Selected by expertise? Scientific experts in German news coverage on Covid-19 compared to other pandemics

Melanie Leidecker-Sandmann[1], Patrizia Attar[1], & Markus Lehmkuhl[1*]

[1] Karlsruhe Institute of Technology, Department of Science Communication, Germany

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***Corresponding author:**

Markus Lehmkuhl, Karlsruhe Institute of Technology, Department of Science Communication, Englerstr. 2, 76131 Karlsruhe, Germany. Telephone: +49721-608-41631. E-Mail: markus.lehmkuhl@kit.edu

Abstract

At the time of the corona pandemic, the population has a great need for information. (Mass) Media try to provide the concerned citizens with answers to their pressing questions with the help of scientific actors and their expert knowledge. Scientific experts serve as an important source of information for journalists and for society. Therefore, it is of particular relevance to examine, which scientific actors are discussing scientific issues related to the Covid-19 pandemic publicly via media coverage. Of particular interest is a look at the scientific expertise of the so-called experts, because the quality of the available information stands and falls with it. Our study describes the journalistic selection of scientific experts in German news coverage on Covid-19 compared to other pandemics. We analyze, which experts get a chance to speak in media coverage, how diverse the spectrum of selected experts is and how their scientific expertise is to be assessed. Our findings show that the Covid-19 coverage is dominated by actors from the political executive and less than in previous pandemics by scientific experts. Further, the Corona debate is characterised by a greater diversity of expert voices than the previous pandemic debates and therefore less concentrated on a few individual scientists only. Further, the journalistic selection of scientific experts is biased in favour of those who have a high scientific expertise. On average, media coverage on the Covid-19 pandemic makes references to more reputable and acknowledged scientific experts compared to earlier pandemics.

Keywords

Covid-19, Corona, experts, scientists, content analysis, media coverage

1 Introduction and objectives

During the Corona crisis, the population's need for scientifically valid information is extremely high in all segments of society and greater than it has been for a long time (Schütte, 2020). People want to know or understand what the coronavirus is all about, how dangerous it is, how to protect themselves, how to control the virus' spread or, ideally, how to stop it. The vaccines that have been available since the end of 2020 also raised questions: How do they work, how well do they protect, do they cause side effects, have they been adequately tested?

In search of answers, people increasingly use (mass) media to get information. As early as the 1970s, Ball-Rokeach and DeFleur (1976) stated that in periods of rapid social change or conflict audience dependency on mass media coverage is especially high. We can see this in the increased use of (traditional) mass media during the Corona crisis (Lehmkuhl, in press/2021; Wormer, 2020). In this situation of great uncertainty and immediate personal concern, people long for reliable information in order to be able to navigate safely through the crisis (Viehmann, Ziegele, & Quiring, 2020).

At the time of the corona pandemic, scientific expertise is more in demand than perhaps ever before. The perceived relevance of science is increasing. According to a representative population survey in Germany 89 percent of the German-speaking population believe that scientific knowledge is important in order to slow down the corona pandemic. The expertise of researchers is very important to those surveyed in the Corona crisis. 81 percent consider that political decisions in dealing with Covid-19 should be based on scientific findings (Wissenschaftsbarometer, 2020).

Also journalists consult scientific experts – those who are most likely to be able to provide at least partial answers to the questions of the concerned public. In modern societies, science has differentiated itself over a period of perhaps 150 years into a system that produces truths whose content can no longer be judged outside of science. Ordinary citizens, but even non-specialist scientists are simply no longer able to answer these questions. Therefore, non-specialized people have no choice but to rely on scientific actors who have the necessary specialized knowledge.

All of this makes one thing clear: scientific experts, and in the case of the Covid-19 pandemic especially virologists and epidemiologists, serve as an important source of information for journalists and for society. Those scientific experts discuss and analyze current developments and advise both governments and the population as a whole.

Therefore, we see particular relevance in examining *which* scientific actors are discussing scientific issues related to the current Covid-19 pandemic publicly via mass media coverage. The 'quality' of the information on questions concerning the Covid-19 pandemic stands and falls with the journalistic choice of scientific actors cited in media coverage. It is of crucial importance that journalists are able to independently as well as competently select scientific experts for news media coverage of high quality. The journalistic selection of experts determines, among other things, which opinions on an issue are made public, which facts support or weaken these opinions, whether and to what extent an issue appears controversial, and how the situation is perceived by the recipients. Above all, the free choice of its sources means that journalism is an important actor in public decision-making processes (e.g., Carlson, 2009, p. 526; Lewis, Williams, & Franklin, 2008, pp. 1–2; Vonbun-Feldbauer & Dogruel, 2018, p. 2). For example, when a serious health risk phenomenon like the SARS-CoV-2 virus occurs, a poor quality of journalistic expert selection could, in the worst case, lead to misinformation and thus facilitate disadvantageous political and societal decision-making.

Our study aims at describing the journalistic selection of scientific experts in German news coverage on Covid-19 compared to other pandemics. Which scientific experts get a chance to speak in media coverage, how diverse is the spectrum of selected experts and how is their scientific expertise to be assessed? Concretely, we ask whether journalists use scientific expertise for orientation in their selection of scientific experts.

We begin by describing the state of research on media coverage of Covid-19 in Germany and then refer to research findings on the representation of scientific experts in mass media coverage based on scientific expertise. Thereupon, we discuss the journalistic source selection problem theoretically, with a special focus on the definition and selection of scientific experts. We consider why scientific

expertise could or should be a suitable criterion for the selection of scientific experts. Subsequently, we derive our research hypotheses and describe the methodical approach to as well as the results of our quantitative content analyses. Finally, we draw a critical summary and give an outlook for potential future studies.

2 Research state and research desiderata

2.1 Variety of communication studies

The Covid-19 pandemic has caused a veritable deluge of scientific studies, especially in the research areas of virology, epidemiology or medicine, but also in communications science. Many of them are still in a preliminary state on preprint servers. Further, the corona crisis not only led to a flood of scientific studies, but also to an enormous amount of media coverage due to its explosive nature (e.g., Eisenegger, Oehmer, Udris, & Vogler, 2020).

Infection events of particular media interest have occurred several times in Germany over the past 20 years: examples are SARS (2002/2003), the bird flu (2005/2006), or the swine flu that was of particular media importance at its peak in 2009 due to its easy transmission from person to person (e.g., Glasmacher, 2012; Günther, Ruhrmann, & Milde, 2011). Nevertheless, the current situation is something special. With the SARS-CoV-2 virus, humanity is observing for the first time in its history, in real time, how a virus pandemic is developing (Leopoldina, 2020). In addition, the current pandemic is causing very many deaths, for instance more compared to the swine flu. One of the reasons for this is that there was already a background immunity to swine flu in the population at that time – namely in the otherwise particularly endangered risk group, the elderly (e.g., Rütten, 2020).

Given the strong media presence of the corona crisis, it is not surprising that an increasing number of communication scientists are expressing themselves publicly and giving assessments, for example, on the quality and even more on the problems of media reporting. Criticism was raised, among other things, on the supposed monothematic orientation of the whole news coverage on the coronavirus

(e.g., Russ-Mohl, 2020), on the fixation on numbers in Covid-19 coverage (e.g., Meier & Wyss, 2020; Meyen, 2020; Lehmkuhl, in press/2021), or the supposed lack of diversity or critical debates within media coverage (e.g., Jarren, 2020; Brost & Pörksen, 2020; Meyen, 2020). The media were also accused of panicmongering (instead of initiating a socio-political debate and reflecting on containment measures) for instance through the use of war metaphors (e.g., Gordeeva, 2020/2020; Brost & Pörksen, 2020). At this point we would like to indicate that most of these personal assessments were not based on systematic (quantitative) analyzes. In addition, some of them have been revised by other scientists (e.g., Schäfer, 2020) and journalists (e.g., D'Inka, 2020).

With a focus on the Covid-19 issue, we currently find studies on media reception and media usage behavior in times of the crisis (e.g., Viehmann et al., 2020; Gehrau, Blöbaum, Fujarski, Lorenz, & Schieb, 2021) and also analyses of the (social) media coverage on Covid-19 (e.g., Quandt, Boberg, Schatto-Eckrodt, & Frischlich, 2020; Chen, Lerman, & Ferrara, 2020; Basch et al., 2020; Pearman et al., 2021), for example in terms of quality aspects (e.g., Eisenegger et al., 2020), regarding their tone of coverage (e.g., Aslam, Awan, Syed, Kashif, & Parveen, 2020) or regarding their degree of politicization and polarization (e.g., Hart, Chinn, & Soroka, 2020).[1]

In the context of our analysis, studies that deal with the selection of scientific experts for media coverage of covid-19 are particularly relevant.

2.2 Scientific actors in media coverage (on Covid-19)

Due to the Covid-19 pandemic, scientific experts were more present in media coverage than perhaps ever before (Schütte, 2020). This impression also sparked critique. Communication scientist Otfried Jarren (2020) for example criticized that – in his opinion – the same scientific experts and politicians always had their say on German public television, and were staged as crisis managers. Also Brost and

[1] This list of studies does certainly not claim to be complete, but is only intended to give an impression of the abundance of studies that already exist after – measured against scientific publication periods – a relatively short time.

Pörksen (2020) spoke of the formation of a ‘monopoly of experts’ in media coverage; Meyen (2020) even talked about an ‘expertocracy’.

Eisenegger et al. (2020) provide scientifically profound findings on the selection of experts in Swiss news media coverage of the Covid-19 pandemic (between January and June 2020). They conclude, that the diversity of experts from different areas of society was comparatively high, especially in public broadcasting. 83 % of all media articles analyzed focus on an expert. Business representatives were most often chosen as experts (13.6 %); the proportion of scientific experts was 7.6 % (their amount was especially high within interviews and articles that interpret events, namely 16.3 % and 13.6 %). The authors interpret this finding as an indication that there was a great need in the population for classification and orientation, particularly from the voices of scientific experts. It is precisely for this reason that it is necessary to investigate which scientific actors are chosen for news coverage and how pronounced the diversity of the scientists involved is. Eisenegger et al. (2020) show that most scientific experts in Swiss media coverage on Covid-19 conduct research in the fields of virology, epidemiology and immunology. Of the 30 most often occurring scientific actors there are only three who do not research in the medical-biological field. These are all economists.

Two content analyses of German tv news coverage on Corona (Prommer & Stüwe, 2020) and news articles in online editions from 13 German print media (Berggren, 2020) (both conducted in April 2020; n=174 newscasts; n=17,807 news articles) focused on the gender of experts that were mentioned in news coverage and refer to the low percentage of women. In tv news, for example, among the interviewed virologists without a management position, the proportion of women was 27 percent, only seven percent of those with management functions. In contrast to that the proportion of women in the field of virology would be around 45 percent. Within the analyzed online articles, only seven percent of the cited experts were women, four percent of them were named as virologist.

What none of these studies analyze, however, is the question of whether the scientific expertise of a so-called expert plays a role in the journalistic selection process or, to put it bluntly, whether the

scientific actors chosen for media coverage are acknowledged scientists in the relevant research area at all (in the case of Covid-19: virology and epidemiology in particular). We argue that it is of importance for journalists to base their selection of scientific experts for news coverage on scientific expertise, because a discrepancy between scientific expertise and the scientific experts' media presence would be problematic from a socio-scientific point of view (see Weingart, 2001, p. 263):

1. In terms of public theory, a decoupling of expertise and public presence would result in a legitimation problem for journalism because the attribution of superior competence would not be justifiable. This, in turn, would give political decision-makers the opportunity to focus on issues or problem solutions that are not relevant or not appropriate from a scientific point of view.
2. In terms of journalism theory, there would be doubts about the performance of journalism if the public representation of a level of scientific knowledge about a social problem stemmed largely from actors who had no scientific expertise related to the problem. This opens up wide-ranging possibilities for instrumentalization, both for journalism and for scientific experts.

In the past, only a few studies have specifically dealt with the connection between scientific expertise and scientific experts' mass media presence. As far as we know, there are only a handful of studies, mostly older ones, that deal with the role of scientific expertise as the basis for journalistic source selection. With one exception (Weingart, 2001), their results suggest that there is at most a weak correlation between a scientist's expertise and their public presence (see e.g., Goodell, 1977; Boyce, 2006; Dunwoody & Ryan, 1987; Shepherd, 1981; Lehmkuhl & Leidecker-Sandmann, 2019).

In her pioneering study *The Visible Scientists*, Goodell (1977) found that the most important characteristics of scientists that are selected for news coverage are 1) compatibility with the 'media logic' (for example the ability to present themselves, a certain 'charisma', quick accessibility and the ability to formulate clear statements), and 2) activities outside the scientific community, especially "in the tumultuous world of politics and controversy" (Goodell, 1977, p. 4).

A few years after Goodell (1977), Shepherd (1981) published an analysis of the presence of scientific actors in American news media coverage on the so-called marijuana controversy. He found that the "scientific standing" (Shepherd, 1981, p. 132) of the researchers in the field had almost no influence on journalists' selection decisions. 69 percent of scientists cited in the media coverage had never been cited by any scientific journal on the marijuana issue: "[T]he great majority had, in fact, never done any research on marijuana at all" (Shepherd, 1981, p. 134).

The results of the works by Boyce (2006) and Dunwoody and Ryan (1987) are similar. They come to the conclusion that a substantial proportion (61 % according to Dunwoody and Ryan (1987)) of the scientific experts were interviewed by journalists on topics that had nothing to do with their actual research area or only marginally.

The analysis of the present paper can be seen as a continuation of a study (Lehmkuhl & Leidecker-Sandmann, 2019) in which we used the individual citation profile of a scientist as an indicator for scientific expertise. As part of a quantitative content analysis of the media coverage of three health risk phenomena (antibiotic resistance, the flu pandemic, and Ebola fever), we analyzed all scientific actors who were cited in the coverage of six news media between 1993 and 2015. On the one hand, our analysis shows that the journalistic selection is not biased in favor of experts with poor scientific expertise. Rather, the selection approximately reflects the expertise gap within science. On the other hand, scientific expertise does not seem to be a general journalistic selection criterion but is only practiced by science journalism departments that select significantly more acknowledged scientific experts than other media departments. This can be seen as a real achievement of science journalism departments. Without those science journalists, the public would receive far less information from acknowledged scientists.

3 The selection problem – defining expertise and identifying scientific experts

Scientific actors are an attractive source of information for journalists. Various studies show an increase of scientific actors in media coverage (e.g., Albæk, Christiansen, & Togeby, 2003; Huber,

2014; Soley, 1994). Because scientists are a popular source for journalists, it is relevant to look at how or according to which criteria journalists choose them for their reporting. Depending on which expert gets a chance to express his/her opinion in media coverage, a social problem can appear more or less urgent, as can be seen very clearly from the example of the Covid-19 pandemic.

It is practically and factually impossible for all scientific actors to be selected for media coverage by journalists (e.g., Habermas, 1992, among others). According to a study by Huber (2014) usually a single (scientific) expert gets a chance to speak within an article. From a normative point of view, one could argue that it would be desirable if those scientists with proven expertise in the respective research area found their way into mass media coverage (in contrast to those who are not very experienced in the field). Only those scientists can be called real *experts* who can give well-founded evaluations.

According to an objectivistic expert definition by the sociologists Collins and Evans (2002), the highest form of scientific expertise is when scientists are able "to contribute to the science of the field being analysed." (p. 254) These scientists are the so called "contributory experts" in the field of research (Collins & Evans, 2002, p. 254). But what does 'to contribute to the field' mean? Collins (2004, p. 128) refers to the publication of articles in scientific journals as the most relevant indicator of contributory expertise, an assessment that is also confirmed by other scientists, e.g., (Goddiksen, 2014, p. 113): "In science, co-authorship of relevant scientific papers seems to be among the most important ways of recognizing that a person has made a significant contribution to the development of a given domain." Bibliometric parameters – such as publication and citation frequency or impact factors of the publication locations – are widely used and widely recognized criteria for scientific expertise in the science system; they are some of the most reliable indicators of scientific expertise in a specific field of research, at least in the natural sciences (see e.g., Shepherd, 1981; Eisenegger, 2005; Dewett & Denisi, 2004; Schimank, 2010; Peters, 1994; Weingart, 2001). Of course, these are not the only criteria that can be used to determine a scientist's professional expertise. They are,

however, widely used as criteria, for example in appointment procedures, and can be measured objectively.

The crucial question, however, is whether journalists base their selection of scientific experts on their scientific expertise. It is also an open question how exactly journalists can assess the competence of scientific experts – in order to select the 'best' experts as a source of information, so to speak. Recognizing the expertise of a scientist is not a trivial undertaking. If the above definition from Collins and Evans (2002) is taken as a basis, then ideally journalists would first have to research all scientists who are active in a certain field of research and then investigate and compare all their publications.

However, scientific expertise is not the only potential criterion for the selection of scientific experts. Other factors that determine the 'value' of an expert for journalists are, for example, the news factors local or regional proximity (possibly also the political and cultural proximity) (see e.g., Eisenegger et al., 2020), the institutional influence, the availability of the scientific actor and the willingness to provide opinionated, concise information. Studies show, for example, that the status within the science system influences journalistic selection, but at least occasionally also the local or regional proximity as well as the accessibility and communication ability of a source and its willingness to provide information quickly and up-to-date. Additionally, *what* an expert says is of importance, especially in controversy (e.g., Boykoff & Boykoff, 2004; Conrad, 2016; Kruvand, 2009; Kruvand, 2012; Nölleke, 2009; Peters, 1994; Peters, 2014; Rothman, 1990; Schütz-Ierace, 2010). Further, processes of co-orientation or intermedia agenda setting (see e.g., Reinemann, 2008; Roberts & McCombs, 1994; Boyle, 2001; Golan, 2006; Vliegenthart & Walgrave, 2008) can influence journalistic selection decisions. Probably one of the most important reasons why journalist A selects a scientific expert for news coverage at time X is the same choice of experts by journalist B at an earlier time Y (Lehmkuhl, in press/2021).

In addition, numerous 'external' framework conditions, such as editorial standards and work routines (e.g., Breed, 1955; Engelmann, 2012), also influence the selection decisions of journalists. These

influencing factors are systematized, for example, by models that follow a micro-, meso- and macro-logic, such as the models of Donsbach (1987), Weischenberg (1992), Esser (1998) or Reese (2001). Recently, Lehmkuhl and Promies (2020) described in more detail factual, temporal, and social restrictions that affect journalistic selection decisions at the micro level.

4 Hypothesis and research questions

From these theoretical considerations (chapter 3) in combination with the empirical findings on the journalistic selection of scientific experts based on their expertise (chapter 2.2), the assumption can be made that the public presence of scientific experts and their scientific expertise within the scientific community are decoupled. The journalistic selection of scientific experts is an extremely complex decision-making process that cannot be reduced to one single selection criterion. Further, we do not suppose that journalists really do investigate all publications of all scientists in a certain research area to evaluate his/her scientific expertise – more likely, they approximately gauge scientific expertise. In addition, the existing empirical findings do not indicate a connection between scientific expertise and scientific experts' media presence.

The assumption that scientific expertise and media presence of scientific actors are decoupled can be formulated in the following hypothesis:

> H1: The presence of scientific experts in media coverage is biased in favor of actors who have a poor scientific expertise.

In addition, we would like to shed more light on one point of criticism of the media coverage that has been expressed several times, namely that the selection of experts in media coverage on Covid-19 was not very diverse (see e.g., Jarren, 2020; Brost & Pörksen, 2020; Meyen, 2020. Since this impression is not yet based on systematic (quantitative) analyzes and is also disproved by the analysis of Eisenegger et al. (2020) at least for the Swiss media coverage, we decided to formulate an overall research question (instead of hypotheses):

> RQ1: How diverse is the selection of experts within media coverage on Covid-19?

This research question may be specified in two sub-questions:

RQ1.1: Is the selection of experts for media coverage on Covid-19 dominated by scientific experts?

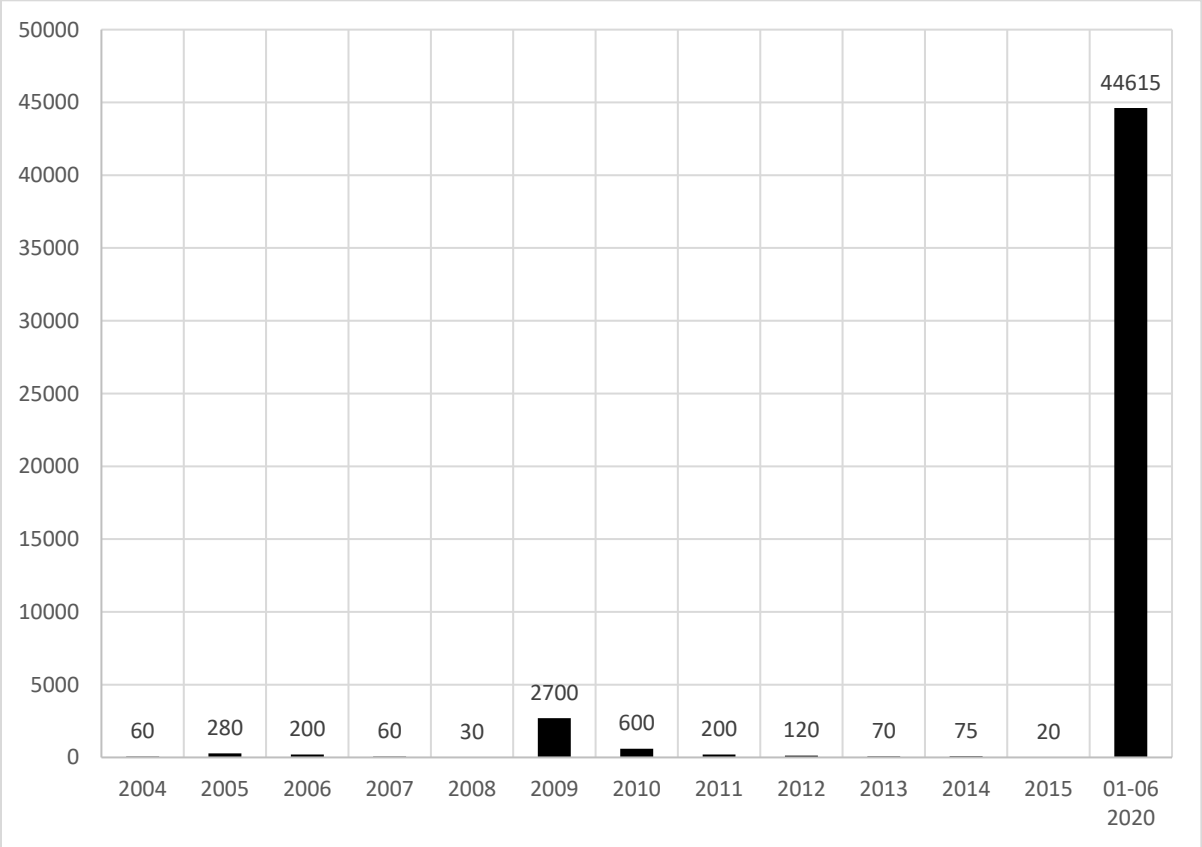
RQ1.2: Is media coverage on Covid-19 focused on only a few scientific experts?

5 Methodology

5.1 The Issue: Pandemics

In order to empirically analyze the selection of scientific experts in news coverage, we researched a corpus of articles thematically dealing with actual or potential pandemics. This corpus covers the years 2004 to 2015 and the first half of 2020. The articles in our sample deal with the following topics: 1) the current Covid1-9 pandemic, 2) the former swine flu pandemic from 2009 and 3) speculations on a pandemic to come related mainly to the bird flu virus H5N1 in 2005/2006.
All three topics received extensive media attention, with the attention for SARS-Cov-2 exceeding considerably all previously known standards for media attention.

Fig. 1: Number of articles on pandemics between 2004 and June 2020 (excluding the years 2016 - 2019) in the four German media titles dpa, Die Welt, Süddeutsche Zeitung, Der Spiegel (N = 49,060)



All three topics related to pandemics are highly complex medical risk issues, for which one can expect that journalists are dependent on the help of external scientific experts in order to be able to report well-founded on those issues. There were also practical research reasons for choosing issues from biomedical research: As described in chapter 2.2, the current analysis was created as a continuation of a former study (Lehmkuhl & Leidecker-Sandmann, 2019) in which we based on Collins and Evans (2002) used bibliometric parameters, such as citation rates or the h-index (see chapter 5.3), as indicators of scientific expertise. The use of these indicators does not make sense in all scientific disciplines, given the different publication cultures; however, these parameters are relatively established in biomedical research. In addition, the *PubMed Europe* database from which we retrieve the citation profiles (see also chapter 5.3) offers an almost complete and automatically searchable source for the identification of biomedical publications.

5.2 Design of the content analysis

5.2.1 Media and sampling

In order to gather the news coverage, we have chosen a multi-step procedure. First of all, by means of a Lexis-Nexis search, we determined the universe of all articles about pandemics in the four German media titles *Der Spiegel*, *Die Welt* (DW), *Süddeutsche Zeitung* (SZ) and *dpa* between 2004 and 2015 and in the first half of 2020. This means that we have two national daily newspapers in the sample, which are among the largest daily newspapers in Germany, that differ in terms of their editorial lines (SZ: left-liberal, DW: conservative) and that belong to the opinion-leading media in Germany. The news magazine *Der Spiegel* is also known as opinion-leading medium in Germany (e.g., Scheufele & Engelmann, 2013; Schindler, Krämer, & Müller, 2017). The *dpa* is the largest German news agency and is considered to be the "pacesetter" for news, especially in the regional press.

The following search strings were used to gather media coverage on the analyzed topics:

- The keywords 'Corona*, Covid*, Corvid*, nCov*, n-Cov*, SARS*, Wuhan and lung*, Wuhan and disease, China and disease, China and lung*' were chosen to capture Corona reporting. The last combinations served to capture the initial coverage as well. On February 11th, WHO announced Covid-19 as the official name for the lung disease and Sars-CoV-2 for the causative virus. The keywords used to extract articles that appeared after this date were reduced to 'Corona*, Covid* and SARS-*'.
- To capture coverage related to the preceding swine flu pandemic and to speculations about a pandemic to come in the years preceding the swine flu pandemic, the keywords: 'flu pandemic, swine flu or (pandemic + flu)' were chosen.

To search for the relevant articles, we used the databases *wiso presse* (*Der Spiegel* and *Die Welt*), *sz library* (SZ), the dpa-news database *dpa-news.de* (dpa).

The universe of articles retrieved in this way was 49,060 articles (see Fig. 1). From this, we sampled approximately five percent, 2,483 articles (1,887 articles on SARS-Cov-2 and 596 on former pandemics) using different methods of sampling, based on the specifics of the quantitative distribution of the news coverage on the issues.

For articles on pandemics prior to Corona, the population was split into three groups:

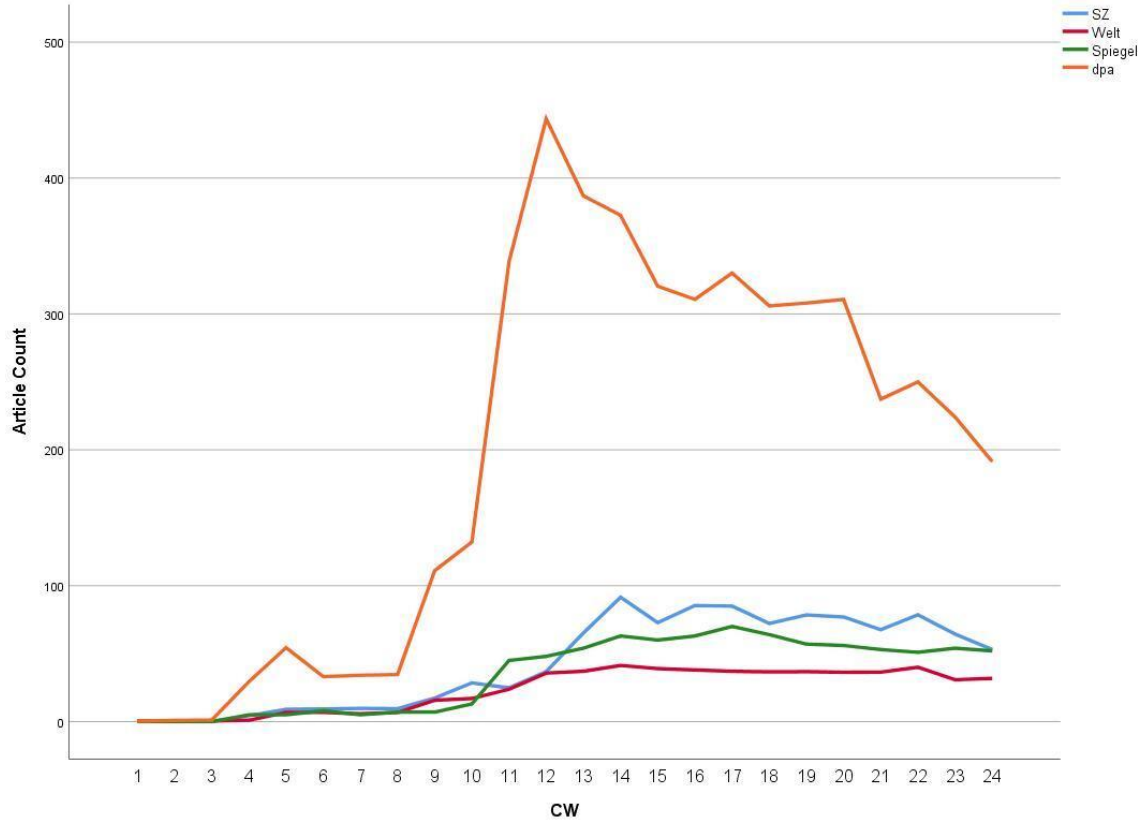
- Years with <10 articles/year: all articles.
- Years with <50 articles/year: 10 articles randomly selected per year.
- Years with >50 articles/year: 15 % of articles randomly selected.

For articles on the current Corona pandemic in the first half of 2020 (see Fig. 2) the population was also split into three groups:

- The preliminary phase until a pandemic is declared by the WHO on March 11th 2020 (week 11). In this phase, eight percent of the *dpa* articles and 15 percent of all other articles were randomly selected.
- This determination was followed by successive decisions by the German federal and state governments to restrict social contact. Most articles are disseminated during this peak phase. It ends on April 15th 2020 (week 15). In this phase, four percent of the *dpa* articles and ten percent of all other articles were randomly selected.
- The 16th calendar week marks the beginning of the steady-state phase, which was studied until week 24. In this week, the decisions to relax the contact bans were announced by the federal government. In this phase, two percent of the *dpa* articles and five percent of all other articles were randomly selected.

The different quota for *dpa* was necessary because it distributed a significantly larger number of articles via Corona than the other media titles. This in turn is due to the fact that it is a news agency that supplies the entire German media system with news and, unlike print titles, is not subject to line restrictions.

Fig. 2: Average number of articles published about Corona per calendar week 2020 by media title (N = 44,615)



5.2.2 Identification of (scientific) actors

For the identification of scientific actors and the context of their citation, we distinguish between two levels of investigation: firstly, the article as a whole and, secondly, the statements made in the article that could be attributed to individual or institutional actors because they were either quoted verbally or the wording of their statements were indirectly portrayed by the journalist. The detailed statement analysis is limited to a random selection of those articles in which pandemics were the main topic (n = 1,472; 271 on previous pandemics and 1,201 on SAR- CoV-2).

The actors were coded by five coders (former pandemics) respectively three coders (SARS-CoV-2) who all had previously taken part in an intensive training from the project leader. At the article level (in addition to formal aspects), the department of the newspaper in which the article is placed, the thematic focus (main, secondary or marginal topic) as well as the specific content of the topic were

coded. At the statement level, more detailed information on the actors were coded, such as name, frequency of (direct or indirect) citation, affiliation and affinity to a social area (e.g., science, politics, interest group, etc.). The reliability between the five coders who have coded the sample on former pandemics was satisfactory (article analysis: Holsti: 0.82–0.98; Cohen's Kappa: 0.74–082; statement analysis: Holsti: 0.92–0.97; Cohen's Kappa: 0.82–0.93) and is reported in detail elsewhere (Lehmkuhl & Leidecker-Sandmann, 2019). With regard to the Corona sample three reliability tests served to ensure data quality. The first and second was composed of a pretest sample of articles that were not part of the analysis corpus. The third was composed of 20 articles and in addition 73 statements of the analysis corpus, which were categorized independently by all coders. The results of the reliability test refer to the last-named corpus. Two reliability values were determined for each individual variable: the average agreement of the pairwise comparisons among the three coders (Holsti coefficient) and the Kappa coefficient according to Cohen. The reliability values of the article analysis are in a very good to satisfactory range for all semantic variables for both coefficients (Holsti: 0.79-1.00; Cohen's Kappa: 0.74–1.00). The values of the statement analysis, i.e. the coding of the actors present in the articles are very good (Holsti: .91–.95; Cohen's Kappa: .82-.90).[2]

5.3 Operationalization of scientific expertise

We operationalize scientific expertise based on Collins and Evans (2002) definition of contributory expertise (see also Collins, 2004, p. 128) by collecting bibliometric profiles of all scientific actors who appear in the media coverage we analyze. Through an analysis of the *PubMed Europe* database, in which primarily biomedical publications are summarized, we determined the number of publications per actor and the number of thematically relevant publications in the relevant research fields of virology and epidemiology. In order to create a comparative value that estimates the relative position of a scientific actor within his scientific community, we determine the average impact of all

[2] We would like to thank Nikolai Promies, Kristina Schreiber, Evgeniya Boklage, Pia Stejskal, Moritz Schmid and Felix Höting who helped to collect the data.

thematically relevant publications written by the actors. In addition, we used the average impact of any individual scientist, i.e. the average number of citations of all scientific papers published by a scientist.

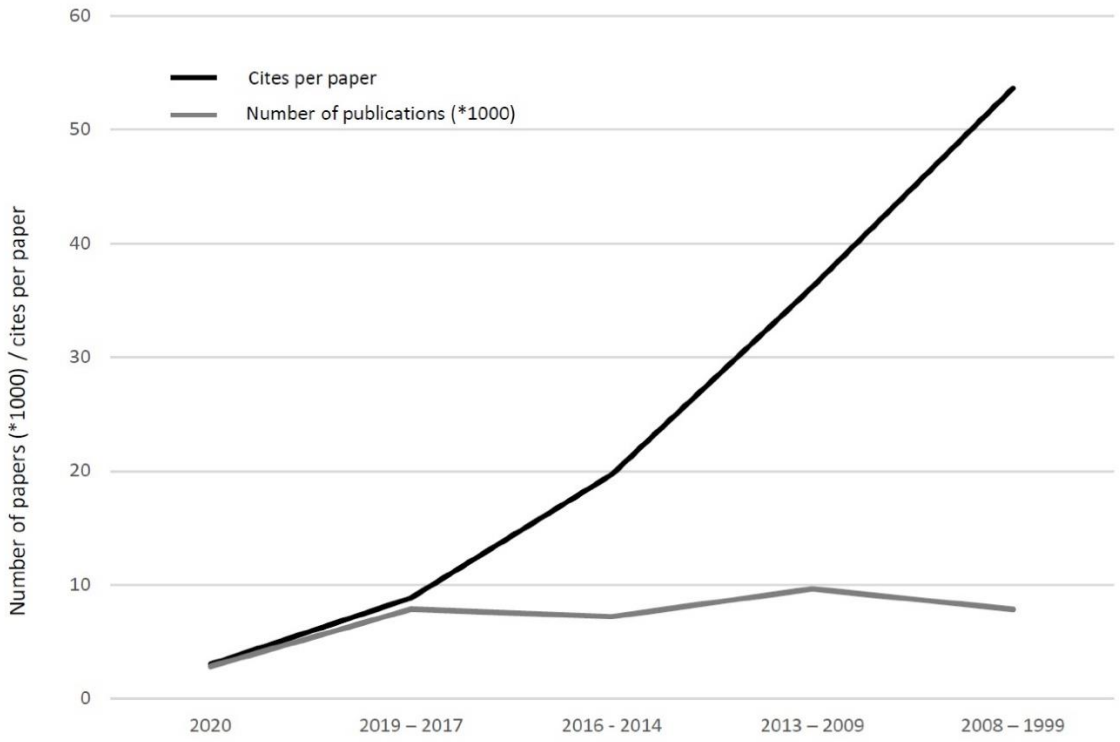
The individual publication profiles were retrieved with the help of a specially developed Python script that automatically retrieves the data via the *PubMed* API. The program is published together with a detailed description of how it works (Milhahn, Boklage, & Lehmkuhl, 2018). To validate the results, the number of publications and the Hirsch index (h-index) were compared with manually determined results from the *Scopus* database from a random selection of 120 scientific actors. The number of publications correlated with r = .72; the h-index with r = .77.

To classify the scientific actors' expertise, we use the h-index. It combines the number and impact of published studies. In a first step, we determine the sum of all h-index values of the scientific experts quoted by journalists. We regard this total value as an indicator of the expertise that all scientific experts have in common. In order to assess whether greater scientific expertise is linked to a higher public presence of experts, we compared the average impact of visible scientists with that of all scientists in the fields of virology and epidemiology. To determine a reference value, we used *Web of Science* to calculate the average citation rate of all relevant publications. We obtained two benchmarks from this analysis. Each of the almost 33,000 scientific publications that have appeared between 1999 and 2020 in the relevant subject areas will bring an average of 28 citations by 2020; only up to 2009 will the publications bring an average of just under 20 citations. This lower benchmark is to be applied to those scientific experts who publicly commented on pandemics before the Corona crisis.

Figure 3 shows the distribution of the number of articles and reviews from the field of virology and epidemiology that were assigned to the topic 'infectious diseases' by *Web of Science*. The distribution of the average citation rate of the studies is also shown. The impact of the publications is higher the older they are. The approximately 8,000 relevant studies published between 1999 and 2008 were

cited more than 50 times on average by the end of 2020; in contrast, the almost 3,000 current studies from 2020 have only three citations on average. If we add up all the studies since 1999 and all the citations of these studies up to the end of 2020, we arrive at the benchmark of 28. We proceeded in the same way to determine the benchmark for the studies up to 2009.

Fig. 3: Number of articles and distribution of impact of all thematically relevant studies since 1999 (N = 35,406)



6. Results

6.1 Patterns of actor references in the Corona debate

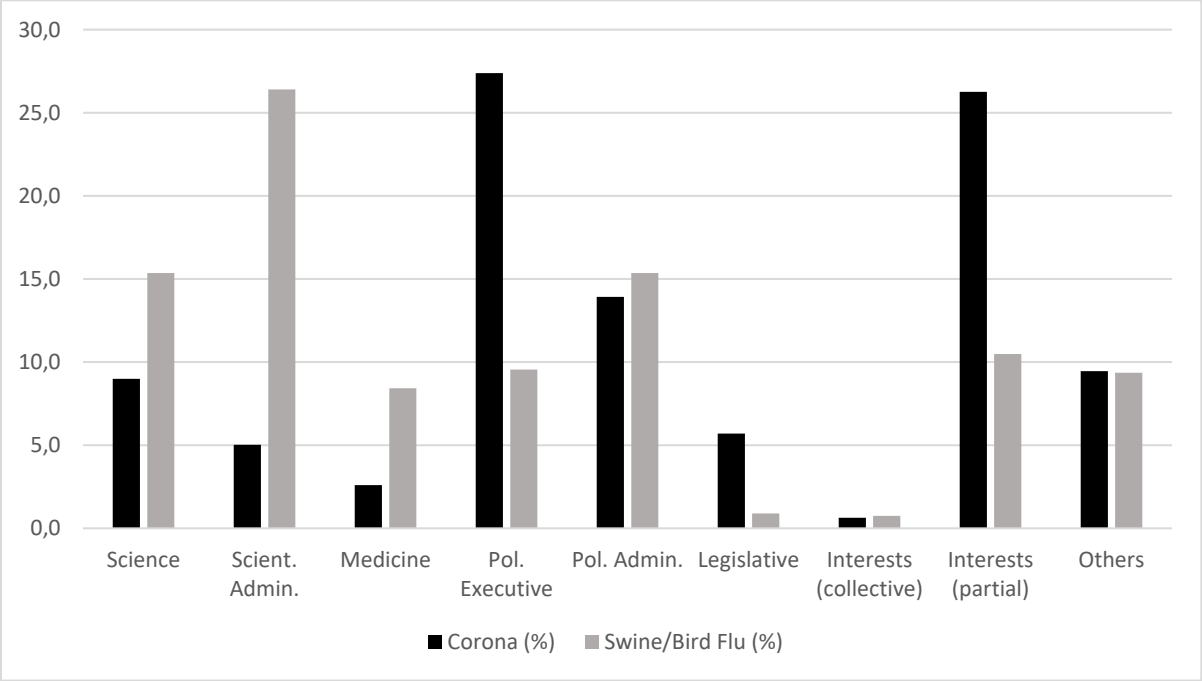
Before testing the hypotheses, we highlight some general characteristics of the coverage. This will later be important for classifying the findings on the expertise of publicly visible experts in the current Corona debate in Germany, whereby we repeatedly use the chronologically preceding coverage of the 2009 flu pandemic and the 2005/2006 bird flu as a reference. In this way, we hope to profile the specifics of the Corona debate in a sufficiently concise manner.

In the 1,202 articles in our Corona sample, we captured all 2,845 references to actors. 67.5 percent of these references (1,920) are to individually identifiable persons, 28.1 percent (800) to institutions (e.g., WHO, RKI, etc.), without an individual actor having been named. 4.4 percent (125) of the references refer to 'generic' actors ("according to many virologists..."; "epidemiologists estimate..." etc.).

As a comparison, we used a sample of 271 articles on earlier thematizations of pandemics in the same media titles (*dpa*, *SZ*, *Die Welt* and *Spiegel*), from which all 532 references to actors were recorded. Of these references, 58.4 percent (312) referred to individually identifiable actors, the rest to institutional (28.3%) or generic actors (13.3%).

Crises are considered to be a matter for the executive. This is clearly reflected in the distribution of references to actors within the Corona coverage. In the case of Covid-19, unlike the previous pandemic in 2009 and the bird flu in 2005/2006, where the pandemic potential of this flu was addressed, the public is 'dominated' by powerful actors from the executive branch in particular. Of the 2,845 references, a good 41 percent were made by executive actors from government and administration (see Fig. 4).

Fig. 4: Distribution of references among the different groups of actors within Corona coverage 2020 and swine flu/ bird flu 2009/2010 and 2005/2006 respectively (N = 2845/ N = 532)



Also of prominent importance is the group of interest groups, which account for a good 25 percent of the references in the Corona debate. Scientific or science-related actors also play a major role, but it lags behind the two previously mentioned groups. In view of this actor structure, one will be able to conclude that Corona in the period covered here from the beginning of January to the end of June 2020 is a highly 'power dominated' discourse, because it is approximately two-thirds dominated by actors who use public attention to pursue strategic goals. This contrasts relatively strongly with the structure of actors in the earlier debates on pandemics. These were characterised by a relatively strong dominance of science-related actors and a comparatively low significance of strategically communicating actors from the political executive and the partial interests. Accordingly, previous debates on pandemics within the four media titles researched were 'expert dominated'. In this respect, we have to deny our RQ1.1 (the selection of experts for media coverage on Covid-19 is not dominated by scientific experts), and we further cannot confirm the impression of Meyen (2020), for

example, who talked about an ‘expertocracy’ in media coverage on Covid-19. It appears that scientific experts were even more present in media coverage on former pandemics.

6.2 Distribution of attention for visible scientists

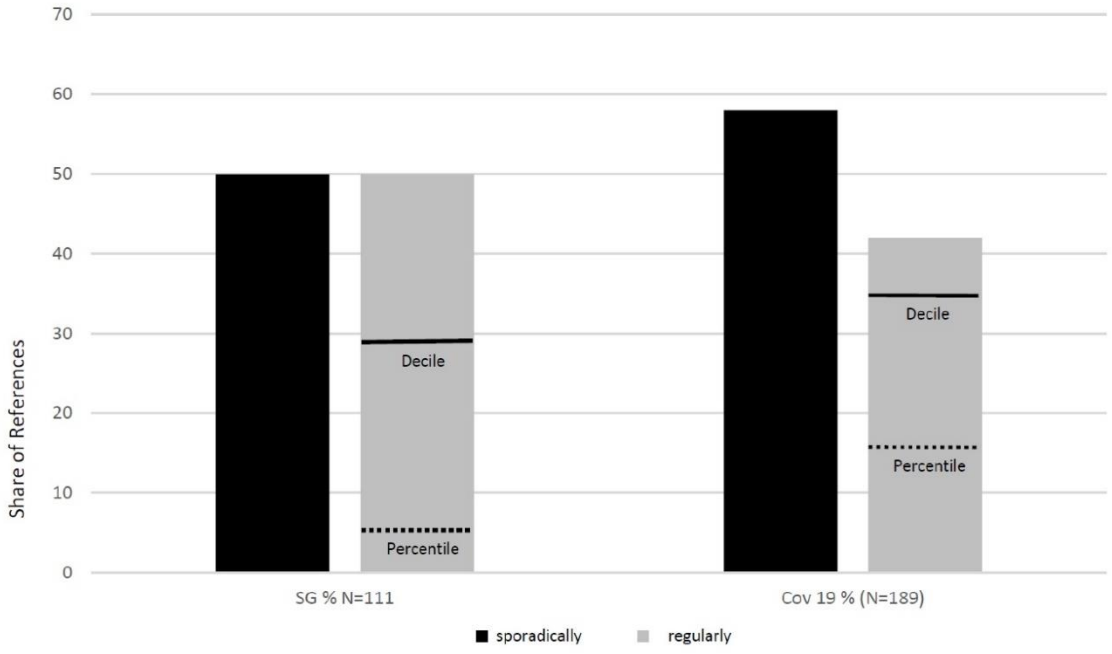
In the next step of the analysis, we turn to a detailed analysis of the references that are attributed to individual, science-related actors. Within the Corona dataset, 16.6 percent of all references refer to this group of actors; in the comparative sample, as shown, the amount is significantly higher, namely 50.2 percent of all references. We want to examine how these references are distributed among individually identifiable scientific experts. It is to be expected that there will be a left-skewed distribution (see e.g., (Lehmkuhl & Leidecker-Sandmann, 2019); there are very many scientists who only speak sporadically and there are a few experts who, however, account for a considerable proportion of all references. Accordingly, the first group is made up of actors who only receive a comparatively small amount of attention. The second group is made up of actors who may be named richly in relation to their share of public attention. In studies on unequal distributions (e.g., Lehmkuhl & Promies, 2020), it is common to distinguish the totality of all actors into an upper decile (the 10 percent of the richest) or an upper percentile (1 percent of the richest). So how is the attention to scientific experts distributed in the Corona debate between January and June 2020?

To give a first impression, we first roughly divided the scientific experts into two groups. The group of those who speak only sporadically (only once) and the group who are regularly referenced by journalists in their reporting. A more precise breakdown of the distribution does not make sense in view of the relatively small study sample.

Let us first look at the distribution of the 282 references to the 189 individual scientific experts in our SARS-CoV-2 sample (see Fig. 5). 87 percent of these scientists spoke only sporadically. These scientists accounted for 58 percent of all references. The remaining 13 percent of the scientists who were regularly referenced accounted for 42 percent of the journalistic references.

In the comparative sample, the proportion of those scientists who only spoke sporadically was significantly smaller (70 percent) and the proportion of those who spoke regularly was correspondingly larger. This suggests that the concentration on individual scientists in the breadth of the debate on SARS-Cov-2 was less pronounced than in the pandemic debates that preceded it in 2005/2006 and 2009/2010. In other words, the public debate was less dominated by actors who were regularly referenced. This suggests that the Corona debate is characterised by a greater diversity of expert voices than the previous pandemic debates. Therefore, we have to deny our RQ1.2 (media coverage on Covid-19 is not focused on only a few scientific experts). At first glance it looks like we also cannot confirm the impressions of Jarren (2020) or Brost and Pörksen (2020) who criticized that always the same experts were chosen for media coverage on Covid-19 (although it should be noted that we are investigating a different media sample).

Fig. 5: Distribution of references differentiated according to the public presence of actors



However, it may be an accurate perception that the Corona pandemic made individual virologists or epidemiologists alive today celebrities for the first time. This becomes particularly clear when looking

at the distribution of references in the group of those who were regularly asked for advice by journalists. The top percentile, i.e. one percent of all scientific experts with the greatest appeal, accounted for 17 percent of all references to scientific experts in our sample. In the comparative sample, this was only six percent. Taken together, this indicates that the references in the Corona pandemic were much more diverse than usual, but that they were at the same time much more focused on individual actors at the top, in Germany especially on Christian Drosten and Lothar H. Wieler.

6.3 Connection between public presence and academic expertise of scientific experts

Finally, we want to examine the relationship between the public presence of scientific experts and their scientific expertise. This analysis was restricted to biomedical experts in both samples only. It is essentially based on two comparisons:

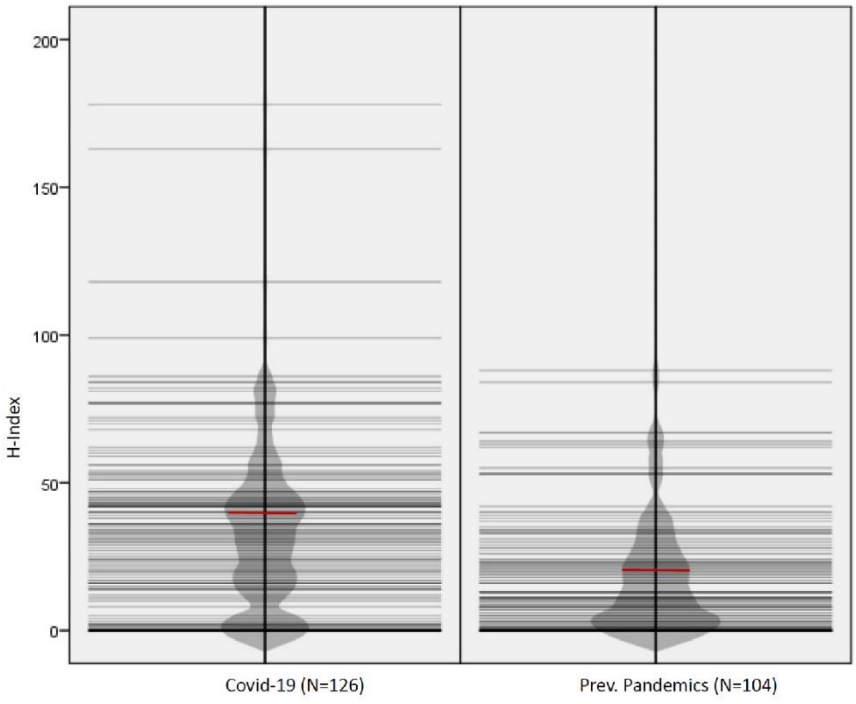
First, the comparison of the average h-index of the 126 publicly visible biomedical corona experts in our sample with that of the 104 biomedical pandemic experts in our reference sample from 2005/2006 and 2009/2010. A h-index value of 20, for example, tells us that a scientist has published 20 research papers, all of which have been cited at least 20 times. This indicator has been widely used to estimate the impact of a scientist because, unlike the mean, it is very robust against outliers.

Secondly, the analysis is based on the comparison of the average citation rate of the Corona experts' thematically relevant publications with those of all other publications since 1999 on the subject of virology and epidemiology (of infectious diseases). This was based on a bibliometric analysis in the two databases *Scopus* and *Web of Science*.

Tab. 1: Comparison of the h-indices of biomedical experts

	Previous Pandemics	Covid-19 Pandemic
N	104	126
Mean	19	35
Median	13	32,5
Modus	0	0
Minimum	0	0
Maximum	88	178
Sum	1,977	4,406
Percentil 25	3	14
50	13	32.5
75	28	47
90	53	73.50
75	28	47
90	53	73.50

Fig. 6: Beanplot of the distribution of h-indices (mean red marked)



As Table 1 and Figure 5 show, the distribution of the h-indices in both expert groups is left-skewed with a wide range, between 0 and 88 and between 0 and 178 respectively. In the case of the publicly visible experts, too, the great inequality of the distribution of expertise within the science system is reflected in both samples. A small number of scientists account for a large share of the expertise.

The comparison of the two groups shows that the scientific expertise of the Corona experts is significantly higher (Mann-Whitney-U-Test: Z= -4.48, p=.000) than that of the comparison sample, although in both groups a quite considerable proportion of medical experts have no scientific expertise in virology or epidemiology. Their share in the sample of Corona experts is just under 32 percent (40), in the reference sample a good 36 percent (38). However, this share is difficult to interpret because in both discourses compared here, physicians also have their say who often have no scientific reputation, although they undoubtedly have expert knowledge and contribute expertise to the public debates. Excluding doctors from the sample of biomedical experts is problematic because doctors who work scientifically often also have their say, without it being possible to make a precise distinction on the basis of the reporting.

Taken together, the differences in the h-indices indicate that in the Covid-19 debate, journalists referenced scientists who, on average, have a higher expertise than those scientists who were referenced in previous pandemics.

Finally, we want to investigate whether the expert selection of the four news media we examined is biased in favour of those bioscientific experts who have a high expertise. We will base this estimate on a comparison of the average citation rate of the public Covid-19 experts with a benchmark showing the average citation rate of all papers published in the field of virology and epidemiology of infectious diseases since 1999.

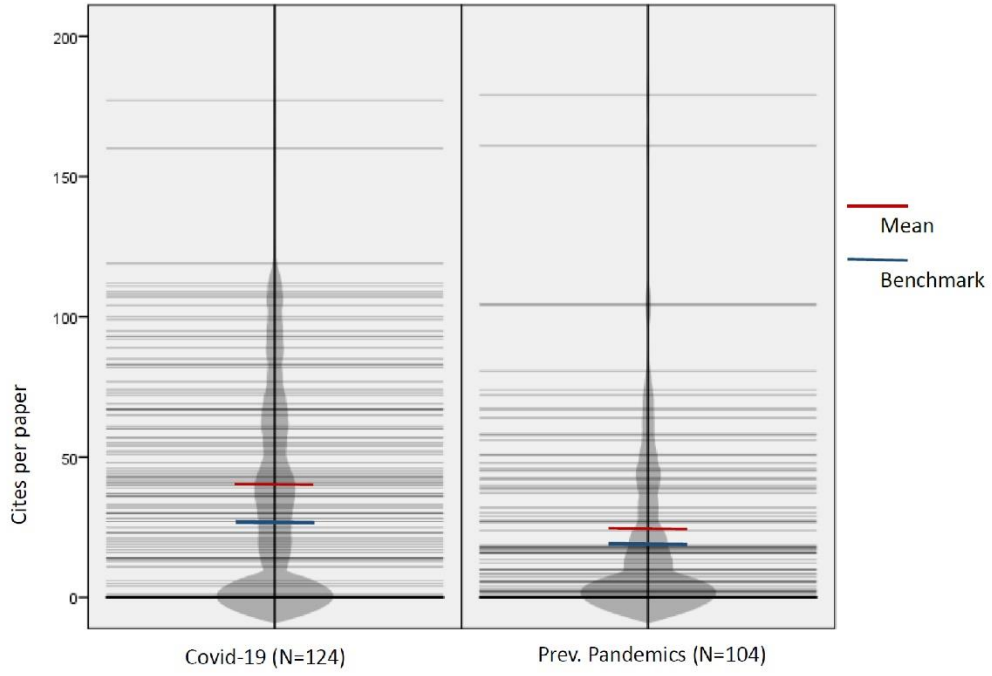
As the comparison shows (see Tab. 2 and Fig. 7), the average citation rate of the public Covid-19 experts is much higher than the benchmark, which is 28. In the case of the reference sample, the citation rate is only moderately higher than the benchmark, which is 19. This difference is essentially due to the fact that for the comparability in the first case all thematically relevant publications from

1999 up to the year 2019 were included, while in the case of the reference sample only studies and citations up to the year 2009 were included (see method section).

Tab. 2: Comparison of the average citation rates of the biomedical experts

	Previous Pandemics	Covid-19 Pandemic
N	104	126
Mean	25 (Benchm. 19)	41 (Benchm. 28)
Median	8,4	29
Modus	0	0
Minimum	0	0
Maximum	403	558
Sum	2,623	5,161
Percentil 25	0	0
50	8	29
75	36	62
90	65	96

Fig. 7: Beanplot of the distribution of average cites per paper without outliers (2) (mean red marked, blue are the benchmarks)



This comparison thus also indicates that, in contrast to earlier coverage of pandemics, the current Covid-19 pandemic is characterised by the fact that, on average, reference is made to more reputable or acknowledged experts than would be expected in a random selection and to significantly more experienced experts than in the reference group (Mann-Whitney-U Test: Z= -2,82, p= .005). The referencing in the Covid-19 coverage in the four media titles we examined is biased differently than expected in favour of those biomedical experts who have a standing in their field that is above the average. Thus, we cannot confirm our hypothesis.

7. Summary and conclusion

The selection of experts in media coverage on Covid-19 was criticized several times by communication scholars, among others, to be not very diverse. Our analysis cannot confirm these individual impressions. We find that the selection of experts for German media coverage on Covid-19 is not dominated by scientific experts but rather by strategically communicating actors from the political executive. Further, media coverage on Covid-19 is not focused on only a few scientific experts. The concentration on individual scientists was less pronounced in the Covid-19 coverage compared to previous pandemic debates.

In addition, in this study we ask if there is a connection between the public presence of scientific experts (through media coverage) and their scientific expertise. If this is the case, this could ideally contribute to a "knowledgeable society" (Lane, 1966, p. 649), which is characterized by sober pragmatism – mediated by scientific expertise – instead of ideology, ignorance or (science-related) populism (e.g., Mede & Schäfer, 2020). It is of undeniable relevance whether public discourses are shaped by scientific experts who, as a rule, know what they are talking about due to their many years of research activity in a field. We can answer our question with yes. We can state that the public presence of life science experts on Covid-19 is biased in favour of those who have an above-average expertise in their field.

At the same time, in view of the relevant but very scanty state of research on the relationship between public presence and scientific expertise, we have to note that with this finding we cannot confirm previous study results that refer to other science-related debates (Boyce, 2006; Dunwoody & Ryan, 1987; Goodell, 1977; Lehmkuhl & Leidecker-Sandmann, 2019; Shepherd, 1981). Beyond the small, specialised science press expertise is not usually used by journalism as a criterion for expert selection. This raises the question of how a disproportionately high public presence of top scientific experts can plausibly be explained. We do not want to discuss this question extensively, but only mention a few possible reasons that seem particularly important to us.

From our point of view, the most important reason is the enormous social relevance of the issue. This, above all, may have contributed to the fact that high-ranking scientific experts have mobilized resources to a considerable extent in order to share findings and expertise publicly. This, in turn, is likely to have fuelled the enormous political explosiveness of these findings and expertise, which was particularly evident at the beginning of this pandemic. Looking at the presence of high-level experts in the public sphere in other, less relevant public debates, one may conclude: If it is really important, they are there!

In addition, activities of influential intermediary actors such as the *Science Media Center Germany*, especially at the beginning of the pandemic, may also have contributed to bringing highly reputable scientists into the public eye. Ultimately, however, the role of such intermediaries cannot be assessed on the basis of this analysis. The sample studied here is clearly too small to discuss such detailed questions, which leads to another possible reason that needs to be discussed.

The overrepresentation of highly reputed experts, especially in comparison with previous pandemic debates, could also be an artefact resulting from ‘undersampling’. Due to capacity constraints, we were only able to examine in detail a tiny fraction of a huge number of articles, which exceeds the number in previous pandemics by a factor of 16. It is therefore very likely that we have mainly those scientific experts in the sample who were referenced comparatively often in the period under investigation. Accordingly, we have only inadequately recorded scientific experts who were

referenced more selectively. Therefore, our study ultimately only provides an answer to the question of the expertise of the very frequently referenced scientific actors; it does not provide an answer to the expertise distribution of the entire biomedical experts who have publicly commented on Covid-19 in the four media titles examined here. Differences in sampling could therefore explain, at least in part, why the expertise of Covid-19 experts differs so markedly from that of previous pandemics and also other comparative issues.

Although, in summary, there are considerable uncertainties regarding the expertise distribution of the expert community as a whole, we consider the findings to be reliable, at least with regard to the frequently referenced biomedical experts in the four media titles examined.

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