BMJ Open Quality COVID-19 advocacy bias in the BMJ: meta-research evaluation

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ABSTRACT

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Dr John P A Ioannidis; jioannid@stanford.edu **Objectives** During the COVID-19 pandemic, *BMJ*, a leading journal on evidence-based medicine worldwide, published many views by advocates of specific COVID-19 policies. We aimed to evaluate the presence and potential bias of this advocacy.

Design and methods Scopus was searched for items published until 13 April 2024 on 'COVID-19 OR SARS-CoV-2'. BMJ publication numbers and types before (2016-2019) and during (2020-2023) the pandemic were compared for a group of advocates favouring aggressive measures (leaders of both indieSAGE and the Vaccines-Plus initiative) and four control groups: leading members of the governmental SAGE, UK-based key signatories of the Great Barrington Declaration (GBD) (favouring more restricted measures), highly cited UK scientists and UK scientists who published the highest number of COVID-19related papers across science (n=16 in each group). Results 122 authors published >5 COVID-19-related items each in BMJ: 18 were leading members/signatories of aggressive measures advocacy groups publishing 231 COVID-19-related BMJ documents, 53 were editors. journalists or regular columnists and 51 scientists were not identified as associated with any advocacy. Of 41 authors with >10 publications in BMJ, 8 were scientists advocating for aggressive measures, 7 were editors, 23 were journalists or regular columnists and only 3 were non-advocate scientists. Some aggressive measures advocates already had strong *BMJ* presence prepandemic. During pandemic years, the studied indieSAGE/Vaccines-Plus advocates outperformed in BMJ presence leading SAGE members by 16.0-fold, UK-based GBD advocates by 64.2-fold, the most-cited scientists by 16.0-fold and the authors who published most COVID-19 papers overall by 10.7-fold. The difference was driven mainly by short opinion pieces and analyses.

Conclusions *BMJ* had a strong bias in favour of authors advocating an aggressive approach to COVID-19 mitigation. Advocacy bias may influence public opinion and policy decisions and should be mitigated in future health crises in favour of open and balanced debate of different policy options.

INTRODUCTION

Science ideally develops conclusions from systematic evidence and balanced analysis of risks, intervention benefits and harms and uncertainties.¹² In contrast, advocacy groups lobby for specific policies, often in unilateral fashion not reflecting the full complexity of the issues involved. Advocacy has an

WHAT IS ALREADY KNOWN ON THIS TOPIC

- ⇒ Advocacy of policy by scientists is intensely debated for its merits to science and policy.
- ⇒ Many journals increasingly publish pieces by advocates, and it is thus important to understand the nature, scale and impact of this phenomenon.

WHAT THIS STUDY ADDS

- ⇒ This study provides a detailed quantitative assessment of journal-promoted advocacy, focusing on one of the world's leading medical journals, the BMJ.
- ⇒ We show that *BMJ* had massive bias towards specific COVID-19-related advocacy favouring aggressive measures.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ Our study reveals a need for editorial guidelines on journal-promoted advocacy.

important mission in raising awareness of critical needs. However, it may also be biased towards special ideological or financial interests that could sometimes harm society by unbalanced resource allocation.³⁴

Leading medical and scientific journals publish many opinion, editorial and journalistic pieces, and these could shape how science and evidence are perceived and what policies are adopted. These pieces are typically published quickly, often with little or no external review. Sometimes they may reflect overt advocacy that may increase the danger of bias and polarisation of the scientific community.⁵ As more journals move towards publishing more opinion and advocacy, ethical guidelines are warranted.⁶

During the COVID-19 pandemic, sciencebased advocacy was common.⁷ While some argued for milder mitigation with restricted measures focused primarily on those at highest risk (eg, the Great Barrington Declaration (GBD)⁸,), others argued for mass suppression of the virus (eg, the John Snow memorandum (JSM)¹⁰) or for elimination using aggressive lockdown measures, intense testing and contact tracing, social distancing, masking and air monitoring and air cleaning interventions ('zeroCovid').¹¹ ¹² Understanding the presence of this advocacy in leading medical journals, given the historical importance of the issues involved, may help inform the development of better guidelines for science-based advocacy in medical journals.

Here, we aimed to quantify the potential COVID-19 advocacy bias in the BMJ. BMJ is a leading journal with tremendous influence worldwide, arguably the premier journal championing evidence-based medicine with rigorous methods and protection from bias and conflicts of interest. We evaluated the share of advocates, editors, journalists/columnists and independent scientists among the most prolific authors of COVID-19-related work in the BMJ; and assessed how BMJ published items authored by publicly declared advocates of aggressive measures (those who were leading members of both the Independent Scientific Advisory Group for Emergencies (indieSAGE)^{13 14} and the Vaccines-Plus initiative)¹⁵ relative to other scientist groups.

METHODS Design

This is an exploratory meta-research analysis, and thus no protocol was preregistered. We explored two research questions: (1) whether some advocacy was enriched in *BMJ* relative to the most prolific authors of COVID-19related papers with UK addresses in the general literature (enrichment analysis) and (2) how strongly the dominant advocate group outperformed other groups of scientists in numbers of *BMJ* publications (controlled advocacy bias analysis) before (2016–2019) and during (2020–2023) the pandemic. We followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines in reporting the controlled comparison.

Advocacy groups of interest

We focused on advocacy groups with clear, visible presence and public listing of key members. In the bibliometric analysis of prolific authors, we studied eight main advocacy groups: (1) indieSAGE members/key advisors (UK-based)¹⁴; (2) World Health Network (WHN) advocates defined as cosignatories on the Lancet WHN letter¹⁶ (this group is led from the USA but also advocated elimination and its advocacy letter from October 2021 features many indieSAGE advocates); (3) advocates on the Vaccines-Plus letter, which contains UK and non-UK advocates but was initiated by UK indieSAGE advocates¹⁵; (4)JSM cosignatories on the original Lancet paper (contains non-UK signatories but was initiated by scientists affiliated with zeroCovid advocacy); (5) GBD; (6) UK-led CollateralGlobal (CG); (7) UK-based UsForThem; (8) UK-led Health Advisory & Recovery Team (HART). Groups 1-4 advocated for more aggressive policies, whereas groups 5-8 advocated for more restricted policies. Details on the eight groups are summarised in supplementary text in the online supplemental file 1.

Data extraction

Data were extracted by two researchers independently (for the SCOPUS data: JPAI and IC; for the *BMJ* data: KPK and JPAI) and discrepancies were discussed with a third researcher (KPK or IC, respectively). A predesigned data extraction was developed that included use of the *BMJ* website's advanced search method with manual inspection of all collected documents to reduce misclassification. Information collected included the *BMJ* ID of the publication, the document type, the authors, and the publication year. Details of specific data protocols and extracted data are described below.

Initial bibliometric analysis: most prolific COVID-19 authors

We searched Scopus for items published in the BMJ until 13 April 2024 on COVID-19 using the search string 'COVID-19 OR SARS-CoV-2' in all fields. The most prolific authors were checked for being at any time members (indieSAGE webpage, HART group, UsForThemUK) or cosignatories (main authors of the advocacy letters) of the eight initiatives listed above; editors, regular columnists or journalists; or, if none of these, other scientists. Members of official organisations like the WHO and the Royal Society of Medicine and patient interest groups not clearly aligned with a pandemic policy were included in the 'other scientists' group. The analysis focused on those with six or more COVID-19-related publications in the BMJ, with special emphasis also on those with >10 such publications. This cut-off was used to make the analysed list manageable and comparable in size to the top 100 most prolific UK-based scientists' overall publishing on COVID-19, which were also obtained from Scopus, excluding journalists, in any publication venue.

Bibliometric analysis: controlled comparisons

Given the strong presence of indieSAGE and aligned advocacy groups in the retrieved documents, we performed additional analysis to investigate if the frequency of authorships and publications were biased. In order to ensure that we analysed clear rather than short-term or low-commitment advocacy, our primary group of interest included the 16 scientists who were both members or key advisors of indieSAGE and coauthors of the Vaccines-Plus advocacy letter. We specifically evaluated whether indieSAGE/Vaccines-Plus advocates published more papers in *BMJ* during the pandemic years 2020–2023 as compared with the prepandemic years 2016–2019, and compared with other control groups of authors.

We considered four control groups, aiming to have exactly n=16 authors in each for balance against the indieSAGE/Vaccines-Plus group: the first control group included the 16 members of SAGE who attended at least four of the first nine meetings of SAGE in early 2020.¹⁷ This comparison contrasts official government advisers versus self-organised advocates.

The second control group included the 16 scientists with a UK affiliation who were the most highly cited according to a database of composite citation indicators¹⁸

and whose primary field in that database was considered to be relevant to *BMJ* according to the Science-Metrix classification and field nomenclature: General & Internal Medicine; Epidemiology; Neurology & Neurosurgery; Nutrition & Dietetics; Respiratory System; Substance Abuse; Cardiovascular System & Hematology; Developmental & Child Psychology; Psychology; Statistics; Psychiatry; Immunology. We used the most updated citation database that focuses on the citation impact in a single most recent calendar year (2022) rather than whole career-long impact, so as to capture contemporary impact. This comparison contrasts advocates against the most extremely highly cited scientists.

The third control group included the 16 UK-based scientists who are listed by name in the GBD website.⁸ This comparison contrasts two opposing advocacy groups with anti-diametric views.

The fourth control group included the 16 UK-based scientists who published the highest number of COVID-19 papers overall across all journals indexed in Scopus (excluding any indieSAGE members and current or previous editors such as Richard Horton from Lancet and Richard Smith and Fiona Godlee from *BMJ*). This comparison contrasted the advocates against a group with maximal interest in publishing COVID-19-related work.

For each author in the indieSAGE/Vaccines-Plus group and in each of the control groups, we examined whether they were among the top 2% most-cited authors in their field according to the composite citation indicator for single-year impact in 2022¹⁸ and in 2019.¹⁹ We then counted the number of publications they had authored in BMJ each year between 2016 and 2023, using the advanced search method of the BMJ website on author name (and affiliation, in cases of doubt), counting all document types. Membership of consortia also counted as authorship. The indieSAGE letter to BMJ was only counted to the main author, although other indieSAGE advocates cosigned it, given that it was merely a response to another paper. One letter listing indieSAGE as an author by itself was also not included. Given the large number of total counts, these two choices do not affect any conclusions of our work.

The search was done both for all document types without restriction, and restricted to COVID-19-related pieces (defined by presence of 'COVID', 'SARS' or 'Pandemic' in the text, abstract or title (using option: any word)). We also examined data for 2024 (up to 20 April 2024) to explore potentially differential evolution of publication patterns in the postpandemic era. Publications were classified into four major groups: Original Research (Research), Review and Methods (Review, Research Methods and Reporting, Practice), Analysis (lengthy narrative papers that include opinion and occasionally also some data) and Short Opinion (all other identified items: Views and reviews, Editorial, Opinion, Feature, Letter, Observation). Obituaries were not included in the analysis.

Statistical analyses

We present descriptive statistics and avoid statistical testing of hypotheses given the exploratory nature of the evaluation.

RESULTS

Bibliometric analysis: most prolific COVID-19 authors

BMJ published 4075 COVID-19-related items by 13 April 2024. One hundred and twenty-two authors published more than five (up to 330 in the case of a journalist) COVID-19-related items each in the BMJ (online supplemental table S2). They included 18 advocates of aggressive policies (indieSAGE n=9, including a *BMJ* freelance journalist), WHN n=5, Vaccines-Plus n=12 (including the same BMJ freelance journalist), JSM main authors n=11 (20 if including low-level JSM cosignatories defined as signatories not featuring as main authors on the associated paper), with substantial overlap. The other prolific authors were 53 editors, columnists or journalists, and 51 other scientists not identified as associated with any advocacy. The 18 advocates of aggressive policies published 231 COVID-19-related papers in BMJ. An advocate who was a member of indieSAGE left the organisation in September 2020 and later joined CG that advocated for restricted measures. Since this advocate published three papers in 2020 before indieSAGE was formed, four while a member and six after indieSAGE membership and the CG involvement started only in 2024, we classified this advocate as belonging to indieSAGE to avoid double counting. The prolific BMJ editors and journalists published about half of all BMJ COVID-19-related papers (n=564 and n=1355, respectively). Among 41 authors publishing >10 items in BMJ, 8 were advocates of aggressive policies, 0 of restricted measures, 7 were editors, 23 journalists/columnists and 3 were non-advocate scientists.

Conversely, among the 100 most prolific authors of COVID-19-related papers with a UK address, there were only 3 advocates of aggressive measures, 2 BMJ editors, 16 editors of other journals and 79 other scientists (online supplemental table S3). If analysis was restricted to publications retrieved with COVID-19 OR SARS-CoV-2 in 'Article title, Abstract, Keywords' rather than 'All fields' in Scopus, the aggressive advocacy bias was similarly very large (online supplemental table S2). Figure 1 summarises these results on the representation of the studied advocates, editors, columnists and journalists in *BMJ* versus the overall UK-based literature.

Bibliometric analysis: controlled comparisons

To understand whether the enrichment seen in figure 1 also translated into an actual publishing bias, we report below a controlled publication analysis using five comparison groups to account for various types of confounding. All five groups of n=16 included excellent, high-impact scientists, as testified by the high proportion who were in the top 2% based on composite citation indicator data for their most recent year impact. For 2019 citation data,



Figure 1 Most-prolific authors. Left: 122 authors with more than five *BMJ* COVID-19-related publications. Middle: 41 authors with more than 10 *BMJ* COVID-19-related publications. Right: 100 authors with 74 or more (up to 253) COVID-19-related publications with any UK address published in any venue (journalists excluded). One indieSAGE member subsequently advocated restricted measures (CG) in 2024; this special case was classified as aggressive measures advocacy, as best reflecting the *BMJ* publications of the study period.

9/16 in the indieSAGE/Vaccines-Plus group, 10/16 of the SAGE group, 8/16 of the GBD UK group, 16/16 of the UK most highly cited group and 12/16 in the group of UK scientists who published most COVID-19-related publications overall belonged to the top 2% most-cited scientists. In 2022 citation data, respective figures were 12/16, 10/16, 8/16, 16/16 and 16/16 (online supplemental table S4).

Table 1 shows the total number of authorships in the *BMJ* for the five groups. In the prepandemic period, the group of the most-cited scientists had the strongest presence in Research articles, while scientists who

TI=T0 autilors					
	Total	Research	Opinion	Review/methods	Analysis
2016–2019 (prepandemic)					
IndieSAGE/Vaccines-Plus	88	3	74	0	11
SAGE	4	1	2	0	1
GBD UK	0	0	0	0	0
UK most highly cited	32	20	7	3	2
UK most COVID-19 papers	9	3	5	1	0
2020–2023 (pandemic)					
IndieSAGE/Vaccines-Plus	385	18	330	7	30
SAGE	24	17	4	0	3
GBD UK	6	4	2	0	0
UK most highly cited	24	6	14	3	1
UK most COVID-19 papers	36	25	8	2	1
2024 (postpandemic)					
IndieSAGE/Vaccines-Plus	16	0	16	0	0
SAGE	0	0	0	0	0
GBD UK	0	0	0	0	0
UK most highly cited	4	0	3	0	1
UK most COVID-19 papers	1	1	0	0	0
GBD. Great Barrington Declaration.					

 Table 1
 Number of BMJ authorship appearances for indieSAGE/Vaccines-Plus advocates and four control groups, each with n=16 authors





Figure 2 Historic development of unique number of *BMJ* publications featuring any member of the five studied groups of n=16 authors each (all publications with no content restriction). GBD, Great Barrington Declaration.

subsequently became indieSAGE/Vaccines-Plus advocates had quite strong presence in writing opinion pieces and scientists who subsequently became GBD advocates had practically no presence in the *BMJ*.

During pandemic years, indieSAGE/Vaccines-Plus advocates massively outperformed in *BMJ* presence all four control groups: 16.0-fold compared with leading SAGE members, 64.2-fold compared with the GBD advocates, 16.0-fold compared with the most-cited group and 10.7-fold compared with the most prolific on COVID-19 group. The dominance of indieSAGE/Vaccines Plus advocates was most overwhelming in the Short Opinion group, where they outperformed the four control groups by 82.5-fold, 165-fold, 23.6-fold and 41.3-fold, respectively; and in Analysis articles (10–30-fold, depending on comparison group). In the postpandemic year, indieSAGE/Vaccines Plus authors seem to still publish many opinion pieces, while GBD authors have published nothing in the *BMJ* and the other three groups also had limited presence.

Although some publications were coauthored by several advocates, when reducing the analysis to unique publications, a very similar picture was evident (online supplemental table S5). Comparing the prepandemic and pandemic years, although two indieSAGE/Vaccines-Plus associates already published many opinions in *BMJ* before 2020, the bias was massively enhanced during pandemic years (figure 2).

A total of 338 (72%) of 475 authorships during the pandemic years 2020–2023 of the members of the five groups were on COVID-19-specific publications. The extreme dominance of indieSAGE/Vaccines-Plus remained similar when analysis for 2020–2023 was limited to COVID-19-specific publications (table 2).

Table 2	Number of BM	J authorship a	ppearances fo	r indieSAGE	/Vaccines-P	lus advocates	and four	control g	groups,	each with
n=16 aut	hors, limited to	published item	ns that are CO	VID-19-spec	ific					

	Total	Research	Opinion	Review/methods	Analysis		
2020–2023 (pandemic)							
IndieSAGE/Vaccines Plus	272	17	221	7	27		
SAGE	21	15	3	0	3		
GBD UK	6	4	2	0	0		
UK most highly cited	11	1	9	0	1		
UK most COVID-19 papers	28	20	5	2	1		
GBD. Great Barrington Declaration.							

The relative presence in the *BMJ* of the different indieSAGE/Vaccines-Plus members varied substantially. During 2020–2023, one member who also served as a freelance journalist published 180 opinions and views (97 of them COVID-19-related) in the *BMJ*. Even without this author, the bias remained massive (online supplemental tables S6 and S7). Among other indieSAGE/Vaccines-Plus members, one published 81 papers (69 COVID-19-related) in the same period, and another published 29 (28 COVID-19-related), while the others had less prolific contributions.

DISCUSSION

Our analysis suggests that BMJ massively published advocate authors championing zeroCovid policies and later, other indieSAGE-led aggressive approaches to COVID-19 during the pandemic. Leading members of SAGE, highly cited UK scientists and the most prolific researchers on COVID-19 across the entire scientific literature had very limited BMJ presence compared with the preferred advocates. Advocates of restricted, focused measures have been almost extinct from BMJ pages. BMJ editors, staff and apparently advocate contributors developed a massive literature, comprised mostly of opinion pieces that in general (as acknowledged by the BMJ) underwent no external review in the BMJ. The degree of apparent favouritism exhibited by what is considered to be the premier venue of evidence-based medicine is very concerning and invites further scrutiny.

Scientific journals have a responsibility to be balanced, objective and factual, giving that endorsement of specific ideological or political positions may distort evidence and lead to polarisation of the scientific community and loss of trust.²⁰ The intense advocacy by indieSAGE in *BMJ* was accompanied by UK media publishing many views by indieSAGE, with almost 200 being available on IndieS-AGE's own web page, and these views were sometimes confused with the official SAGE in British media.^{21 22} This confusion led to exposure of the British population to zeroCovid advocacy without appropriately recognising it as such. Given the worldwide influence of *BMJ*, the impact of this distortion probably had global consequences.

Advocacy may be associated also with hostility towards other scientists, both on social media and in *BMJ*, promoting obsessive forms of criticism.²³ In *BMJ*, SAGE modelling was held coresponsible for tens of thousands of deaths.²⁴ On Twitter/X, UK scientists were also criticised intensely (online supplemental table S8). In a letter in *BMJ Evidence Based Medicine*,²⁵ three WHN advocates called a paper on long covid²⁶ a 'Trojan horse' and accused the authors of ideological biases, while themselves declaring no association with WHN or indieSAGE. A paper on 'misinformation' in *BMJ*^{P7} by advocates studied here that criticised some other groups also lacked these declarations.

Some limitations of our work should be discussed. First, we only evaluated one major journal, and similar assessments in other leading journals seem warranted as part of a more general postpandemic meta-science evaluation. Discussion of journal-led science-based advocacy is needed. Leading journals with large, influential magazine sections, like the *BMJ*, are particularly important to study because they have major impact and can publish many opinion papers very quickly, while peer-reviewed research is far slower. *BMJ*, *Lancet*, *Nature* and *Science* have many editors, columnists and journalists who may publish hundreds of items in their pages, typically without external peer-review and disclosure of conflicts of interest.²⁸

The specific bias we observed here may also have occurred elsewhere. For example, the author who published most COVID-19-related publications in *BMJ* was also the most prolific academic in COVID-19-related publications in the *Lancet* (n=36 published items); and the second most-prolific in *BMJ* was also prolific in the *Lancet* (n=10 published items). Both were indieSAGE/Vaccines-Plus advocates, with most of their documents being opinion pieces. In the case of the *Lancet*, the highest number of COVID-19-related publications were anonymous editorials (n=65) or items authored by the editor-in-chief (n=50). The editor-in-chief himself also advertised 'noCOVID' aggressive mitigation advocacy.²⁹

Second, as submission statistics for individual authors are not available, our study only informs on the bias of the volume of publications. This bias is shaped both by the volume of submissions and rejection rates. The large majority of submissions to BMJ are rejected. Editors and advocates may shape what gets published through the editorial and peer-reviewing process, and authors with views not congruent with zeroCovid advocacy may even have stopped submitting to BMJ after seeing the overt bias that we describe here. The extreme (>10-fold) differences in publication volume between groups may reflect both submission volume and rejection rate differences. Nevertheless, it is implausible that indieSAGE advocate papers were >10 times 'better' than papers by, for example, the most highly cited UK scientists or the scientists publishing most research on COVID-19. Regardless, even if advocates submitted many times more papers to BMJ than other scientists, which is plausible, the editors should have a particular role in ensuring that a flood of zeroCovid-associated advocacy was reasonably checked by counterviews.

We encourage the *BMJ* to release information that could illuminate these questions further, including how many papers the scientists analysed here were invited to review. In support of this concern, we preliminarily explored the available reviewer names of the 64 COVID-19-related externally reviewed *BMJ* Research, Analysis and Review papers that were published by the 80 members of the five analysed groups of authors (17 Research and 22 Analysis for the indieSAGE/vaccines-Plus group and 37 by the other groups combined, which reduced to 25 unique documents after removing duplicates due to group authorship overlap). Nine of the 64 unique documents had been reviewed by at least one advocate of aggressive measures and zero by advocates of restricted measures; of these nine cases, seven were papers by indieSAGE, that is, advocates reviewed papers by other advocates belonging to the same advocacy group. For example, Greenhalgh reviewed Haque (BMJ 2021; 372: n693) and Scally and Kvalsvig reviewed McKee (BMJ2021; 372: n208; BMJ2022; 378: e069558). Two of the analyses written by indieSAGE on masks³⁰ and COVID-19 misinformation²⁷ did not have their peer-review reports available despite the journal policy of public reviews. These sparse data suggest strong advocacy coordination, but they need to be augmented by reviewer information on all COVID-19 papers submitted to the BMJ, including rejected submissions. Given that space in a competitive journal is very limited, the many advocate Analysis papers in BMJ and the editorial commissioning of many indieSAGE opinions³¹ may possibly have led to correspondingly less favourable acceptance rates for other scientists.

Third, the comparisons made here have various confounding effects. Dedicated advocates are by their very call to advocacy more likely to publish opinions. Our analysis has attempted to account for this confounding by comparing to diverse groups of other authors, including leading GBD scientists, who are also expected to have a call to advocacy. One of the indieSAGE advocates was a BMJ freelance journalist publishing 180 opinions and views during 2020-2023, many proposing wide-reaching public health policies with little or no evidence. Although this by itself raises questions and contributes to the massive bias observed here, the bias remains massive if this journalist is removed from the analysis (online supplemental tables S6 and S7). One could argue that SAGE as a comparison group has less inclination to publish pandemic opinion pieces by their role as official advisors; we controlled for this by comparing also to other highly cited UK scientists and non-advisor scientists with a clear research interest in COVID-19. The fact that the bias was massive regardless of what control group we used shows that all these potential confounders have limited effect compared with the total observed bias signal.

Fourth, views of advocates within an advocacy group may differ on some matters. Members of a group that proposes aggressive measures may not always have the same aggressive fervour on all issues. However, the differences in typically expressed views between the advocacy groups were stark and highly consistent throughout the pandemic and even seen as narrative opposites (eg, GBD and zeroCovid). Notably, all the 16 studied authors were members of indieSAGE which specifically recommended zeroCovid, a well-defined elimination policy, and authors representing the vast majority of the identified papers also advocated zeroCovid individually (online supplemental table S8). With this zeroCovid definition of 'exposure', misclassification of views is thus unlikely to substantially affect our controlled analysis. We note that we did not aim to appraise whether the claims and policy proposals of the advocates were correct or wrong, or if the methods used were worse than any other science-related advocacy

in circulation. However, the status of elimination policies as a minority position in the scientific community³² and the eventual infeasibility of zeroCovid³³ contrast strongly to the special preference that advocates of this position had in *BMJ*. This suggests that the bias was not only misplaced in quantitative terms but also misplaced or even devastatingly wrong in qualitative terms.

Fifth, we only examined advocates based on highly visible, uncontestable advocacy groups, but there are several other organisations, movements and initiatives that advocated and lobbied during the pandemic, often without having publicly listed memberships. Therefore, advocacy infiltration of the literature may be more prominent than what we observed.

Some suggestions for the future can be made based on our analysis. First, editors should consider placing a cap on how often they can host opinion pieces of any particular scientist (or even their own views) in a given calendar year. Editorial nepotism has been described to be a widespread problem.³⁴ Massive publication of non-evidencebased opinions by editors or favoured authors could distort consensus on available evidence in some critical circumstances. Original research articles rarely affect public policy by themselves, while opinions in major journals set the tone for far-reaching policy choices. Second, journals where massive advocacy bias and other forms of favouritism are demonstrated may wish to establish independent auditing to examine whether collusion affected editorial practices. Third, readers and the general public should be sensitised to these problems so as to avoid being misled in the future. This requires new empirical studies and clarified principles regulating science communication. Finally, journals may need to ensure space for debate articles where different views are juxtaposed, each supported by evidence, in the best interest of science and evidence-based policy-making.

Contributors KPK and JPAI had the original idea and all authors brainstormed in generating the protocol. All authors collected data and KPK and JPAI performed analyses. All authors interpreted analyses. KPK and JPAI wrote the paper and all authors edited the paper for content and approved the final version. JPAI is guarantor.

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Competing interests According to Scopus, JPAI has published 75 items over the last 30 years in the *BMJ* (categorised by Scopus as Articles (n=43), Reviews (n=12), Letters (n=10), Editorials (n=7) and Short Surveys (n=3) and is thus ranked 160th among the most-prolific authors in *BMJ*. Of the 75 items, 3 are related to COVID-19: a non-commissioned opinion piece where he has declared his opposition to signing petitions, memoranda, declarations and any other open advocacy letters as a means to settle scientific matters; a debate article on lockdowns; and an editorial on the peer review congress cosponsored by *BMJ* and his center (METRICS). IAC has published two Articles in *BMJ* and TM has published one Review in *BMJ*, all unrelated to COVID-19. KPK has not published in *BMJ* but coauthored an electronic response to a *BMJ* Analysis by indieSAGE with European epidemiologists. According to Scopus (all publications considered), JPAI has published 102 COVID-19-related items, TM has published 10, IAC has published 3 and KPK has published 10 COVID-19-related items.

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