patients”, and “psoriasis”. The highest number of contributions came from Hamburg, Berlin and Munich. High diversity in research topics was found, as well as a well-connected research network.

Conclusions: Focus of the well-connected German-speaking dermatology community meeting 2019 was patient and therapy centered and lies especially on the diseases psoriasis and melanoma. Network graph analysis can provide helpful insights and help planning future congresses. It can facilitate the choice which contributors to include as imbalances become apparent. Moreover, it can help distributing the topics more evenly across the whole dermatologic spectrum.

Keywords

Digital health, digital, health informatics, epidemiology, network analysis, personalised medicine

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Introduction

Dermatology is a broad medical field with a vast scientific ecosystem.¹ Especially in Germany, Dermatology with its long tradition is a broad medical field including many different subspecialties such as – among others – allergology, dermatooncology, dermatologic surgery, dermatopathology, aesthetic dermatology, andrology and microbiology.² In the last few years, dermatology has experienced a great thrust forward as therapies were developed based on new insights into the pathogenesis of several dermatologic diseases operating on a molecular level.^{3–7} It is also a time of change, where old truths become

irrelevant and less goals seem out of reach.⁸ Today, for example patients with diseases like psoriasis, once considered untreatable, have a real chance of being symptom-free and living a normal life.⁸

Department of Dermatology and Allergy, School of Medicine, Technical University of Munich, Munich, Germany

Corresponding author:

Robert Kaczmarczyk, Department of Dermatology and Allergy, School of Medicine, Technical University of Munich, Biedersteiner Str. 29, 80802 München, Germany.
Email: Robert.Kaczmarczyk@mri.tum.de



Once every two years, the German-speaking community together with a selection of clinicians and scientists from all over the world convenes at the Meeting of the German Society of Dermatology (DDG) in Berlin. At this meeting current research as well as new clinical findings are shared and discussed in lectures, symposia, smaller groups, workshops and posters. Lessons learned at the meeting from lectures and medical training courses at the conference can be translated into dermatologic practice.

Visualization through network graphs can enable humans and especially scientists to understand intricate, multi-dimensional and closely intermeshed data. It is already used widely within the digital humanities including for example social⁹ and political sciences.¹⁰ Medical sciences have yet to discover the full potential of network analysis, which seems especially powerful in understanding and verifying the output of increasingly published techniques and systems using artificial intelligence.^{11,12} Analyzing keywords has been done scarcely across the medical field, an exception being epidemiology¹³ and public health.¹⁴ However, it is a very effective way to reveal networks and trends in large samples of text-based data. Because the biennial DDG meeting is so influential within the German-speaking dermatology community, the goal of this work was to assess the relevant topics and to highlight overall trends and movements in order to reflect what's currently driving dermatology and in which direction modern dermatology is moving.

Material and methods

Study design

We performed a retrospective analysis of all contribution titles in the program of the 50th anniversary congress of the DDG which took place in Berlin, Germany from the 1st to the 4th of May 2019 with 3098 participants. The contributions could be submitted between the 2nd of July to the 11th of November 2018. Late-breaking submissions were accepted between the 1st of December 2018 till the 6th of January 2019.

Setting

All congress contributions can be classified into 9 categories: courses, working groups, free lectures, plenary lectures, keynote lectures, clinical slideshows, symposia, industry lectures and posters. Contributions can be further divided into open (posters and free lectures submitted within the deadlines) and compulsory (courses, working groups, plenary lectures, keynote lectures, clinical slideshows, symposia and industry lectures) presentations.

Variables

The category, cities and titles were analyzed for all program contributions. The titles were divided into separate word and word groups for further analysis.

Data sources/measurement

All data were taken from the official conference program pdf file.¹⁵ Data were extracted from the pdf file using tabula v1.2.1 open-source software. Filling words like 'and' were excluded from the analysis, as well as duplicate titles and words to prevent an artificial increase in word counts.

Software

Python's project 'langdetect v1.0.7', a direct port of Google's language detection library, was used to identify the English titles and 'googletrans v2.4.0', a Google translation API, to translate the English titles into German. After translation, the titles were standardized semi-automatically using custom-written python code (e.g. plurals and singular forms, synonyms). Disease entities with names with more than one word were split into fragments (e.g. atopic dermatitis into atopic and dermatitis). This was necessary to get a more reliable output because multiword terms, often spelled aberrantly, can decrease the software performance. The cities to which the authors were affiliated were separated from the title analysis.

The network was drawn using a ForceAtlas 2 layout.¹⁶ Nodes and their titles were sized proportionally to their counts. In the titles network graph, the node degree cutoff was 20, whereas in the city network all nodes and connections were drawn. Labels were drawn for all visible nodes. The parameters were manually adjusted to guarantee a comprehensive overview of each network (Tolerance: 0.1, Approximation 1.0, Scaling: 10, Stronger gravity, Gravity: 0.1, Dissuade Hubs, LinLog mode, Prevent Overlap, Edge Weight Influence, 1.0 – export parameters: Border Width 1.0, Border Color: parent, Opacity: 100, Show Labels, Font Arial 12 Plain, Proportional node size, Max characters: 30, Outline opacity: 80, Edge Thickness: 10, Min. rescaled weight: 0.01, Max. rescaled weight: 10.0, Opacity: 50, curved radius).

Quantitative variables

We analyzed typical network variables calculated by Gephi v.0.9.2¹⁷ open-source software to examine the contribution and city networks. A network consists of nodes and edges. A node describes a single word/word group or city, and an edge a connection between two nodes. All word-groups or cities from one submission

are connected by edges. The same nodes from different contributions appear within the same single node in our network.

The degree of a node describes the number of edges from that specific node, and the average degree the average of all nodes' degrees. The average path length is the average distance between the nodes of a network, wherein connected nodes have a graph distance of 1. Network density examines how close a network is from a complete network, where every node is connected to every other node. A complete network's density equals to 1. Modularity measures the strength of division of a network into compartments. A network with higher modularity has dense connections within the compartments and sparse connections between the compartments. Different colors within a network represent different modularity classes.

In the context of our analysis, the degree of a word or city, the 'node', describes the number of connections, the 'edges', to and from that specific word or city. Every single node has connections to every other node within a single title. The same nodes from different titles appear in the same single node in our network graphs.

Statistical methods

Statistical analysis was carried out using Microsoft Excel, Python's 'pandas v0.24.2'¹⁸ and 'collections' library and Gephi v0.9.2¹⁷ open-source software. Since we extracted the submissions from the pdf file of the official conference program,¹⁵ we did not have missing data (except for removed duplicates and fill words, which were not included in the analysis). We created two network graphs, one for all contribution titles and the other for contributing cities. If more than one author of one contribution was from the same city, that was only counted as one contribution from the respective city in order not to heighten the count artificially.

We presented the title word counts for each skin disease proportionally to all listed skin diseases. The numbers are either absolute counts, percentages or both.

Results

All in all, we extracted 5509 words or word groups and 1596 cities from 1150 titles of the program of the 50th Meeting of the Germany Society of Dermatology (DDG) in April 2019 in Berlin, Germany. In total, sixty-eight of the 1150 titles (5.9%) were in English language, which were translated into German using Google's translate API. Naturally and as expected for a German-speaking meeting, the majority of contributions came from Germany, followed by other European countries and the United States of America with a total

of 223 different contributing cities. Some contributions even came from as far as Pelotas, Brazil and Phnom-Penh, Cambodia (Figure 1).

The 10 cities with the most contributions were Hamburg (n=166), Berlin (n=103) and Munich (n=98), representing the three largest German cities by inhabitants, followed by Kiel (n=54), Münster (n=41), Bonn (n=41), Göttingen (n=37), Lübeck (n=35), Bochum (n=33) and Frankfurt (n=32) (Figure 2). Apart from cities in Germany, the highest number of contributions were counted for Zurich, Switzerland (n=12), Vienna, Austria (n=9), New-York, United States (n=7), Basel, Switzerland (n=7), Prague, Czech Republic (n=4) and Cardiff, United Kingdom (n=4). The Top 10 contributing cities in terms of collaboration with other cities were Hamburg with 83 connections to other cities, Berlin (n=66), Munich (n=58), Kiel (n=56), Frankfurt (n=43), Dresden (n=41) and Hannover (n=39) (all Germany), Saint-Louis (USA) (n=39), Lübeck (GER) (n=36) and New-York (USA) (n=34) (Figure 3). The city network graph reveals four big communities, wherein cities are more likely to work together than between different communities: Two German communities, one British-American community led by Saint-Louis (n=39), New-York (n=34) and Tarrytown (n=26) and a Scandinavian-Eastern-European community. These four represent the biggest communities at the DDG conference 2019 with all other 95 communities being relatively small in comparison (Figure 1). These other 95 communities are mainly cities with few or no connections and were mainly part of the 'courses'-section. On average, one city was connected to 10 other cities and 4.4% of all possible city connections were observed (network density). A network density of 100% means, in the context of collaborations, that every city collaborates with every other city at least on one project. A city can reach any other city on average within 2.6 connections (average path length: 2.6). This shows a well-connected dermatologic research community.

After translating the German titles into English, the word with the highest overall counts was "therapy" (n=144), followed by "patients" (n=98), "psoriasis" (n=72), "dermatology" (n=41), "diagnostics" (n=32), "chronical" (n=31), "Germany" (n=29), "cutaneous" (n=28), "dermatitis" (n=27) and "severe" (n=27) (Figure 4, 5). The poster contributions were further divided into 36 subcategories, in descending order "Care research" (n=49), "educative case (therapy)" (n=31), "educative case (diagnostics)" (n=30), "clinical studies" (n=27), "pediatric dermatology" (n=26) and "microbiology" (n=21).

The subgroup analysis of the network graph reveals differences and similarities between open and

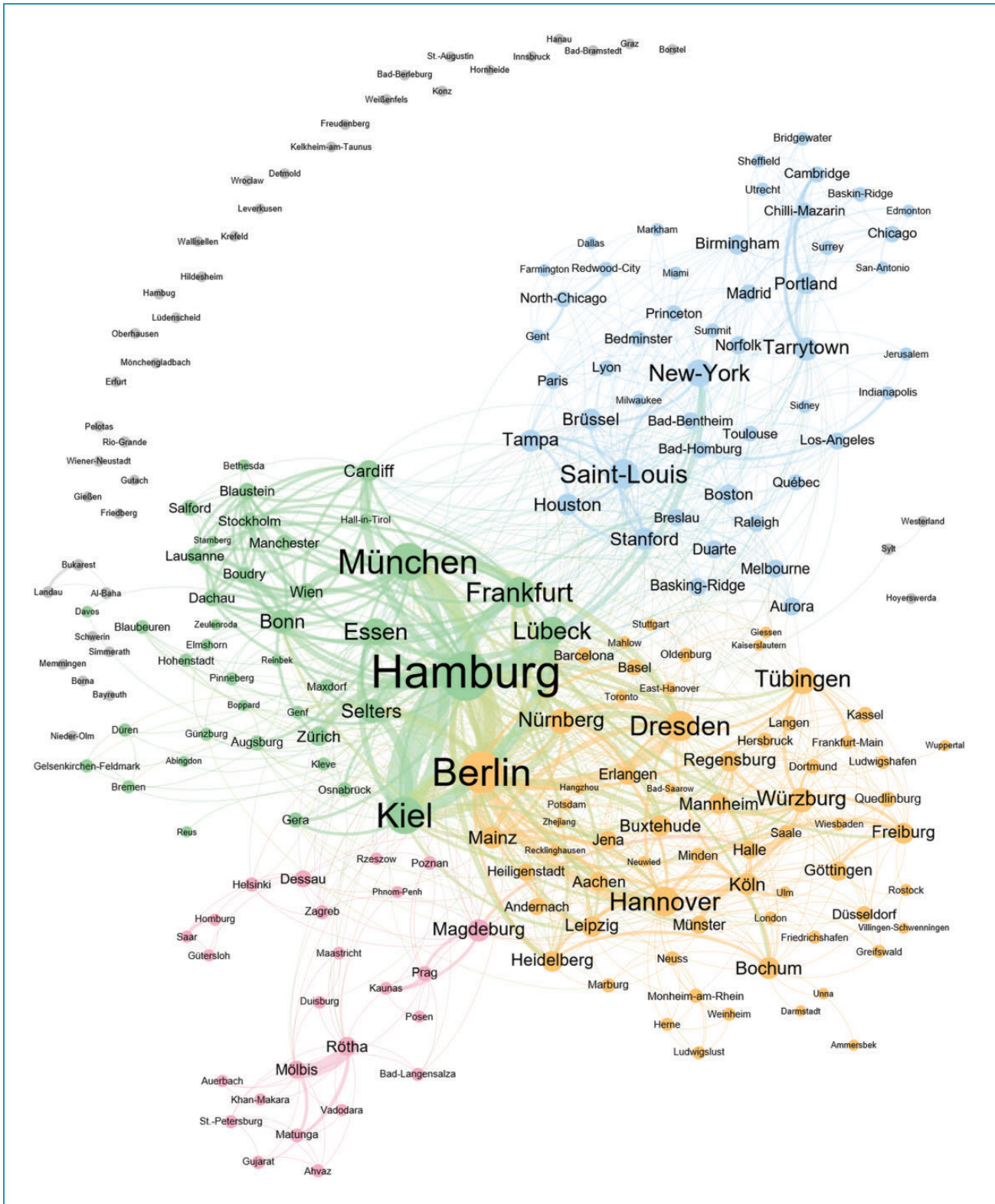


Figure 1. Cities network graph with separated communities based on modularity levels of contributions to the congress of the DDG 2019. This network graph shows all 223 cities (nodes) and 1083 city connections (edges) of all contributions of the 50th congress of the German dermatologic society in Berlin 2019. The 4 colors (red, blue, green and yellow) represent one community each within the network graph. Grey subsumes all other 42 communities. Based on the modularity level, a community groups cities which appear together more often and thus have more connections between them.

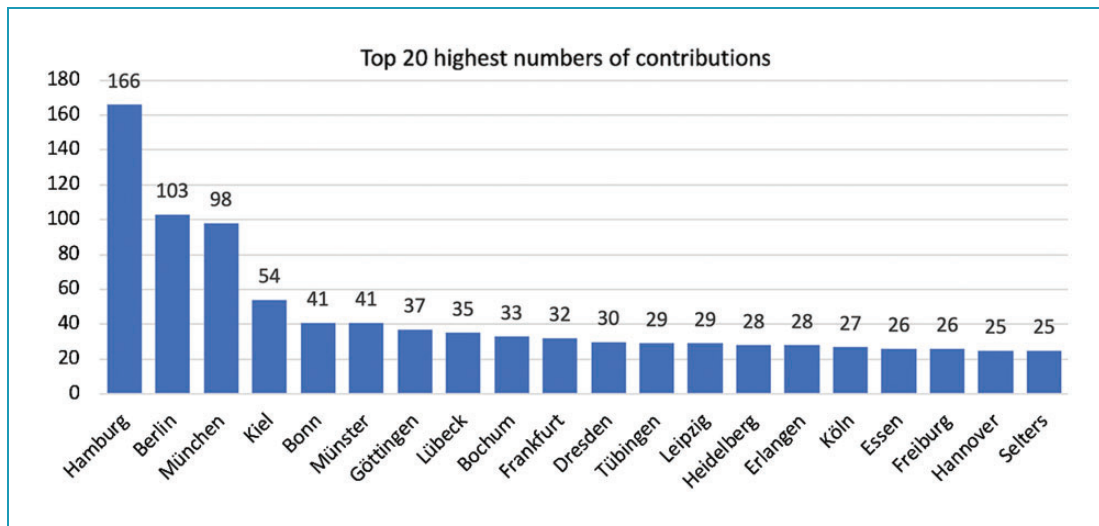


Figure 2. Top 20 most contributing cities to the congress of the DDG 2019. This figure shows the number of total contributions of cities sorted in descending order. The three largest cities in Germany, Hamburg, Berlin and Munich already account for 22,99% of all contributions made to the congress.

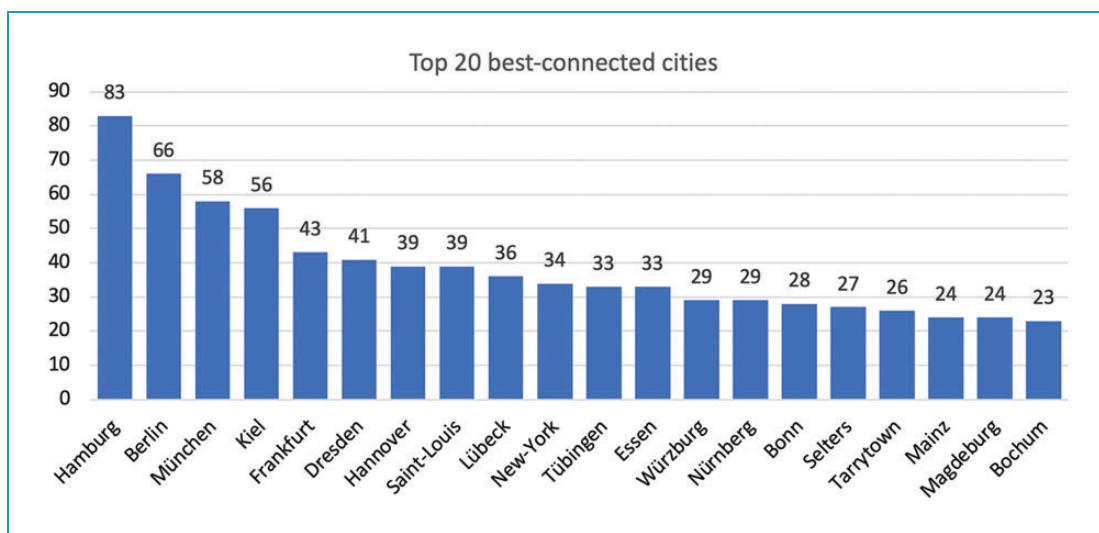


Figure 3. Top 20 best-connected cities to the congress of the DDG 2019. This figure shows the number of connections, the degree, of each city contributing to the congress. Again, Hamburg, Berlin and Munich rank among the three best connected cities.

compulsory contributions (Figures 6-8). The top 10 highest word counts in the open submissions were seen for “patients” (n = 87), “therapy” (n = 80), “psoriasis” (n = 67), “Germany” (n = 26), “dermatology” (n = 24), “chronical” (n = 23), “severe” (n = 22), “results” (n = 20), “study” (n = 19) and “case” (n = 19), whereas the highest word counts for compulsory contributions were “therapy” (n = 64), “diagnostics” (n = 22), “dermatology” (n = 17), “recent” (n = 14), “track” (n = 12), “patients” (n = 11), “cutaneous” (n = 11), “STI” (n = 11), “practice” (n = 11) and “dermatosis” (n = 9) (Figures 6–8).

A focus on therapy and clinical practice can be derived from the analysis, both open and compulsory contributions. The title network parameters revealed that on average, 1 word was connected to 11 other words and 0.5% of all possible word connections were detected. The average path length is 3.2, which means that the average distance between any two words is 3.2 connections. The network parameters for open and compulsory contributions show slight differences: The compulsory network graph has a higher network diameter and average path length but a lower graph density and average degree.

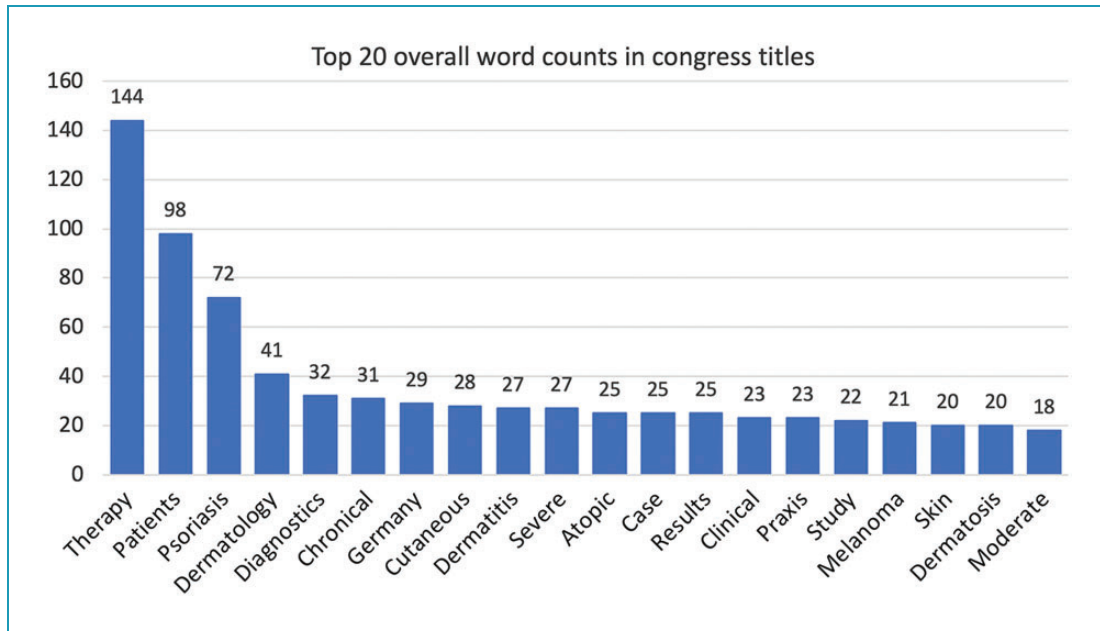


Figure 5. Top 20 overall word counts in congress titles. This figure shows the word ranking in descending order from all contributions at the 50th DDG congress in Berlin 2019.

inflammatory skin diseases (e.g. psoriasis²⁰) and skin malignancies (e.g. melanoma²¹) using antibody medications. This is supported by the fact that psoriasis, atopic dermatitis and melanoma were the skin diseases most assessed by the contributions. Another focus was the teaching cases for clinical practice which highlight the educational aspect of the 2019 DDG meeting.

The comparison of open and compulsory contributions network parameters reveals a higher diversity of the compulsory contributions – this could be explained by the fact that there were more categories in the compulsory group.

Analyzing the DDG 2019 contribution titles using word network analysis provides an account of topics and co-operation networks. The data is visualized in comprehensive graphs and can be examined by professionals of all disciplines as well as even laypersons without further data science training. A detailed analysis of all subcategories might be able to reveal their different focus of interest in the future. Longitudinal analyses of contributions could delineate trends and derive predictions. Apart from that, funding sources of the contributions, quality of life data, overall PubMed results on different dermatologic topics as well as disability-adjusted life years from skin diseases could be compared to our network parameters, which might give a broader and more complete account on this topic.

A downfall of the method is a difficult and time-consuming process of standardization. A researcher must list all possible semantic expressions and register synonyms and word groups. Qualitative categorization

is difficult when a title's hints at certain pathogens which cause skin and other diseases without naming the exact disease. Another limitation is the analysis of a German congress which, although with international participation, shows mostly German research interests.

Of course, not every specialist within the German-speaking dermatology community contributed to the DDG 2019. Evaluating the DDG 2019 contribution titles therefore can only offer a snapshot of the research community. Also, there is a publication bias, as some authors contributed a lot while others could have contributed their work but for whichever reason chose not to do so. Another limitation is the evaluation only of the title of the contributions, not the complete abstracts where available, which could have influenced our findings in either ways, over- or underrepresenting different topics. Most important, however, it has to be highlighted that network analysis can only assess the quantity but not the quality of the contributions. In this study, we did not differentiate between the different types of studies that were submitted (e.g. case report vs. randomized clinical trial) nor does the analysis take into account the actual proportion of the work among the different authors of a multicity contribution.

As word network analysis of contribution titles offers valuable insights and easy to understand visualizations of complex context, they seem very useful for a variety of different application areas. This tool could be used to overview and summarize but also meticulously study medical conferences of all specialties including non-medical conferences by analyzing their

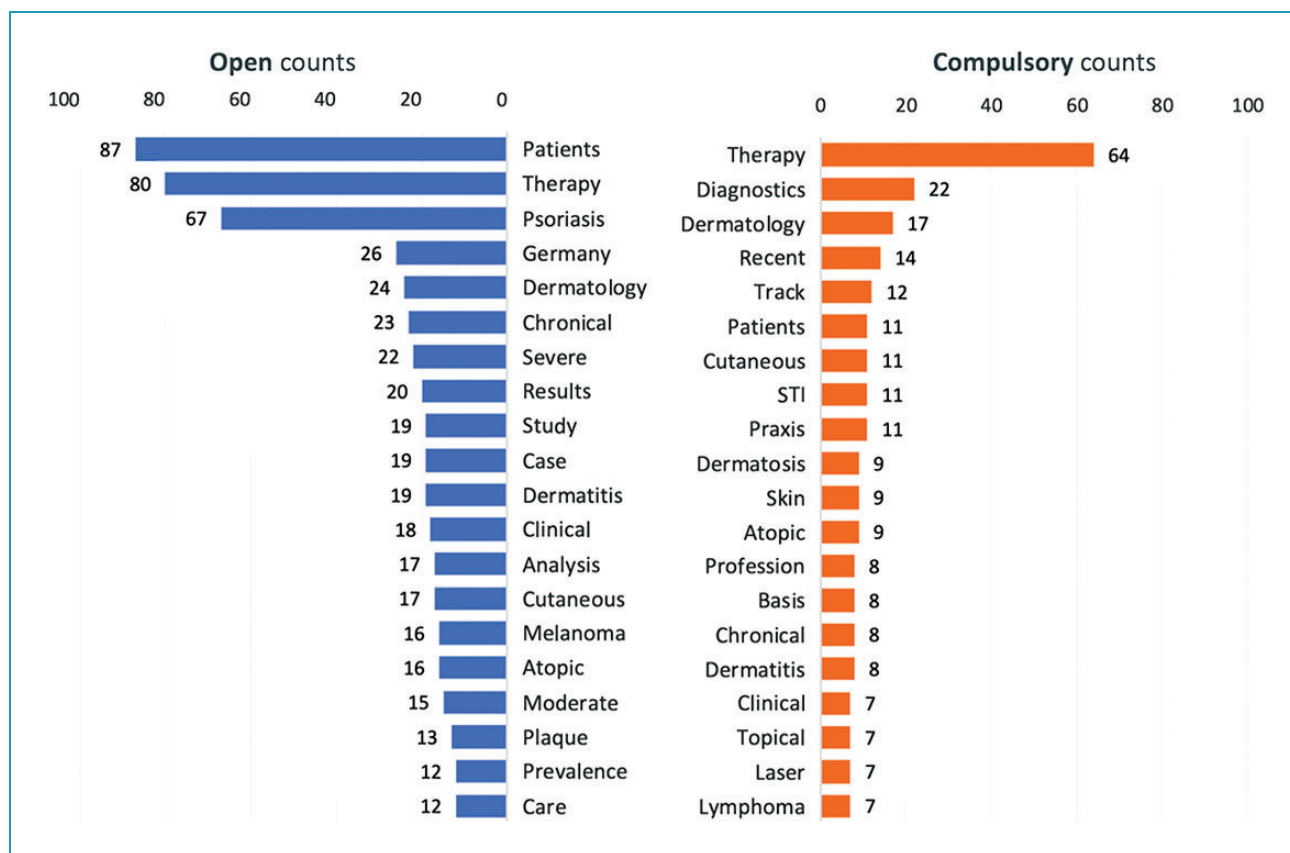


Figure 8. Top 20 word counts in open (left) and compulsory (right) submissions titles. The graph shows a side by side comparison of total word counts in open vs compulsory contributions' titles. The numbers represent absolute values.

detects imbalances of the topics and the selection of the contributors. At the same time, the visualization are easy to understand even for people without further data science training. This makes this tool potentially very useful in the assessment and (human) evaluation of results provided by artificial intelligence tools or machine learning, which will for sure change and enrich medicine, and dermatology.

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ORCID iDs: Robert Kaczmarczyk  <https://orcid.org/0000-0002-8570-1601>

Alexander Zink  <https://orcid.org/0000-0001-9313-6588>

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