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Editors' perspectives on the roles and tasks of peer reviewers in biomedical journals: A qualitative study

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Editors' perspectives on the roles and tasks of peer reviewers in biomedical journals: A qualitative study

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Abstract

Objective Peer reviewers of biomedical journals are expected to perform a large number of roles and tasks, some of which are seemingly contradictory or demonstrate incongruities between the respective positions of peer reviewers and journal editors. The aim of this study was to explore the perspectives of journal editors regarding the roles and tasks of peer reviewers in order to advance understanding of the findings from a previously conducted scoping review and to facilitate knowledge translation for improved communication and better outcomes in the peer review process.

Design Qualitative study

Setting Worldwide

Participants 56 journal editors from biomedical journals most of whom, were Editor-in-Chiefs (n=39), male (n=40) and worked part-time (n=50) at journals from 22 different publishers.

Methods Semi-structured interviews with 56 journal editors were conducted. Recruitment was based on purposive maximum variation sampling. Data were analysed thematically following the methodology by Braun and Clarke.

Results Journal editors' understanding of the roles and partly of tasks of peer reviewers are profoundly shaped by each journal's unique context and characteristics including financial and human resources and journal reputation or prestige. There was a broad agreement among editors on expected technical tasks of peer reviewers related to scientific aspects but show different expectations in the level of depth. We also found that most editors support the perspective that authorship experience is key to high-quality reviews while formal training in peer reviewing is not.

Conclusions These editors' accounts reveal issues of a social nature within the peer review process related to missed opportunities for journal editors to engage with peer reviewers to clarify the expected roles and tasks. From this, we conclude that the social dimensions of biomedical manuscript review should be made more explicit and acknowledged as an integral part of the peer review process that needs to be communicated through appropriate channels to authors and peer reviewers, and integrated into existing and future interventions aimed at improving peer review.

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3 **Keywords:** Peer review; Biomedical publishing; Scientific journal publishing; Qualitative research;
4 Stakeholder consultation
5

6 **Strengths and limitations of this study**

- 7 - This study is one of few qualitative studies that explore biomedical journal editors' views
8 regarding the roles and tasks of peer reviewers
- 9 - The participants were diverse in terms of characteristics related to the journals
- 10 - The majority of the participants were Editor-in-Chiefs, which may limit the generalisability of
11 the results
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17 **Introduction**

18 Peer reviewers of biomedical journals are key stakeholders in the editorial ecosystem, helping authors
19 to improve manuscripts and providing advice to scientific editors on their decision regarding the
20 acceptability of publishing papers. Despite their importance for scientific publishing, fundamental
21 principles such as the roles, tasks and core competencies of peer reviewers – including a minimum
22 standard of knowledge, skills, and characteristics that are needed to effectively deliver high quality
23 reviewer reports – are neither well defined, agreed upon, or formally established (1). While core
24 competencies have been to some degree established for journal editors (2) thus far this is not the case
25 for peer reviewers. In a recent scoping review (2019), we showed that there is a large number of roles
26 and tasks that peer reviewers of biomedical journals are expected to carry out. In this review, we
27 identified 76 'roles' referring to the overarching nature of peer reviewers' function and 73 'tasks'
28 referring more specifically to actions that fulfil these roles. Some of the roles and tasks seemed to
29 contradict each other, and apparent incongruities between the position of the peer reviewer and the
30 position of the journal editor were highlighted (3).

31 Given that peer review is a complex social process (4), qualitative methods may lead to a deeper
32 examination of the complexities of these processes compared to quantitative approaches. Therefore,
33 we decided to conduct a stakeholder consultation through interviews with biomedical journal editors
34 who lead the editorial process.

35 Our aim was to examine editors' experiences of interacting with peer reviewers and to characterise
36 their perspectives, expectations and understanding of the roles and tasks of peer reviewers.
37
38

39 **Methods**

40 **Study design**

41 We conducted semi-structured interviews with biomedical journal editors. The design of the study and
42 reporting of study results were informed by relevant guidance for reporting qualitative research (5).
43 Key methodological components are presented below; a detailed description of the study
44 methodology is available elsewhere (6).
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55 **Patient and Public Involvement**

56 It was not appropriate or possible to involve patients or the public in the design, or conduct, or
57 reporting, or dissemination of our research.
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Sampling and recruitment

We used purposive maximum variation sampling (7) to obtain as much diversity in the demographic and journal characteristics of study participants as possible. Interviewees were recruited from multiple sources, including the lead author's professional network within the Methods in Research on Research (MiRoR) project (8); from two publishers, namely, BioMed Central (BMC) and British Medical Journal (BMJ) publishing group; and attendees of the Eighth International Congress on Peer Review and Scientific Publication (9). In addition, interviewees were asked to recommend other editors who would potentially be interested in contributing to this study.

Since sample size is irreversibly linked to saturation, which in turn can only be operationalized during data collection (10), our approach to data collection and analysis was iterative. Thus, recruitment continued until saturation – conceptualized as the point at which no new codes and themes were identified from the data – was achieved.

Data collection

All interviews were conducted between October 2017 and February 2018 by the lead author (KG). Interviews were conducted either face-to-face or by telephone to accommodate for the geographical diversity and availability of study participants. A topic guide (Additional file 1) was used during the semi-structured interviews. The guide was initially informed by the outcomes of the scoping review (1), and was piloted and further refined over the course of the study, particularly after the first four interviews.

KG was a PhD student at the time of the interviews. She has previously experienced the peer review process in biomedical journals as an author and peer reviewer, and had undergone training in conducting qualitative interviews prior to data collection. She was supervised by DH, who has extensive experience of the peer review process in biomedical journals as an author, peer reviewer and journal editor.

Analysis

Interviews were transcribed verbatim and fieldnotes were written up after every interview. All documents were then imported into NVivo V.12 and subjected to thematic analysis as described by Braun and Clarke (11) and outlined in the protocol (6). In summary, a preliminary codebook was generated by two researchers (KG and DH) independently from a subset of six interviews (12) using both, deductive codes from topics in the interview guide and inductive content-driven codes. The remaining 50 interviews were coded by the lead researcher (KG), supervised by DH through regular meetings. In line with the iterative process of data collection and analysis, interviews were analysed in the order in which they were conducted. To assess saturation, the lead researcher documented the process of code development, updating the codebook after analysing each transcript. Saturation was achieved after 56 interviews.

To establish trustworthiness in this research, the step-by-step approach proposed by Nowell et al., which provides a detailed description of how to conduct a trustworthy thematic analysis, was followed (13). This approach used criteria for trustworthiness in qualitative research proposed by Lincoln and Guba (14) and shows how these can be achieved throughout the six phases of thematic analysis. The methodological techniques that we undertook to ensure a trustworthy analysis throughout our study are presented in Additional file 2.

Results

A total of 56 biomedical journal editors were interviewed (Table 1). Of these, the majority were male Editor-in-Chiefs who were based in 21 different countries. Most editors worked part-time at their respective journals, which were mainly specialty journals. Most journals employed a single-blind review process. There was a balance of journals with and without an impact factor. Most interviewees were editors of journals that are published through commercial publishers.

Table 1 Sample characteristics

Demographic characteristics	
Sex	Female (n=16), Male (n=40)
Position	Junior Editor (n= 1), Senior/Associate Editor (n=11), Co-Editor-in-Chief (n=4), Editor-in-Chief (n=39), Editorial Director (n=1)
Commitment	Part-time (n=50), Full-time (n=6)
Geographic location	Asia (n=2), Africa (n=1), North America (n=19), South America (n=3), Europe (n=28), Oceania (n=3)
Journal characteristics	
Journal specialty	General medicine and Mega journals* (n=13), Specialty (n=43)
Impact factor	Impact factor (n=27), No impact factor (n=29)
Peer review model	Single-blind (n= 38), Double-blind (n=7), Triple-blind (n=1), Open peer review (n=9), Post-publication (n=1)
Open access, Subscription, Mixed	Open access (n=35), Subscription (n=4), Mixed (n=17)
Publishers	Academic (n=9), Commercial (n=34), Mixed model** (n=13)

*A peer-reviewed academic open access journal designed to be much larger than a traditional journal by exercising low selectivity among accepted articles.

** Refers to journals that are either co-owned by medical societies and commercial publishers, or owned entirely by medical societies but operated through a commercial publisher

Roles of peer reviewers

Journal editors outlined a variety of roles, which coalesced around five domains. Peer reviewers should be: (1) Proficient experts in their field qualified to peer review; (2) Dutiful towards scientific community vs volunteers who deserve recognition; (3) Professionals; (4) Advisors to the editor; (5) Roles that peer reviewers should not perform

Peer reviewers should be 'Proficient experts in their field qualified to peer review'

There was agreement among editors that peer reviewers are experts in their field when they: (1) have expertise and demonstrate high-level knowledge in their subject area; (2) are up to date with existing

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3 evidence and practice guidelines; and (3) have experience of publishing their own research. However,
4 there was substantial disagreement on how these criteria are defined and understood, and how
5 'expertise' is operationalized.
6
7

8 One common narrative was that qualified peer reviewers are "experienced authors" who have a strong
9 reputation and publication record in "high-impact journals". Concurrently, a number of editors linked
10 the quality of the peer review report with the reviewers' writing and analytical skills, which they
11 believed are gained through extensive authorship in their field. In their view, authorship hones both
12 writing and reviewing ability, since authors are theoretically able to learn from review reports on their
13 own submitted manuscripts:
14

15
16 *"You learn by doing and if you have published let's say 200 articles then normally you are*
17 *also a good reviewer... and if you are a bad author of manuscripts then you are a bad*
18 *reviewer. And your opinion leaders are the sought after reviewers because they know the*
19 *field and can write well and can also analyse a manuscript from another author quite*
20 *well."* (Editor-in-Chief, specialty journal).
21

22 Interviewees also indicated that they had a preference for seasoned authors and opinion leaders in
23 the field over junior researchers. Here, their main concern was about fulfilling authors' expectations
24 of an objective peer review by recruiting an expert to review their manuscript:
25

26
27 *"Well first of all I think our reviewers ... are seasoned, they have to be experts, I mean*
28 *otherwise why are they reviewing? That is not fair to the author."* (Co-editor-in-Chief,
29 specialty journal)
30

31 However, several editors commented that the actual level of expertise needed to deliver a high quality
32 review report does not necessarily depend on publication record and seniority level. Some editors
33 considered reviewing to require a different type of skillset that is not necessarily developed through
34 writing or present by default. Other key factors drive review quality, such as "dedication of sufficient
35 time" and "hands on experience with the methods used". This is often the case with junior
36 researchers, who go through an active learning experience of applying methods for their own research
37 and receiving feedback on their work. Less experienced researchers' greater motivation to peer review
38 was also mentioned as a major driver of high-quality reviewer reports. For these reviewers, receiving
39 the invitation to review is in itself a confirmation of growing personal reputation and recognition by
40 the journal, and by the broader scientific community. At the same time, their supposed lack of self-
41 confidence due to their current low career status/standing within the scientific field could also drive
42 the delivery of high-quality reviewer reports, in a desire to establish and maintain their status within
43 the scientific community:
44
45

46
47 *"I will say that junior faculty and post doctorate fellows often write the best reviews*
48 *because they tend to be insecure and tend to over-compensate and to be very careful in*
49 *doing a good job."* (Editor-in-Chief, specialty journal).
50

51 In the same vein, a number of editors from non-high ranking journals commented that senior
52 reviewers' increasing scientific status and "self-regard" might lead to declining review report quality,
53 most commonly demonstrated by the "lack of detailed comments" or "two-line" review reports that
54 did not aim to help "to improve a manuscript", but only to judge publication potential. That being said,
55 "experienced" peer reviewers were still highly sought after by all interviewees. Since they typically
56 receive a high volume of reviewer requests, journal editors suspect that they prioritize their reviewing
57 time in favour of highly ranked journals, a behaviour that multiple journal editors unapologetically
58 reported practicing themselves when asked to perform a peer review. Although the least experienced
59
60

1
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3 reviewers are generally more available, most editors feel that they lack the degree of experience
4 required to conduct a good peer review and “focus excessively on technical details”, instead of the
5 “bigger picture” that more experienced reviewers are able to provide.
6

7
8 Regardless of preference for the type of peer reviewer, the vast majority of interviewees – except for
9 those editors working for high-ranking journals - acknowledged that it is hard to solicit peer reviewers
10 in general, particularly experienced ones:

11
12 *“And one of the things that we face is that we have on one side younger investigators,*
13 *willing to do the job. Sometimes they lack you know, the view and then you will have the*
14 *very established scientist who in most cases do refuse to make reviews. And so we have to*
15 *balance out ...these two extremes.”* (Editor-in-Chief, specialty journal).
16

17
18 Lastly, whilst peer reviewers were expected to fulfil the above outlined criteria to some degree,
19 interviewees did not consider the completion of a training or a course on peer reviewing as a
20 prerequisite or necessary qualification to become a peer reviewer. All interviewees stated that they
21 learnt to peer review manuscripts “by just doing it”, without having had previous training, and
22 suggested that this was also the case for the majority of the peer reviewers in biomedical journals.
23 Editors explained how one way of honing reviewing skills is through indirect feedback and comparisons
24 with fellow reviewers’ reports (i.e. operationalized through comparing their own feedback with that
25 of other peer reviewers for the same manuscript); and through the final decision taken by the Editor-
26 in-Chief on the fate of the manuscript.
27

28
29 *“We also tried to train our reviewers in an indirect way that is when a decision was*
30 *completed and when we send the decision letter to the author we usually carbon copy the*
31 *decision along with the comments of all the reviewers to all the reviewers so that every*
32 *reviewer can see and compare their comments, their own comments with the comments*
33 *of other reviewers and that would be a form of training for them.”* (Editor-in-Chief,
34 specialty journal).
35

36
37 There was a division of opinions on the usefulness of courses that aim to teach peer reviewing skills.
38 While several editors were receptive to the idea, others felt that they could only be useful to less
39 experienced researchers because they can only teach about the technicalities of the process and
40 cannot replace experience gained over time:
41

42
43 *“I learnt on the field. First, as an author and then, you know, when I become more*
44 *established a scientist, as a reviewer it is a long process, and difficult process... [with]*
45 *courses, you can learn the technicalities of the process but you know experience is very*
46 *relevant... courses do not help established scientists, they may help young scientists but*
47 *the courses won't give them experience in actually in the field.”* (Editor-in-Chief, specialty
48 journal).
49

50 51 **Peer reviewers should be ‘Dutiful towards scientific community vs. volunteers who deserve** 52 **recognition’**

53
54 The majority of interviewees repeatedly expressed their gratitude towards peer reviewers, whom they
55 most commonly framed as “volunteers” who perform peer review out of “altruistic motives”. Being
56 occasional reviewers themselves, editors were well aware of the many competing duties of peer
57 reviewers in the biomedical field - including research, teaching and/or clinical responsibilities –
58 between which reviewing has to be squeezed in. Many interviewees emphasised that reviewing is
59 “time consuming” and repeatedly described it as an “unpaid” and largely “unrecognised” role:
60

1
2
3 *“...Most of the work that is done on journals is uncompensated, and ... you are already*
4 *dealing with people who are very busy people in their professional lives, and so you are*
5 *really asking them to do things at nights and weekends for which they get really very little*
6 *recognition. And very little compensation if any.”* (Editor-in-Chief, specialty journal).
7

8
9 Given that the majority of editors face difficulties finding peer reviewers, several considered peer
10 reviewers to be a “precious resource” that needs to be treated with “care”. Interviewees reported
11 doing so through: (1) careful screening of submissions to ensure that only sufficiently good-quality
12 manuscripts are forwarded to peer reviewers (2) not overburdening good peer reviewers with too
13 many invitations; and (3) provision of recognition and rewards. Several recognition and reward
14 schemes were mentioned, which can be broadly divided into two categories: (1) Financial rewards
15 (free access to journal/publication discount) and small tokens of appreciation (e.g. mugs, books); and
16 (2) Rewards aimed at boosting career progress through official professional development (e.g.
17 Continuing Medical Education (CME) points; official letters for Continuing Professional Development
18 (CPD); and through journal rewards aimed at enhancing peer reviewers’ visibility, reputation and
19 credibility within the scientific community (e.g. being invited to become editors and/or editorial board
20 members, names published on journal website, invitations to social events).
21
22

23
24 In contrast to the more common perception of reviewers as “volunteers”, a small number of editors
25 commented that peer reviewers should consider the act of peer reviewing to be a “responsibility”,
26 “duty” and “obligation to their field” and to the scientific community in general. In their view, the
27 entire process relies on - and only works because of - the principle of reciprocity and researchers
28 perpetuating the development of the own research community. In their view, reciprocity should be a
29 strong motivational drive for peer reviewers:
30

31 *“Those of us who have a track record in publication get solicited for doing an awful lot of*
32 *reviewing and you have got to fit that in around your other time and you are doing it*
33 *because the process is important and you want your next paper to get properly reviewed*
34 *so you want to peer review the paper that you have been sent.”* (Interim Editor-in-Chief,
35 specialty journal).
36
37

38
39 A few editors were more critical of the rationale for reviewing “for free”, suggesting that the concept
40 of duty in peer reviewing had originally been coined and continued to be fostered by publishers for
41 profit-making purposes, and is now dated:
42

43 *“I mean they... they say this is your duty, you know it is your duty as a scientist to, you*
44 *know, do these things ... and give back, but ... really the journals ... certainly are profiting*
45 *now the authors are paying pretty good page charges, the reviewers aren’t getting paid,*
46 *and you know this could be an issue.”* (Editor-in-Chief, specialty journal).
47
48

49 **Peer reviewers should be ‘Professionals’**

50 Of the nine domains identified regarding the role of peer reviewers there was general agreement on
51 the need for reviewers to be: (1) Unbiased and ethical professionals; (2) Reliable professionals; (3)
52 Skilled critics
53

54 Editors outlined three aspects related to their expectation that peer reviewers should be ‘unbiased
55 and ethical professionals’ consistent with ‘scientific ideals’. These were: (1) being “fair” and “objective”
56 (i.e. peer reviewers are expected to evaluate and judge manuscripts in a fair and objective manner);
57 (2) “maintain confidentiality” (i.e. peer reviewers are expected keep manuscript content confidential
58 avoiding disclosure to others); and (3) “declare/avoid potential or actual conflict of interest”. Editors
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3 emphasized the importance of the latter most frequently. Some editors explained that conflict of
4 interest could potentially contribute to increased review quality but stressed that transparency is key.
5 They emphasized their own position as “decision makers” within the peer review process to assess and
6 decide whether the reported conflict of interest is prohibiting a fair and objective assessment.
7

8
9 Editors also unanimously agreed that peer reviewers should be ‘reliable professionals’ who should
10 “respond promptly to peer reviewer requests”. They should either accept or decline, but not “ignore
11 the invitation to review”, which is the more common frustrating practice reported by interviewees
12 from non-high ranking journals. The common understanding among all editors was that a good peer
13 reviewer report takes a substantial amount of time to be written, something that peer reviewers
14 should be aware of prior to accepting. They should be willing to devote sufficient time and attention
15 to the evaluation of manuscripts yet deliver the reviewer report within the agreed timeline out of
16 “respect” and “fairness” to authors, to the journal and the publisher.
17
18

19
20 Lastly, the majority of interviewees considered helping authors to “improve their manuscript” to be
21 the primary purpose of the peer reviewer, not to suggest a rejection or to “filter it out”. Therefore, the
22 need for reviewers to be ‘skilled critics’ was explicitly and implicitly voiced throughout the interviews.
23 As part of the improvement role, it was expected that peer reviewers provide “constructive criticism
24 embodying specific and addressable comments”. Peer reviewers were also expected to be “thorough
25 and detailed” and to “systematically address every aspect of the manuscript”. Another aspect
26 emphasised by interviewees was the need for an “evidence-based review”, where peer reviewers’
27 statements should be “supported by references” that aid the author and guide the editor.
28

29 Editors expected peer reviewers to be ‘respectful communicators’. They outlined basic principles of
30 courtesy such as “respect for the work of the authors”. Peer reviewers were expected to provide
31 comments that “serve a scientific purpose” whilst keeping in mind that they are criticising the
32 manuscript, not the authors. Appropriate communication was deemed to be crucial. Based on editors’
33 accounts that peer reviewers should be “kind” and offer “positive” comments to nurture and
34 “encourage” authors to improve their work, it became evident that peer reviewing should go beyond
35 the mere technical assessment of manuscripts, and thus has also a supportive role:
36
37

38
39 *“I often think the peer reviewers are incredibly negative, and they rarely have anything*
40 *positive to say. And I tend to feel, you know if somebody was reviewing my manuscript I*
41 *would want them to try to say at least one tiny little positive thing about what I have*
42 *done.”* (Editor-in-Chief, specialty journal)
43
44

45 **Peer reviewers should be ‘Advisors to the editor’**

46 Editors were explicit in their attribution of a primarily “advisory role” to peer reviewers. Our
47 interviewees perceived and stressed their own role as the “ultimate decision makers” who take
48 decisions based on the sum of the factors outlined above. They have the authority to “override peer
49 reviewers recommendations” and “ignore their opinion” if necessary thereby directly or indirectly
50 exerting influence on authors to modify their manuscripts:
51

52
53 *“...the peer reviewer is really playing an advisory role to the editors...it’s only the editors*
54 *that make a decision on whether to accept or not and how they want the paper to be*
55 *written.”* (Editor-in-Chief, specialty journal).
56

57 Editors made it clear that decision-making within the editorial process is shaped and influenced by the
58 interplay of a complex web of factors, including: (1) the editors’ own expert knowledge and ability to
59 assess different aspects of manuscripts; (2) peer reviewer reports; (3) authors’ replies; (4) discussions
60

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3 between editors and editorial board members during manuscript meetings where manuscripts
4 considered for publication are discussed; (5) the number and type of submissions received; (6) the
5 strategic approach of the journal; (7) consideration of readership, and (8) subjects related to
6 publishers. Thus, while peer reviewer reports play a key part, they are not the only element within the
7 equation. While scientific quality and value of submitted manuscripts were at the foreground,
8 interviewees were largely open about the influence of other non-scientific factors that play into their
9 decision making process. Nevertheless, the peer reviewer report was consistently regarded as a key
10 pillar supporting publication decisions, including peer reviewers' advisory role of providing the editor
11 with a "recommendation on the fate of the manuscript". With few exceptions, most editors reported
12 that their journal submission systems ask peer reviewers to indicate whether the manuscript should
13 be accepted (with major/minor revisions) or rejected:
14
15

16
17 *"...the most important thing for me is actually at the end, the advice to reject the paper or*
18 *have it revised."* (Editor-in-Chief, specialty journal).
19

20 Most editors were open about the substantial influence of peer reviewer recommendations on their
21 decision-making. This was rationalized in a variety of ways, which often co-exist. Editors partly deferred
22 their decision to peer reviewers when they felt uncertain about their own knowledge and ability to
23 assess the manuscript adequately, referring to the "trust" they extend towards experts in the field to
24 help in decision-making. Ticking the recommendation box was also useful to justify editorial decisions
25 to authors when the peer reviewer report did not convey a clear direction for the manuscript, and the
26 editor wants them to "come off the fence". Many editors reported deferring to additional peer
27 reviewers in case of disagreements between the initially selected peer reviewers - described as a
28 common occurrence. Another problematic aspect of the recommendation function was the lack of a
29 common understanding of what the individual recommendation categories actually mean. Since this
30 is a subjective recommendation, there are inherent variations in reviewers' views.
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34 **Roles that peer reviewers should not perform**

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36 The last domain focused on roles that peer reviewers are *not* supposed to perform. Editors' accounts
37 highlighted how peer reviewers regularly tend to comment on aspects that go beyond the content of
38 manuscripts that fall squarely within the remit of editors. Editors from non-high ranking journals
39 criticised peer reviewers who review manuscripts according to a self-determined quality threshold that
40 they project onto the journal, despite requests for an objective assessment.
41

42 *"...we would tell them to please review it like it is for the best and most influential journal*
43 *- we will make the decision on what to accept but we want an objective review of the*
44 *qualities of the study design and findings and so on - very often we would get the answer*
45 *saying "It's good for you"...but that's not what we want. Of course we know that we're not*
46 *going to get the best research, but regardless of that we would like to have an objective*
47 *assessment."* (Co-Editor-in-Chief, specialty journal).
48
49

50 Editors of lower-ranking journals felt resentful at this "arrogant" and "dismissive" attitude, and yet
51 were cognisant of the lower "quality" of the research that they receive and end up publishing in
52 comparison with high-ranking journals until their journal gains "visibility" through external recognition
53 in the form of an impact factor and becomes "attractive" to authors that offer better quality research:
54
55

56 *"So in this case my responsibility is mainly...to develop an important scientific new journal*
57 *with quite good quality, scientific quality with a significant impact factor that could be*
58 *attractive to the authors...So my, my task is to be attractive for authors and to expect that*
59
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3 *they will, they will send to our journal as a best quality articles, manuscript in the field.*
4 (Editor-in-Chief, specialty journal).
5

6 In contrast, since the motivation for reviewers to deliver a high-quality report in high ranking journals
7 was to maintain their status and reputation within the 'elite' scientific community, their reviewing
8 standards are likely to be different than those for lower-ranked journals:
9

10 *"I would be a bit surprised if someone would submit a really unkind, mean, unjustified*
11 *review [to top journals]. I mean the stakes are just too high, no one, no one wants to*
12 *submit a review like that and have the editors think poorly of them."* (Editor-in-Chief,
13 specialty journal).
14
15
16
17

18 Peer reviewer tasks

19 Editors outlined a number of tasks which coalesced around four domains: (1) Organisation and
20 approach to reviewing; (2) Make general comments; (3) Assess and address content for each section
21 of the manuscript; and (4) Address ethical aspects.
22
23

24 **Organisation and approach to reviewing**

25 At the beginning of the reviewer report editors prefer to see a "summary of the key points" of the
26 manuscript, which functions as a 'quality check' for editors "to be confident that they [the peer
27 reviewers] have read it and understood it [the manuscript]". The majority of editors expect reviewers
28 to provide a balanced view by identifying both "strengths and weaknesses of the manuscript". Editors
29 also expect peer reviewers to "identify flaws" and differentiate between "fatal and addressable flaws"
30 in order to understand and assess whether the manuscripts could be improved. Furthermore, a
31 number of editors suggested that it is helpful to differentiate between "major and minor comments".
32 It became evident that the approach to peer review is mostly aimed at helping editors in their decision
33 making process.
34
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37 **Make general comments**

38 Editors specified that they expect to see some general and overarching comments that provide an
39 "overall picture" of the "importance and significance" of the manuscript as well as "relevance to field
40 and (clinical) practice". Additional comments should focus on the general aspects of "validity",
41 "quality", "technical merit" and "rigor". The assessment of "novelty" and "originality" was mentioned
42 by a number of editors, however there was a clear divide between high-ranking journals and other
43 journals – with editors from the latter repeatedly acknowledged that manuscripts with "novel findings"
44 tend to be preferentially submitted to high-ranking journals.
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48 **Assess and address content for each section of the manuscript**

49 The majority of editors expected peer reviewers to thoroughly appraise the content of each manuscript
50 section. The "soundness of the methodology used" was most frequently mentioned by peer reviewers.
51 Generally, the level of detail expected of peer reviewers seemed to differ according to the resources
52 that journals had as well as the editors' own abilities. While this was oftentimes implicit, it was
53 apparent in the example of 'statistics'. For example, while a number of journals reported to employ a
54 "statistical review by default" other had to rely heavily on peer reviewers for that to supplement their
55 own limitations:
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58 *"...bringing expertise such as looking at the statistical analysis which is not my strong point*
59 *at all. So bringing that sort of expertise to it."* (Co-Editor-in-Chief, specialty journal).
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4 Another aspect that was repeatedly mentioned was the focus on 'spin' in the discussion/conclusion
5 section. Although not explicitly named as 'spin' editors want peer reviewers to look out for any "claims
6 that are not supported by the results", "overenthusiasm" and "extrapolation".
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8

9 **Address ethical aspects**

10 Editors reported that their submission systems typically offers two text boxes to peer reviewers – one
11 for comments to the authors and the other one for confidential comments to the editors. The latter
12 should be used by peer reviewers to advise the editor on any aspects related to "ethics" and 'research
13 integrity' such as suspicion of research misconduct and detrimental and questionable research
14 practices. The confidential comments are a means of avoiding any potential conflict arising from such
15 criticism between authors and reviewers.
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18 **Discussion**

19 This study provided an in-depth, behind-the-scenes account of 56 editors' experiences with, and
20 expectations towards, peer reviewers. We found that journal editors' understanding of the roles and
21 tasks of peer reviewers are profoundly shaped by each journal's unique context and characteristics,
22 including financial and human resources and journal reputation. Thus, in line with existing literature,
23 we found that editorial decision-making and expectations toward peer reviewers are unavoidably
24 shaped by social externalities that at times may have little to do with scientific content of the
25 manuscript (4,15). The complex system of social interactions underlying the decision-making process
26 was exemplified through the link between peer reviewers' recommendations and editorial decision-
27 making – this was a key aspect that our scoping review (3) had identified as requiring further
28 exploration during this study. We found that the majority of our interviewees gave considerable
29 importance to the reviewers' recommendations function, despite concerns regarding the lack of a
30 commonly agreed-upon definition of the available options, frequent disagreement among peer
31 reviewers (16) and existing bias (17). Given these limitations, editors should seriously consider doing
32 away with this requirement altogether. Instead, considerable efforts should be made to communicate
33 to peer reviewers to place their focus on the evaluation of strengths and weaknesses, major and minor
34 flaws of manuscripts across multiple dimensions and suggestions for improvement. This would also
35 help to realign the role of peer reviewers as 'advisors' rather than convey the idea that they are
36 decision makers. It would also help to delete some of the existing malleable boundaries of authority
37 and responsibility on the review process placing the editor in the sole decision maker position. This
38 recommendation is in line with existing research on relationship between external reviewers'
39 recommendations and the editorial outcome of manuscripts (18).
40

41 Furthermore, although we found considerable agreement among editors concerning technical tasks of
42 manuscript reviewing, there was an apparent difference in editors' expectations of the level of depth
43 and detail they would like to see in a reviewer report. Our study sample showcases the status quo of
44 the editors' market, where there are a few full-time journal editors. The remainder work on a part time
45 basis, usually for a symbolic or stipend-like payment, and combine their editorial responsibilities with
46 research, education, and/or clinical duties (31). Therefore, it might be the case that their own limited
47 time might lead to expectations of greater detail from reviewers. Journal resource availability might
48 also have an impact on their expectations, such as requests for comments related to statistical analysis
49 in the case of journals with fewer resources. Given these existing contextual journal differences and
50 hence peer review report requirements, better ways of communicating editorial expectations to peer
51 reviewers (who might review for different journals having different expectations) are needed.
52 Currently, these expectations are communicated through publishers' and journal-specific guidelines.
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3 However, various studies in this area suggest that these are often not readily available, or are generic
4 and non-specific (19) and thus do not properly convey expectations.
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7 Another key finding was interviewed editors' apparent lack of appreciation of the importance of formal
8 peer reviewer training. The majority embraced a somewhat simplistic and 'linear' view that 'good'
9 authors (i.e. usually defined as authors with extensive authorship in prestigious journals) make 'good'
10 peer reviewers. However, there is no evidence to support this perspective; evidence linking authorship
11 experience and academic qualifications to high-quality reviews is very limited. The only substantial
12 study in this field was unable to predict reviewer performance from easily identifiable types of
13 experience or qualifications. The study authors also found, contrary to the beliefs prevalent among our
14 interviewees, that factors such as academic rank and seniority do not predict performance (20). In fact,
15 studies that have attempted to determine whether some combination of peer reviewer experience
16 could predict the quality of their subsequent reviews found that the highest-rated reviewers tended
17 to be young, and that the quality of peer review did not correlate with academic rank (21–24).
18 However, most of these studies were relatively limited in size, were a sub-analysis of a study of some
19 other intervention, and are more than 20 years old; hence, the evidence base for this finding is limited.
20 Thus far, in the absence of additional research demonstrating the contrary, there are no criteria that
21 predict good peer reviewer performance.
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23
24 Given this situation, we believe that the skillset required to be a good author is not necessarily the
25 same as that required to be a good peer reviewer. In a recent study (2019) by Superchi et al. that
26 systematically reviewed tools used by journal editors to assess the quality of peer review reports, the
27 authors identified nine quality domains pertaining to peer reviewer skills, of which five (i.e.
28 relevance and originality of the study, interpretation of study results, strength and weaknesses,
29 manuscript presentation and organisation) arguably overlap with the skillset of authors. The remainder
30 are directly concerned with skills related to structure and delivery of the peer review report (25), which
31 we believe may not automatically follow from being a prolific author. Therefore, we propose that the
32 following four domains can, and in principle should, be taught to prospective reviewers: (1) structure
33 of the reviewer's comments; (2) characteristics of reviewer's comments including concepts such as
34 clarity, constructiveness, detail/thoroughness, fairness, knowledgeability and tone; (3) timeliness of
35 the review report; and (4) usefulness of the review report to editorial decision-making and manuscript
36 improvement. Based on the findings of this study, our previous scoping review (26) and the study by
37 Superchi et al., it appears that helping to improve the manuscript not only entails providing specific
38 and detailed comments about scientific aspects of the manuscript, but also comments that empower
39 and motivate authors – a skill that is closely aligned to the supportive function of peer reviewers that
40 also emerged from our study.
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42
43 Notwithstanding various surveys on educational needs of young clinicians and researchers across
44 different biomedical fields having revealed a strong interest in attaining better reviewing skills (27),
45 such training is still not commonly included in biomedical postgraduate education programmes. At the
46 same time, existing educational interventions have shown underwhelming results, and their wider
47 applicability remains questionable due to their relatively poor methodological quality (28).
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50 Given this lack of evidence we think it would be helpful to conduct research on the actual content of
51 peer reviewers' reports to help establish educational needs for peer reviewing (29).
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55 According to the majority of our interviewees, it is becoming increasingly difficult to find experienced
56 authors to review manuscripts. On the other hand, junior researchers are often more willing to accept
57 invitations, including from lower-ranking journals. This is in line with existing evidence (30) and is likely
58 to be due to differing levels of motivation (31). Thus, there is an opportunity for acknowledging that
59 the breadth and variety of reviewing roles and tasks may require a more granular approach by editors
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3 when assigning peer reviewers to a manuscript. Achieving a balance of senior and junior reviewers
4 would cater to their wide range of reviewing motivations, as well as to their individual expertise. At
5 the same time, the question of how to attract this ideal mix of reviewers remains. The rewards and
6 incentives offered by most journal editors among our sample are likely to be more attractive for junior
7 peer reviewers than senior reviewers. Based on editors' comments on the lack of effectiveness of the
8 provided incentives and the general difficulty to get peer reviewers to accept invitation across the
9 biomedical field (32,33) and offering higher-level rewards is key. For example, the majority of
10 reviewers are affiliated to academic institutions, which are therefore critical stakeholders in the peer
11 review process. If peer reviewing is incentivized and rewarded as part of one's academic career
12 advancement, it is likely to be as important - if not more important - than whatever journals can offer.
13 Some academic institutions, for example the University of Glasgow (34) have started rewarding peer
14 reviewer and editor responsibilities as a core requirement for academic promotion and achieving
15 tenure. Academic institutions may also play a key role in overcoming the existing dominance of journal-
16 based metrics, such as Journal Impact Factors, as the primary indicators or measures of the quality of
17 individual research articles. Our interviewees reported that peer reviewers apply different reviewing
18 standards as they deem fit to journals depending on their impact factor or 'status' within the field. This
19 in turn may have an impact on the quality of published research and is closely related to one of the
20 critical question identified in our scoping review "Who is responsible for publication of low-quality
21 manuscripts?". The peer review process is part of the social infrastructure of research (35), therefore
22 it is the responsibility of all actors to contribute to better research. Academic institutions and other
23 stakeholders such a funders can play a key role to implement alternative measures of research quality
24 (36) and a stronger focus on research quality.

31 Limitations

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33 Our recruitment approach gave rise to a key limitation of this study. Based on our collective experience
34 as researchers and a former staff member of a biomedical journal (DH) that struggled with response
35 rates involving studies with editorial staff, we anticipated that it would be challenging to recruit journal
36 editors to participate in our research. The majority of journal editors of biomedical journals are part-
37 timers who concurrently work as practitioners, researchers, educators and may have other additional
38 roles. In the light of this situation, our employment of purposive maximum variation sampling resulted
39 in predominant contact with Editors-in-Chief. While one of the strengths of this study is that research
40 participants were diverse in terms of demographic characteristics and characteristics related to their
41 journal (Table 1), two thirds of participants had this role within their respective journal. Although the
42 lead researcher asked potential interviewees either to participate themselves or to recommend
43 suitable journal colleagues who could be contacted in their stead, it is likely that this approach led to
44 the relative homogeneity of our study sample. This may limit the generalisability of the results due to
45 the limited representation of other editorial staff members involved in the peer review process. Our
46 insights from the interviews and wider author and team experiences suggest that Editors-in-Chief
47 might primarily be responsible for higher-level tasks around the journal, and possibly be less involved
48 in the direct communication process with authors and peer reviewers. Therefore, there is a need to
49 explore whether the involvement of editorial staff in other positions would have produced convergent
50 or divergent findings.

56 Conclusion

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58 This study provides more context for, and details about, the roles and tasks of peer reviewers in
59 biomedical journals that we identified in our previously conducted scoping review. It also helps to
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3 explain attitudes and opinions expressed in existing surveys of editors, reviewers and authors on the
4 peer review process. Our research provides a greater understanding of the current status quo of the
5 review process and why particular issues arise around roles and tasks of peer reviewers, and offers
6 insight into how these issues can be addressed.
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8 Further research is needed on actual performance of peer reviewers looking into the content of peer
9 reviewer reports on a large scale to inform meaningful training interventions and to improve existing
10 guidance.
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20 Footnotes

21 **Contributors:** All authors have made substantive intellectual contributions to the development of
22 this manuscript. KG and DH jointly contributed to study conception and design. While KG led data
23 collection, analysis and writing of the manuscript DH led the supervision of all these steps and
24 approved the final manuscript.
25

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28

29 **Competing interests:** KG and DM had an advisory role with Publons Academy. At the time of data
30 collection for this study KG conducted a secondment at the BMJ. The remaining author (DH) declares
31 no competing interests.
32
33

34 **Patient consent:** Not applicable.
35

36 **Ethics approval:** This project has been evaluated and approved by the University of Split, Medical
37 School Ethics Committee. Ethical approval (Reference number 2181-198-03-04-17-0029) was granted
38 in May 2017. Prospective interviewees were provided with information about the study and asked to
39 sign a written consent form prior to commencing the interview. Before starting the interview, study
40 objectives were reiterated and additional information provided where necessary. Their consent to
41 participate was also audio-recorded. Copies of the invitation letter, information sheet, and consent
42 form are available from the leading author (KG).
43
44

45 **Data sharing statement:** The data generated and/or analyzed in the study are not publicly available
46 due to participant anonymity, but may be available from the corresponding author on reasonable
47 request that includes a study protocol, ethical approval and data use agreement.
48

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For peer review only

Topic guide for semi-structured interviews

Key area of investigation	Topics	Questions and prompts
Background information	<ul style="list-style-type: none"> - Explore personal background - Level of experience - Roles and tasks as an editor 	<ul style="list-style-type: none"> • Tell me about your journal and the job you have. • How long have you been in this position? • Did you hold any other editorial position before your current position? If yes, what were your responsibilities then? <p>Prompt: percentage of time devoted to editorial duties (e.g., part time, full time)</p> <ul style="list-style-type: none"> • What are your current responsibilities (roles and tasks)?
Journal set-up	<ul style="list-style-type: none"> - Explore journal set-up 	<ul style="list-style-type: none"> • Tell me about your journal - how does it work? <p>Prompt: availability of resources (e.g. human and financial resources), relationship with publisher</p> <ul style="list-style-type: none"> • How does the peer review process work in your journal? <p>Prompt: submission system, peer review model (e.g., single blind etc)</p> <ul style="list-style-type: none"> • What do you do within the process? <p>Prompt: Interaction with peer reviewers</p>
Opinion on peer reviewers roles and tasks	<ul style="list-style-type: none"> - Roles and tasks of peer reviewers - Expectations 	<ul style="list-style-type: none"> • What do you expect from peer reviewers in terms of their roles and tasks? • What about training for peer reviewers? <p>Prompt: use items from scoping review (roles and task related), attitudes and beliefs (e.g. on training, how they peer review themselves) , organisational expectations</p> <ul style="list-style-type: none"> • How do you let your reviewers know what you expect from them? <p>Prompt: journal guidelines</p> <ul style="list-style-type: none"> • Can you tell me about a specific situation when you were not satisfied with a review report or with a peer reviewer? • What did you do in that a situation? <p>Prompt: probe for factors other than being late with a review, or not doing a review once you they have accepted it</p> <ul style="list-style-type: none"> • Can you tell me about a situation when you were exceptionally satisfied with a review or with a peer reviewer? • Were there situations (in regards to the roles and task of reviewers) when you disagreed with the other editors you work with? What about? What happened? • What about other journals, do roles and tasks differ among journals in your field? <p>Prompt: if yes (i.e. differences exist), then:</p> <ul style="list-style-type: none"> • How does this affect the process? • How does it affect your communication? • How do you negotiate those differences? Does it matter?

<p>1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16</p> <p>Communication between editors, peer reviewers and authors</p>	<p>- Communication between the three parties</p> <p>- Potential conflicts</p> <p>- Power</p>	<ul style="list-style-type: none"> • Can you describe your experience of the communication process between editors, authors and peer reviews? • How do you communicate with authors and peer reviewers? • Can you give me some specific examples of situations where this communication is challenging? <p>Prompt: What are potential conflicts? When do disagreements arise? What happens if there is disagreement between peer reviewers?</p>
<p>17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60</p> <p>Conclusion</p>	<p>- Snowballing</p> <p>- Documents</p> <p>- Final comments</p>	<ul style="list-style-type: none"> • Is there anybody else whom you think I should speak to? • Any articles/documents I can access/should look at? • Any final comments? Is there anything else that you think is important to mention?

Actions undertaken to establish trustworthiness of analysis

Phases of thematic analysis	Techniques for establishing trustworthiness
Phase 1: Familiarizing with the data	Prolonged engagement with data (credibility) <ul style="list-style-type: none"> - KG performed multiple readings of all transcripts Reflexive journaling (confirmability) <ul style="list-style-type: none"> - Documentation of thoughts and potential codes/themes were taken during phase 1 and throughout the entire data analysis
Phase 2: Generating initial codes	Member-checking and peer debriefing (credibility) <ul style="list-style-type: none"> - The first six interviews were coded independently by two researchers (KG and DH) leading to the creation of the initial codebook Audit trail (confirmability) <ul style="list-style-type: none"> - Codebook was updated after every new interview creating an audit trail of the code generation
Phase 3: Searching for themes	Researcher triangulation (confirmability) <ul style="list-style-type: none"> - Regular team meetings to review findings from different perspectives - Diagramming/drawing to make sense of theme connections
Phase 4: Reviewing themes	Researcher triangulation (confirmability) <ul style="list-style-type: none"> - Regular team meetings to vet themes and subthemes Audit trail (confirmability) <ul style="list-style-type: none"> - We returned to raw data to check for referential adequacy
Phase 5: Defining and naming themes	Researcher triangulation (confirmability) <ul style="list-style-type: none"> - Team consensus on themes
Phase 6: Producing the report	Thick description (transferability) <ul style="list-style-type: none"> - The methodological approach and analytical choices were described in detail in previously published study protocol - We provide detailed descriptions of study results - Peer debriefing with researchers outside of the core group (IB and DM)

Consolidated criteria for reporting qualitative studies (COREQ): 32-item checklist

Developed from:

Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *International Journal for Quality in Health Care*. 2007. Volume 19, Number 6: pp. 349 – 357

YOU MUST PROVIDE A RESPONSE FOR ALL ITEMS. ENTER N/A IF NOT APPLICABLE

No. Item	Guide questions/description	Reported on Page #
Domain 1: Research team and reflexivity		
<i>Personal Characteristics</i>		
1. Interviewer/facilitator	Which author/s conducted the interview or focus group?	Page 3
2. Credentials	What were the researcher's credentials? E.g. PhD, MD	Page 3
3. Occupation	What was their occupation at the time of the study?	Page 3
4. Gender	Was the researcher male or female?	N/A
5. Experience and training	What experience or training did the researcher have?	Page 3
<i>Relationship with participants</i>		
6. Relationship established	Was a relationship established prior to study commencement?	N/A
7. Participant knowledge of the interviewer	What did the participants know about the researcher? e.g. personal goals, reasons for doing the research	N/A
8. Interviewer characteristics	What characteristics were reported about the interviewer/facilitator? e.g. Bias, assumptions, reasons and interests in the research topic	Page 3
Domain 2: study design		
<i>Theoretical framework</i>		
9. Methodological orientation and Theory	What methodological orientation was stated to underpin the study? e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis	Page 2 (previously published study protocol)
<i>Participant selection</i>		
10. Sampling	How were participants selected? e.g. purposive, convenience, consecutive, snowball	Page 2
11. Method of approach	How were participants approached? e.g. face-to-face, telephone, mail, email	Page 2-3

12. Sample size	How many participants were in the study?	Page 2-3, and published study protocol
13. Non-participation	How many people refused to participate or dropped out? Reasons?	N/A
<i>Setting</i>		
14. Setting of data collection	Where was the data collected? e.g. home, clinic, workplace	N/A
15. Presence of non-participants	Was anyone else present besides the participants and researchers?	N/A
16. Description of sample	What are the important characteristics of the sample? e.g. demographic data, date	Page 3-4
<i>Data collection</i>		
17. Interview guide	Were questions, prompts, guides provided by the authors? Was it pilot tested?	Page 3, additional file
18. Repeat interviews	Were repeat interviews carried out? If yes, how many?	N/A
19. Audio/visual recording	Did the research use audio or visual recording to collect the data?	Page 3
20. Field notes	Were field notes made during and/or after the interview or focus group?	Page 3
21. Duration	What was the duration of the inter views or focus group?	Methods
22. Data saturation	Was data saturation discussed?	Page 3
23. Transcripts returned	Were transcripts returned to participants for comment and/or correction?	N/A
Domain 3: analysis and findings		
<i>Data analysis</i>		
24. Number of data coders	How many data coders coded the data?	Page 3
25. Description of the coding tree	Did authors provide a description of the coding tree?	N/A
26. Derivation of themes	Were themes identified in advance or derived from the data?	Page 2-3
27. Software	What software, if applicable, was used to manage the data?	NVivo
28. Participant checking	Did participants provide feedback on the findings?	N/A
<i>Reporting</i>		
29. Quotations presented	Were participant quotations presented to illustrate the themes/findings? Was each quotation identified? e.g. participant number	Page 4-10
30. Data and findings consistent	Was there consistency between the data presented and the findings?	Page 11-13
31. Clarity of major themes	Were major themes clearly presented in the findings?	Page 4-10
32. Clarity of minor themes	Is there a description of diverse cases or discussion of minor themes?	Page 4-10

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For peer review only

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Editors' perspectives on the roles and tasks of peer reviewers in biomedical journals: A qualitative study

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Editors' perspectives on the roles and tasks of peer reviewers in biomedical journals: A qualitative study

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Abstract

Objective Peer reviewers of biomedical journals are expected to perform a large number of roles and tasks, some of which are seemingly contradictory or demonstrate incongruities between the respective positions of peer reviewers and journal editors. Our aim was to explore the perspectives, expectations and understanding of the roles and tasks of peer reviewers of editors from general and specialty biomedical journals.

Design Qualitative study

Setting Worldwide

Participants 56 journal editors from biomedical journals most of whom, were Editor-in-Chiefs (n=39), male (n=40) and worked part-time (n=50) at journals from 22 different publishers.

Methods Semi-structured interviews with journal editors were conducted. Recruitment was based on purposive maximum variation sampling. Data were analysed thematically following the methodology by Braun and Clarke.

Results Journal editors' understanding of the roles and partly of tasks of peer reviewers are profoundly shaped by each journal's unique context and characteristics including financial and human resources and journal reputation or prestige. There was a broad agreement among editors on expected technical tasks of peer reviewers related to scientific aspects but show different expectations in the level of depth. We also found that most editors support the perspective that authorship experience is key to high-quality reviews while formal training in peer reviewing is not.

Conclusions These editors' accounts reveal issues of a social nature within the peer review process related to missed opportunities for journal editors to engage with peer reviewers to clarify the expected roles and tasks.

Further research is needed on actual performance of peer reviewers looking into the content of peer reviewer reports to inform meaningful training interventions, journal policies and guidelines.

Keywords: Peer review; Biomedical publishing; Scientific journal publishing; Qualitative research; Stakeholder consultation

Strengths and limitations of this study

- This study is one of few qualitative studies that explore biomedical journal editors' views regarding the roles and tasks of peer reviewers
- The participants were diverse in terms of characteristics related to the journals
- The majority of the participants were Editor-in-Chiefs, which may limit the generalisability of the results

Introduction

Peer reviewers of biomedical journals are key stakeholders in the editorial ecosystem, helping authors to improve manuscripts and providing advice to scientific editors on their decision regarding the acceptability of publishing papers. Despite their importance for scientific publishing, fundamental principles such as the roles, tasks and core competencies of peer reviewers – including a minimum standard of knowledge, skills, and characteristics that are needed to effectively deliver high quality reviewer reports – are neither well defined, agreed upon, or formally established (1). While core competencies have been to some degree established for journal editors (2) thus far this is not the case for peer reviewers. A recent scoping review (2019) showed a large number of roles and tasks that peer reviewers of biomedical journals are expected to carry out some of which seem to contradict each other, or displayed incongruities between the position of the peer reviewer and the position of the journal editor (3). These findings were reflected in a study that aimed to identify the tasks that journal editors expect from peer reviewers who evaluate a manuscript reporting a randomised controlled trial, where a substantial disconnect between the expectations of journal editors and peer reviewers was found (4). A mutual understanding of expectations and responsibilities is one of the key factors that determine the quality of reviewer reports and satisfaction of the actors with the review process. However, biomedical journals differ in their guidance provided to peer reviewers, in their publishing capacity and resources available as well as the reviewer pool (5). Therefore, it is likely that editors might have diverging opinions about the roles and tasks peer reviewers are supposed to perform, something that has not been previously explored in depth.

Given that peer review is a social process that goes beyond the quality control of manuscripts (6), qualitative methods may lead to a deeper examination of the complexities of these processes compared to quantitative approaches and provide important context to improve the understanding of different editorial realities and practices.

Our aim was to examine the experience of general and specialty biomedical journal editors and to characterise their perspectives, expectations and understanding of the roles and tasks of peer reviewers.

Methods

Study design

We conducted semi-structured interviews with biomedical journal editors from general and specialty journals. The design of the study and reporting of study results were informed by relevant guidance for reporting qualitative research (7). Key methodological components are presented below; a detailed description of the study methodology is available elsewhere (8).

Patient and Public Involvement

Patients and the public were not involved in the design, or conduct, or reporting, or dissemination of our research. Sampling and recruitment

We used purposive maximum variation sampling (9) to obtain as much diversity in the demographic and journal characteristics of study participants as possible. Interviewees were recruited from multiple sources, including the lead author's professional network within the Methods in Research on Research (MiRoR) project (10); from two publishers, namely, BioMed Central (BMC) and British Medical Journal (BMJ) publishing group; and attendees of the Eighth International Congress on Peer Review and Scientific Publication (11). A total of 543 prospective interviewees were approached via email and 69 editors responded positively to the request. In addition, interviewees were asked to recommend other editors who would potentially be interested in contributing to this study.

Since sample size is irreversibly linked to saturation, which in turn can only be operationalized during data collection (12), our approach to data collection and analysis was iterative. Thus, recruitment continued until saturation – conceptualized as the point at which no new codes and themes were identified from the data – was achieved. After 56 interviews saturation was obtained and no further editors were contacted and interviewed.

Data collection

All interviews were conducted between October 2017 and February 2018 by the lead author (KG). Interviews were conducted either face-to-face or by telephone to accommodate for the geographical diversity and availability of study participants. They lasted 25–60 minutes.

A topic guide (Additional file 1) was used during the semi-structured interviews. The guide was initially informed by the outcomes of the scoping review (1), and was piloted and further refined over the course of the study, particularly after the first four interviews.

Prospective interviewees were provided with a study consent form and a study information sheet that consisted of information about the researchers, and study information (aim, interview procedures, ethics, confidentiality, funding and contact details). Interviewees were asked to sign a written consent form prior to being interviewed. Before starting the interview, study objectives were reiterated and additional information provided where necessary.

KG was a PhD student at the time of the interviews. She has previously experienced the peer review process in biomedical journals as an author and peer reviewer, and had undergone training in conducting qualitative interviews prior to data collection. She was supervised by DH, who has extensive experience of the peer review process in biomedical journals as an author, peer reviewer and journal editor.

Analysis

Interviews were transcribed verbatim and fieldnotes were written up after every interview.

All documents were then imported into NVivo V.12 and subjected to thematic analysis as described by Braun and Clarke (13) and outlined in the protocol (8). In summary, a preliminary codebook was generated by two researchers (KG and DH) independently from a subset of six interviews (14) using both, deductive codes from topics in the interview guide and inductive content-driven codes. The remaining 50 interviews were coded by the lead researcher (KG), supervised by DH through regular meetings. In line with the iterative process of data collection and analysis, interviews were analysed in the order in which they were conducted. To assess saturation, the lead researcher documented the

process of code development, updating the codebook after analysing each transcript. Saturation was achieved after 56 interviews.

To establish trustworthiness in this research, the step-by-step approach proposed by Nowell et al., which provides a detailed description of how to conduct a trustworthy thematic analysis, was followed (15). This approach used criteria for trustworthiness in qualitative research proposed by Lincoln and Guba (16) and shows how these can be achieved throughout the six phases of thematic analysis. The methodological techniques that we undertook to ensure a trustworthy analysis throughout our study are presented in Additional file 2.

Results

A total of 56 biomedical journal editors were interviewed (Table 1). Of these, the majority were male Editor-in-Chiefs who were based in 21 different countries. Most editors worked part-time at their respective journals, which were mainly specialty journals. Most journals employed a single-blind review process. Most interviewees were editors of journals that are published through commercial publishers.

Table 1 Sample characteristics

Demographic characteristics	
Sex	Female (n=16), Male (n=40)
Position	Junior Editor (n= 1), Senior/Associate Editor (n=11), Co-Editor-in-Chief (n=4), Editor-in-Chief (n=39), Editorial Director (n=1)
Commitment	Part-time (n=50), Full-time (n=6)
Geographic location	Asia (n=2), Africa (n=1), North America (n=19), South America (n=3), Europe (n=28), Oceania (n=3)
Journal characteristics	
Journal specialty	General medicine and Mega journals* (n=13), Specialty (n=43)
Indexing status**	Yes (n=53) No (n=3)
COPE Membership***	Member (n=27), Not a member (n=29)
Peer review model	Single-blind (n= 38), Double-blind (n=7), Triple-blind (n=1), Open peer review (n=9), Post-publication (n=1)
Open access, Subscription, Mixed	Open access (n=35), Subscription (n=4), Mixed (n=17)
Publishers	Academic (n=9), Commercial (n=34), Mixed model**** (n=13)

*A peer-reviewed academic open access journal designed to be much larger than a traditional journal by exercising low selectivity among accepted articles.

** Refers to indexing status on MEDLINE, Scopus and Web of Science

*** COPE – Refers to the Committee on Publication Ethics

**** Refers to journals that are either co-owned by medical societies and commercial publishers, or owned entirely by medical societies but operated through a commercial publisher

An overview of the different domains within our two themes: Roles of peer reviewers and Tasks of peer reviewers are presented in Additional file 3.

Roles of peer reviewers

Journal editors outlined a variety of roles, which coalesced around four domains. Peer reviewers should be: (1) Proficient experts in their field qualified to peer review; (2) Dutiful towards scientific community vs volunteers who deserve recognition; (3) Professionals; and (4) Advisors to the editor

Peer reviewers should be 'Proficient experts in their field qualified to peer review'

There was agreement among editors that peer reviewers are experts in their field when they: (1) have expertise and demonstrate high-level knowledge in their subject area; (2) are up to date with existing evidence and practice guidelines; and (3) have experience of publishing their own research. However, there was substantial disagreement on how these criteria are defined and understood, and how 'expertise' is operationalized.

One common narrative was that qualified peer reviewers are "experienced authors" who have a strong reputation and publication record in "high-impact journals". Concurrently, a number of editors linked the quality of the peer review report with the reviewers' writing and analytical skills, which they believed are gained through extensive authorship in their field. In their view, authorship hones both writing and reviewing ability, since authors are theoretically able to learn from review reports on their own submitted manuscripts:

"You learn by doing and if you have published let's say 200 articles then normally you are also a good reviewer... and if you are a bad author of manuscripts then you are a bad reviewer. And your opinion leaders are the sought after reviewers because they know the field and can write well and can also analyse a manuscript from another author quite well." (Editor-in-Chief, specialty journal).

Interviewees also indicated that they had a preference for seasoned authors and opinion leaders in the field over junior researchers. Here, their main concern was about fulfilling authors' expectations of an objective peer review by recruiting an expert to review their manuscript:

"Well first of all I think our reviewers ... are seasoned, they have to be experts, I mean otherwise why are they reviewing? That is not fair to the author." (Co-editor-in-Chief, specialty journal)

However, several editors commented that the actual level of expertise needed to deliver a high quality review report does not necessarily depend on publication record and seniority level. Some editors considered reviewing to require a different type of skillset that is not necessarily developed through writing or present by default. Other key factors drive review quality, such as "dedication of sufficient time" and "hands on experience with the methods used". This is often the case with junior researchers, who go through an active learning experience of applying methods for their own research and receiving feedback on their work. Less experienced researchers' greater motivation to peer review was also mentioned as a major driver of high-quality reviewer reports. For these reviewers, receiving the invitation to review is in itself a confirmation of growing personal reputation and recognition by the journal, and by the broader scientific community. At the same time, their supposed lack of self-

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3 confidence due to their current low career status/standing within the scientific field could also drive
4 the delivery of high-quality reviewer reports, in a desire to establish and maintain their status within
5 the scientific community:
6

7 *"I will say that junior faculty and post doctorate fellows often write the best reviews*
8 *because they tend to be insecure and tend to over-compensate and to be very careful in*
9 *doing a good job."* (Editor-in-Chief, specialty journal).
10

11 In the same vein, a number of editors from non-high ranking journals commented that senior
12 reviewers' increasing scientific status and "self-regard" might lead to declining review report quality,
13 most commonly demonstrated by the "lack of detailed comments" or "two-line" review reports that
14 did not aim to help "to improve a manuscript", but only to judge publication potential. That being said,
15 "experienced" peer reviewers were still highly sought after by all interviewees. Since they typically
16 receive a high volume of reviewer requests, journal editors suspect that they prioritize their reviewing
17 time in favour of highly ranked journals, a behaviour that multiple journal editors reported practicing
18 themselves when asked to perform a peer review. Although the least experienced reviewers are
19 generally more available, most editors feel that they lack the degree of experience required to conduct
20 a good peer review and "focus excessively on technical details", instead of the "bigger picture" that
21 more experienced reviewers are able to provide.
22
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25 Regardless of preference for the type of peer reviewer, the vast majority of interviewees – except for
26 those editors working for high-ranking journals - acknowledged that it is hard to solicit peer reviewers
27 in general, particularly experienced ones:
28

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30 *"And one of the things that we face is that we have on one side younger investigators,*
31 *willing to do the job. Sometimes they lack you know, the view and then you will have the*
32 *very established scientist who in most cases do refuse to make reviews. And so we have to*
33 *balance out ...these two extremes."* (Editor-in-Chief, specialty journal).
34
35

36 Lastly, whilst peer reviewers were expected to fulfil the above outlined criteria to some degree,
37 interviewees did not consider the completion of a training or a course on peer reviewing as a
38 prerequisite or necessary qualification to become a peer reviewer. All interviewees stated that they
39 learnt to peer review manuscripts "by just doing it", without having had previous training, and
40 suggested that this was also the case for the majority of the peer reviewers in biomedical journals.
41 Editors explained how one way of honing reviewing skills is through indirect feedback and comparisons
42 with fellow reviewers' reports (i.e. operationalized through comparing their own feedback with that
43 of other peer reviewers for the same manuscript); and through the final decision taken by the Editor-
44 in-Chief on the fate of the manuscript.
45

46
47 *"We also tried to train our reviewers in an indirect way that is when a decision was*
48 *completed and when we send the decision letter to the author we usually carbon copy the*
49 *decision along with the comments of all the reviewers to all the reviewers so that every*
50 *reviewer can see and compare their comments, their own comments with the comments*
51 *of other reviewers and that would be a form of training for them."* (Editor-in-Chief,
52 specialty journal).
53
54

55 There was a division of opinions on the usefulness of courses that aim to teach peer reviewing skills.
56 While several editors were receptive to the idea, others felt that they could only be useful to less
57 experienced researchers because they can only teach about the technicalities of the process and
58 cannot replace experience gained over time:
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3 *"I learnt on the field. First, as an author and then, you know, when I become more*
4 *established a scientist, as a reviewer it is a long process, and difficult process... [with]*
5 *courses, you can learn the technicalities of the process but you know experience is very*
6 *relevant... courses do not help established scientists, they may help young scientists but*
7 *the courses won't give them experience in actually in the field."* (Editor-in-Chief, specialty
8 journal).
9

11 **Peer reviewers should be 'Dutiful towards scientific community vs. volunteers who deserve** 12 **recognition'**

14 The majority of interviewees repeatedly expressed their gratitude towards peer reviewers, whom they
15 most commonly framed as "volunteers" who perform peer review out of "altruistic motives". Being
16 occasional reviewers themselves, editors were well aware of the many competing duties of peer
17 reviewers in the biomedical field - including research, teaching and/or clinical responsibilities –
18 between which reviewing has to be squeezed in. Many interviewees emphasised that reviewing is
19 "time consuming" and repeatedly described it as an "unpaid" and largely "unrecognised" role:
20

21
22 *"...Most of the work that is done on journals is uncompensated, and ... you are already*
23 *dealing with people who are very busy people in their professional lives, and so you are*
24 *really asking them to do things at nights and weekends for which they get really very little*
25 *recognition. And very little compensation if any."* (Editor-in-Chief, specialty journal).
26

27 Given that the majority of editors face difficulties finding peer reviewers, several considered peer
28 reviewers to be a "precious resource" that needs to be treated with "care". Interviewees reported
29 doing so through: (1) careful screening of submissions to ensure that only sufficiently good-quality
30 manuscripts are forwarded to peer reviewers (2) not overburdening good peer reviewers with too
31 many invitations; and (3) provision of recognition and rewards. Several recognition and reward
32 schemes were mentioned, which can be broadly divided into two categories: (1) Financial rewards
33 (free access to journal/publication discount) and small tokens of appreciation (e.g. mugs, books); and
34 (2) Rewards aimed at boosting career progress through official professional development (e.g.
35 Continuing Medical Education (CME) points; official letters for Continuing Professional Development
36 (CPD); and through journal rewards aimed at enhancing peer reviewers' visibility, reputation and
37 credibility within the scientific community (e.g. being invited to become editors and/or editorial board
38 members, names published on journal website, invitations to social events).
39

40 In contrast to the more common perception of reviewers as "volunteers", a small number of editors
41 commented that peer reviewers should consider the act of peer reviewing to be a "responsibility",
42 "duty" and "obligation to their field" and to the scientific community in general. In their view, the
43 entire process relies on - and only works because of - the principle of reciprocity and researchers
44 perpetuating the development of the own research community. In their view, reciprocity should be a
45 strong motivational drive for peer reviewers:
46

47
48 *"Those of us who have a track record in publication get solicited for doing an awful lot of*
49 *reviewing and you have got to fit that in around your other time and you are doing it*
50 *because the process is important and you want your next paper to get properly reviewed*
51 *so you want to peer review the paper that you have been sent."* (Interim Editor-in-Chief,
52 specialty journal).
53

54 A few editors were more critical of the rationale for reviewing "for free", suggesting that the concept
55 of duty in peer reviewing had originally been coined and continued to be fostered by publishers for
56 profit-making purposes, and is now dated:
57

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3 *"I mean they... they say this is your duty, you know it is your duty as a scientist to, you*
4 *know, do these things ... and give back, but ... really the journals ... certainly are profiting*
5 *now the authors are paying pretty good page charges, the reviewers aren't getting paid,*
6 *and you know this could be an issue."* (Editor-in-Chief, specialty journal).
7

9 **Peer reviewers should be 'Professionals'**

10 There was general agreement on the need for reviewers to be: (1) Unbiased and ethical professionals;
11 (2) Reliable professionals; (3) Skilled critics
12

13
14 Editors outlined three aspects related to their expectation that peer reviewers should be 'unbiased
15 and ethical professionals' consistent with 'scientific ideals'. These were: (1) being "fair" and "objective"
16 (i.e. peer reviewers are expected to evaluate and judge manuscripts in a fair and objective manner);
17 (2) "maintain confidentiality" (i.e. peer reviewers are expected keep manuscript content confidential
18 avoiding disclosure to others); and (3) "declare/avoid potential or actual conflict of interest". Editors
19 emphasized the importance of the latter most frequently. Some editors explained that conflict of
20 interest could potentially contribute to increased review quality but stressed that transparency is key.
21 They emphasized their own position as "decision makers" within the peer review process to assess and
22 decide whether the reported conflict of interest is prohibiting a fair and objective assessment.
23

24
25 Editors also unanimously agreed that peer reviewers should be 'reliable professionals' who should
26 "respond promptly to peer reviewer requests". They should either accept or decline, but not "ignore
27 the invitation to review", which is the more common frustrating practice reported by interviewees
28 from non-high ranking journals. The common understanding among all editors was that a good peer
29 reviewer report takes a substantial amount of time to be written, something that peer reviewers
30 should be aware of prior to accepting. They should be willing to devote sufficient time and attention
31 to the evaluation of manuscripts yet deliver the reviewer report within the agreed timeline out of
32 "respect" and "fairness" to authors, to the journal and the publisher.
33
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36 Lastly, the majority of interviewees considered helping authors to "improve their manuscript" to be
37 the primary purpose of the peer reviewer, not to suggest a rejection or to "filter it out". Therefore, the
38 need for reviewers to be 'skilled critics' was explicitly and implicitly voiced throughout the interviews.
39 As part of the improvement role, it was expected that peer reviewers provide "constructive criticism
40 embodying specific and addressable comments". Peer reviewers were also expected to be "thorough
41 and detailed" and to "systematically address every aspect of the manuscript". Another aspect
42 emphasised by interviewees was the need for an "evidence-based review", where peer reviewers'
43 statements should be "supported by references" that aid the author and guide the editor.
44

45 Editors expected peer reviewers to be 'respectful communicators'. They outlined basic principles of
46 courtesy such as "respect for the work of the authors". Peer reviewers were expected to provide
47 comments that "serve a scientific purpose" whilst keeping in mind that they are criticising the
48 manuscript, not the authors. Appropriate communication was deemed to be crucial. Based on editors'
49 accounts that peer reviewers should be "kind" and offer "positive" comments to nurture and
50 "encourage" authors to improve their work, it became evident that peer reviewing should go beyond
51 the mere technical assessment of manuscripts, and thus has also a supportive role:
52
53

54
55 *"I often think the peer reviewers are incredibly negative, and they rarely have anything*
56 *positive to say. And I tend to feel, you know if somebody was reviewing my manuscript I*
57 *would want them to try to say at least one tiny little positive thing about what I have*
58 *done."* (Editor-in-Chief, specialty journal)
59
60

Peer reviewers should be 'Advisors to the editor'

Editors were explicit in their attribution of a primarily "advisory role" to peer reviewers. Our interviewees perceived and stressed their own role as the "ultimate decision makers" who take decisions based on the sum of the factors outlined above. They have the authority to "override peer reviewers recommendations" and "ignore their opinion" if necessary thereby directly or indirectly exerting influence on authors to modify their manuscripts:

"...the peer reviewer is really playing an advisory role to the editors...it's only the editors that make a decision on whether to accept or not and how they want the paper to be written." (Editor-in-Chief, specialty journal).

Editors made it clear that decision-making within the editorial process is shaped and influenced by the interplay of a complex web of factors, including: (1) the editors' own expert knowledge and ability to assess different aspects of manuscripts; (2) peer reviewer reports; (3) authors' replies; (4) discussions between editors and editorial board members during manuscript meetings where manuscripts considered for publication are discussed; (5) the number and type of submissions received; (6) the strategic approach of the journal; (7) consideration of readership, and (8) subjects related to publishers. Thus, while peer reviewer reports play a key part, they are not the only element within the equation. While scientific quality and value of submitted manuscripts were at the foreground, interviewees were largely open about the influence of other non-scientific factors that play into their decision making process. Nevertheless, the peer reviewer report was consistently regarded as a key pillar supporting publication decisions, including peer reviewers' advisory role of providing the editor with a "recommendation on the fate of the manuscript". With few exceptions, most editors reported that their journal submission systems ask peer reviewers to indicate whether the manuscript should be accepted (with major/minor revisions) or rejected:

"...the most important thing for me is actually at the end, the advice to reject the paper or have it revised." (Editor-in-Chief, specialty journal).

Most editors were open about the substantial influence of peer reviewer recommendations on their decision-making. This was rationalized in a variety of ways, which often co-exist. Editors partly deferred their decision to peer reviewers when they felt uncertain about their own knowledge and ability to assess the manuscript adequately, referring to the "trust" they extend towards experts in the field to help in decision-making. Ticking the recommendation box was also useful to justify editorial decisions to authors when the peer reviewer report did not convey a clear direction for the manuscript, and the editor wants them to "come off the fence". Many editors reported deferring to additional peer reviewers in case of disagreements between the initially selected peer reviewers - described as a common occurrence. Another problematic aspect of the recommendation function was the lack of a common understanding of what the individual recommendation categories actually mean. Since this is a subjective recommendation, there are inherent variations in reviewers' views.

Peer reviewer tasks

Editors outlined a number of tasks which coalesced around four domains: (1) Organisation and approach to reviewing; (2) Make general comments; (3) Assess and address content for each section of the manuscript; and (4) Address ethical aspects.

Organisation and approach to reviewing

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2
3 At the beginning of the reviewer report editors prefer to see a “summary of the key points” of the
4 manuscript, which functions as a ‘quality check’ for editors “to be confident that they [the peer
5 reviewers] have read it and understood it [the manuscript]”. The majority of editors expect reviewers
6 to provide a balanced view by identifying both “strengths and weaknesses of the manuscript”. Editors
7 also expect peer reviewers to “identify flaws” and differentiate between “fatal and addressable flaws”
8 in order to understand and assess whether the manuscripts could be improved. Furthermore, a
9 number of editors suggested that it is helpful to differentiate between “major and minor comments”.
10 It became evident that the approach to peer review is mostly aimed at helping editors in their decision
11 making process.
12
13

14 15 **Make general comments**

16 Editors specified that they expect to see some general and overarching comments that provide an
17 “overall picture” of the “importance and significance” of the manuscript as well as “relevance to field
18 and (clinical) practice”. Additional comments should focus on the general aspects of “validity”,
19 “quality”, “technical merit” and “rigor”. The assessment of “novelty” and “originality” was mentioned
20 by a number of editors, however there was a clear divide between high-ranking journals and other
21 journals – with editors from the latter repeatedly acknowledged that manuscripts with “novel findings”
22 tend to be preferentially submitted to high-ranking journals.
23
24

25 26 **Assess and address content for each section of the manuscript**

27 The majority of editors expected peer reviewers to thoroughly appraise the content of each manuscript
28 section. The “soundness of the methodology used” was most frequently mentioned by peer reviewers.
29 Generally, the level of detail expected of peer reviewers seemed to differ according to the resources
30 that journals had as well as the editors’ own abilities. While this was oftentimes implicit, it was
31 apparent in the example of ‘statistics’. For example, while a number of journals reported to employ a
32 “statistical review by default” other had to rely heavily on peer reviewers for that to supplement their
33 own limitations:
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36 *“...bringing expertise such as looking at the statistical analysis which is not my strong point*
37 *at all. So bringing that sort of expertise to it.” (Co-Editor-in-Chief, specialty journal).*
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40 Another aspect that was repeatedly mentioned was the focus on ‘spin’ in the discussion/conclusion
41 section. Although not explicitly named as ‘spin’ editors want peer reviewers to look out for any “claims
42 that are not supported by the results”, “overenthusiasm” and “extrapolation”.
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45 46 **Address ethical aspects**

47 Editors reported that their submission systems typically offers two text boxes to peer reviewers – one
48 for comments to the authors and the other one for confidential comments to the editors. The latter
49 should be used by peer reviewers to advise the editor on any aspects related to “ethics” and ‘research
50 integrity’ such as suspicion of research misconduct and detrimental and questionable research
51 practices. The confidential comments are a means of avoiding any potential conflict arising from such
52 criticism between authors and reviewers.
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55 56 **Discussion**

57 This study provided an in-depth, behind-the-scenes account of 56 editors’ experiences with, and
58 expectations towards, peer reviewers. We found that journal editors’ understanding of the roles and
59 tasks of peer reviewers are profoundly shaped by each journal’s unique context and characteristics,
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3 including financial and human resources and journal reputation. Thus, in line with existing literature,
4 we found that editorial decision-making and expectations towards peer reviewers are unavoidably
5 shaped by social externalities that at times may have little to do with scientific content of the
6 manuscript (6,17). We found that the majority of our interviewees gave considerable importance to
7 the reviewers' recommendations function, despite concerns regarding the lack of a commonly agreed-
8 upon definition of the available options, frequent disagreement among peer reviewers (18) and
9 existing bias (19). Given these limitations, editors should seriously consider removing the reviewers'
10 'recommendations function', where they are expected to provide the editor with their
11 recommendation regarding the article's suitability for publication. This is in line with existing research
12 on relationship between external reviewers' recommendations and the editorial outcome of
13 manuscripts (20). This would help to realign the role of peer reviewers as 'advisors' rather than convey
14 the idea that they are decision makers. It would also help to delete some of the existing malleable
15 boundaries of authority and responsibility on the review process placing the editor in the sole decision
16 maker position. Considerable efforts should be made to communicate to peer reviewers to place their
17 focus on the evaluation of strengths and weaknesses, major and minor flaws of manuscripts across
18 multiple dimensions and suggestions for improvement. Furthermore, editors should encourage peer
19 reviewers to refer to appropriate reporting guidelines to ensure the completeness of information
20 provided by authors in their studies. One way of achieving this could be through provision of feedback
21 to peer reviewers by editors i.e. editors could send follow-up emails to peer reviewers requesting
22 clarification of any missing points. This is time consuming, but might help to improve peer reviewer
23 reports.

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28 Furthermore, although we found considerable agreement among editors concerning technical tasks of
29 manuscript reviewing, there was an apparent difference in editors' expectations of the level of depth
30 and detail they would like to see in a reviewer report. Our study sample showcases the status quo of
31 the editors' market, where there are a few full-time journal editors. The remainder work on a part time
32 basis, usually for a symbolic or stipend-like payment, and combine their editorial responsibilities with
33 research, education, and/or clinical duties. Therefore, it might be the case that their own limited time
34 might lead to expectations of greater detail from reviewers. Journal resource availability might also
35 have an impact on their expectations, such as requests for comments related to statistical analysis in
36 the case of journals with fewer resources. Given these existing contextual journal differences and
37 hence peer review report requirements, better ways of communicating editorial expectations to peer
38 reviewers (who might review for different journals having different expectations) are needed.
39 Currently, these expectations are communicated through publishers' and journal-specific guidelines.
40 However, various studies in this area suggest that these are often not readily available, or are generic
41 and non-specific (21) and thus do not properly convey expectations.

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47 Another key finding was interviewed editors' apparent lack of appreciation of the importance of formal
48 peer reviewer training. The majority embraced a somewhat simplistic and 'linear' view that 'good'
49 authors (i.e. usually defined as authors with extensive authorship in prestigious journals) make 'good'
50 peer reviewers. However, there is no evidence to support this perspective; evidence linking authorship
51 experience and academic qualifications to high-quality reviews is very limited. The only substantial
52 study in this field was unable to predict reviewer performance from easily identifiable types of
53 experience or qualifications. The study authors also found, contrary to the beliefs prevalent among our
54 interviewees, that factors such as academic rank and seniority do not predict performance (22). In fact,
55 studies that have attempted to determine whether some combination of peer reviewer experience
56 could predict the quality of their subsequent reviews found that the highest-rated reviewers tended
57 to be young, and that the quality of peer review did not correlate with academic rank (23–26).
58 However, most of these studies were relatively limited in size, were a sub-analysis of a study of some
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3 other intervention, and are more than 20 years old; hence, the evidence base for this finding is limited.
4 Thus far, in the absence of additional research demonstrating the contrary, there are no criteria that
5 predict good peer reviewer performance.

6 Given this situation, we believe that the skillset required to be a good author is not necessarily the
7 same as that required to be a good peer reviewer. In a recent study (2019) by Superchi et al. that
8 systematically reviewed tools used by journal editors to assess the quality of peer review reports, the
9 authors identified nine quality domains pertaining to peer reviewer skills, of which five (i.e.
10 relevance and originality of the study, interpretation of study results, strength and weaknesses,
11 manuscript presentation and organisation) arguably overlap with the skillset of authors. The remainder
12 are directly concerned with skills related to structure and delivery of the peer review report (27), which
13 we believe may not automatically follow from being a prolific author. Therefore, we propose that the
14 following four domains can, and in principle should, be taught to prospective reviewers: (1) structure
15 of the reviewer's comments; (2) characteristics of reviewer's comments including concepts such as
16 clarity, constructiveness, detail/thoroughness, fairness, knowledgeable and tone; (3) timeliness of
17 the review report; and (4) usefulness of the review report to editorial decision-making and manuscript
18 improvement. Thus, it appears that helping to improve the manuscript not only entails providing
19 specific and detailed comments about scientific aspects of the manuscript, but also comments that
20 empower and motivate authors – a skill that is closely aligned to the supportive function of peer
21 reviewers that also emerged from our study.

22 Notwithstanding various surveys on educational needs of young clinicians and researchers across
23 different biomedical fields having revealed a strong interest in attaining better reviewing skills (28),
24 such training is still not commonly included in biomedical postgraduate education programmes. At the
25 same time, existing educational interventions have shown underwhelming results, and their wider
26 applicability remains questionable due to their relatively poor methodological quality (29).

27 Given this lack of evidence we think it would be helpful to conduct research on the actual content of
28 peer reviewers' reports to help establish educational needs for peer reviewing (30).

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31 According to the majority of our interviewees, it is becoming increasingly difficult to find experienced
32 authors to review manuscripts. On the other hand, junior researchers are often more willing to accept
33 invitations, including from lower-ranking journals. This is in line with existing evidence (31) and is likely
34 to be due to differing levels of motivation (32). Thus, there is an opportunity for acknowledging that
35 the breadth and variety of reviewing roles and tasks may require a more granular approach by editors
36 when assigning peer reviewers to a manuscript. Achieving a balance of senior and junior reviewers
37 would cater to their wide range of reviewing motivations, as well as to their individual expertise. At
38 the same time, the question of how to attract this ideal mix of reviewers remains. The rewards and
39 incentives offered by most journal editors among our sample are likely to be more attractive for junior
40 peer reviewers than senior reviewers. Based on editors' comments on the lack of effectiveness of the
41 provided incentives and the general difficulty to get peer reviewers to accept invitation across the
42 biomedical field (33,34) and offering higher-level rewards is key. For example, the majority of
43 reviewers are affiliated to academic institutions, which are therefore critical stakeholders in the peer
44 review process. If peer reviewing is incentivized and rewarded as part of one's academic career
45 advancement, it is likely to be as important - if not more important - than whatever journals can offer.
46 For example, the University of Glasgow (35) has started rewarding peer reviewer and editorial
47 responsibilities as a core requirement for academic promotion and achieving tenure. However, this is
48 the only example we were able to identify. The peer review process is part of the social infrastructure
49 of research (36), therefore it is the responsibility of all actors to contribute to better research.
50 Academic institutions and other stakeholders such a funders can play a key role to implement
51 alternative measures of research quality (37) and a stronger focus on research quality.

Limitations

Our recruitment approach gave rise to a key limitation of this study. Based on our collective experience as researchers and a former staff member of a biomedical journal (DH) that struggled with response rates involving studies with editorial staff, we anticipated that it would be challenging to recruit journal editors to participate in our research. The majority of journal editors of biomedical journals are part-timers who concurrently work as practitioners, researchers, educators and may have other additional roles. In the light of this situation, our employment of purposive maximum variation sampling resulted in predominant contact with Editors-in-Chief. While one of the strengths of this study is that research participants were diverse in terms of demographic characteristics and characteristics related to their journal (Table 1), two thirds of participants had this role within their respective journal. Although the lead researcher asked potential interviewees either to participate themselves or to recommend suitable journal colleagues who could be contacted in their stead, it is likely that this approach led to the relative homogeneity of our study sample. This may limit the generalisability of the results due to the limited representation of other editorial staff members involved in the peer review process. Our insights from the interviews and wider author and team experiences suggest that Editors-in-Chief might primarily be responsible for higher-level tasks around the journal, and possibly be less involved in the direct communication process with authors and peer reviewers. Therefore, there is a need to explore whether the involvement of editorial staff in other positions would have produced convergent or divergent findings.

Conclusion

This study provides context for, and details about, the roles and tasks of peer reviewers in biomedical journals and helps to explain attitudes and opinions expressed in existing surveys of editors, reviewers and authors on the peer review process. Our research provides a greater understanding of the current status quo of the review process and why particular issues arise around roles and tasks of peer reviewers, and offers insight into how these issues can be addressed.

Further research is needed on actual performance of peer reviewers looking into the content of peer reviewer reports on a large scale to inform meaningful training interventions and to improve existing journal policies and guidelines.

Footnotes

Contributors: All authors have made substantive intellectual contributions to the development of this manuscript. KG and DH jointly contributed to study conception and design. While KG led data collection, analysis and writing of the manuscript DH led the supervision of all these steps. IB and DM have contributed to the writing of the manuscript and approved the final manuscript.

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Competing interests: KG and DM had an advisory role with Publons Academy. At the time of data collection for this study KG conducted a secondment at the BMJ. The remaining author (DH) declares no competing interests.

Patient consent: Not applicable.

Ethics approval: This project has been evaluated and approved by the University of Split, Medical School Ethics Committee. Ethical approval (Reference number 2181-198-03-04-17-0029) was granted in May 2017. Prospective interviewees were provided with a study consent form and a study information sheet. Interviewees were asked to sign a written consent form prior to being interviewed. Copies of the invitation letter, information sheet, and consent form are available from the leading author (KG).

Data sharing statement: The data generated and/or analysed in the study are not publicly available due to participant anonymity, but may be available from the corresponding author on reasonable request that includes a study protocol, ethical approval and data use agreement.

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Topic guide for semi-structured interviews

Key area of investigation	Topics	Questions and prompts
Background information	<ul style="list-style-type: none"> - Explore personal background - Level of experience - Roles and tasks as an editor 	<ul style="list-style-type: none"> • Tell me about your journal and the job you have. • How long have you been in this position? • Did you hold any other editorial position before your current position? If yes, what were your responsibilities then? <p>Prompt: percentage of time devoted to editorial duties (e.g., part time, full time)</p> <ul style="list-style-type: none"> • What are your current responsibilities (roles and tasks)?
Journal set-up	<ul style="list-style-type: none"> - Explore journal set-up 	<ul style="list-style-type: none"> • Tell me about your journal - how does it work? <p>Prompt: availability of resources (e.g. human and financial resources), relationship with publisher</p> <ul style="list-style-type: none"> • How does the peer review process work in your journal? <p>Prompt: submission system, peer review model (e.g., single blind etc)</p> <ul style="list-style-type: none"> • What do you do within the process? <p>Prompt: Interaction with peer reviewers</p>
Opinion on peer reviewers roles and tasks	<ul style="list-style-type: none"> - Roles and tasks of peer reviewers - Expectations 	<ul style="list-style-type: none"> • What do you expect from peer reviewers in terms of their roles and tasks? • What about training for peer reviewers? <p>Prompt: use items from scoping review (roles and task related), attitudes and beliefs (e.g. on training, how they peer review themselves) , organisational expectations</p> <ul style="list-style-type: none"> • How do you let your reviewers know what you expect from them? <p>Prompt: journal guidelines</p> <ul style="list-style-type: none"> • Can you tell me about a specific situation when you were not satisfied with a review report or with a peer reviewer? • What did you do in that a situation? <p>Prompt: probe for factors other than being late with a review, or not doing a review once you they have accepted it</p> <ul style="list-style-type: none"> • Can you tell me about a situation when you were exceptionally satisfied with a review or with a peer reviewer? • Were there situations (in regards to the roles and task of reviewers) when you disagreed with the other editors you work with? What about? What happened? • What about other journals, do roles and tasks differ among journals in your field? <p>Prompt: if yes (i.e. differences exist), then:</p> <ul style="list-style-type: none"> • How does this affect the process? • How does it affect your communication? • How do you negotiate those differences? Does it matter?

<p>1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16</p> <p>Communication between editors, peer reviewers and authors</p>	<p>- Communication between the three parties</p> <p>- Potential conflicts</p> <p>- Power</p>	<ul style="list-style-type: none"> • Can you describe your experience of the communication process between editors, authors and peer reviews? • How do you communicate with authors and peer reviewers? • Can you give me some specific examples of situations where this communication is challenging? <p>Prompt: What are potential conflicts? When do disagreements arise? What happens if there is disagreement between peer reviewers?</p>
<p>17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60</p> <p>Conclusion</p>	<p>- Snowballing</p> <p>- Documents</p> <p>- Final comments</p>	<ul style="list-style-type: none"> • Is there anybody else whom you think I should speak to? • Any articles/documents I can access/should look at? • Any final comments? Is there anything else that you think is important to mention?

Actions undertaken to establish trustworthiness of analysis

Phases of thematic analysis	Techniques for establishing trustworthiness
Phase 1: Familiarizing with the data	Prolonged engagement with data (credibility) <ul style="list-style-type: none"> - KG performed multiple readings of all transcripts Reflexive journaling (confirmability) <ul style="list-style-type: none"> - Documentation of thoughts and potential codes/themes were taken during phase 1 and throughout the entire data analysis
Phase 2: Generating initial codes	Member-checking and peer debriefing (credibility) <ul style="list-style-type: none"> - The first six interviews were coded independently by two researchers (KG and DH) leading to the creation of the initial codebook Audit trail (confirmability) <ul style="list-style-type: none"> - Codebook was updated after every new interview creating an audit trail of the code generation
Phase 3: Searching for themes	Researcher triangulation (confirmability) <ul style="list-style-type: none"> - Regular team meetings to review findings from different perspectives - Diagramming/drawing to make sense of theme connections
Phase 4: Reviewing themes	Researcher triangulation (confirmability) <ul style="list-style-type: none"> - Regular team meetings to vet themes and subthemes Audit trail (confirmability) <ul style="list-style-type: none"> - We returned to raw data to check for referential adequacy
Phase 5: Defining and naming themes	Researcher triangulation (confirmability) <ul style="list-style-type: none"> - Team consensus on themes
Phase 6: Producing the report	Thick description (transferability) <ul style="list-style-type: none"> - The methodological approach and analytical choices were described in detail in previously published study protocol - We provide detailed descriptions of study results - Peer debriefing with researchers outside of the core group (IB and DM)

Roles

- Proficient experts in their field qualified to peer review
- Dutiful towards scientific community vs volunteers who deserve recognition
- Professionals
- Advisors to the editor

Tasks

- Organisation and approach to reviewing
- Make general comments
- Assess and address content for each section of the manuscript
- Address ethical aspects

Consolidated criteria for reporting qualitative studies (COREQ): 32-item checklist

Developed from:

Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *International Journal for Quality in Health Care*. 2007. Volume 19, Number 6: pp. 349 – 357

YOU MUST PROVIDE A RESPONSE FOR ALL ITEMS. ENTER N/A IF NOT APPLICABLE

No. Item	Guide questions/description	Reported on Page #
Domain 1: Research team and reflexivity		
<i>Personal Characteristics</i>		
1. Interviewer/facilitator	Which author/s conducted the interview or focus group?	Page 3
2. Credentials	What were the researcher's credentials? E.g. PhD, MD	Page 3
3. Occupation	What was their occupation at the time of the study?	Page 3
4. Gender	Was the researcher male or female?	Page 3
5. Experience and training	What experience or training did the researcher have?	Page 3
<i>Relationship with participants</i>		
6. Relationship established	Was a relationship established prior to study commencement?	Page 3
7. Participant knowledge of the interviewer	What did the participants know about the researcher? e.g. personal goals, reasons for doing the research	Page 3
8. Interviewer characteristics	What characteristics were reported about the interviewer/facilitator? e.g. Bias, assumptions, reasons and interests in the research topic	Page 3
Domain 2: study design		
<i>Theoretical framework</i>		
9. Methodological orientation and Theory	What methodological orientation was stated to underpin the study? e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis	Page 2 (previously published study protocol)
<i>Participant selection</i>		
10. Sampling	How were participants selected? e.g. purposive, convenience, consecutive, snowball	Page 2
11. Method of approach	How were participants approached? e.g. face-to-face, telephone, mail, email	Page 2-3

12. Sample size	How many participants were in the study?	Page 2-3, and published study protocol
13. Non-participation	How many people refused to participate or dropped out? Reasons?	N/A
<i>Setting</i>		
14. Setting of data collection	Where was the data collected? e.g. home, clinic, workplace	N/A
15. Presence of non-participants	Was anyone else present besides the participants and researchers?	N/A
16. Description of sample	What are the important characteristics of the sample? e.g. demographic data, date	Page 3-4
<i>Data collection</i>		
17. Interview guide	Were questions, prompts, guides provided by the authors? Was it pilot tested?	Page 3, additional file with topic guide provided
18. Repeat interviews	Were repeat interviews carried out? If yes, how many?	No repeat interviews carried out
19. Audio/visual recording	Did the research use audio or visual recording to collect the data?	Page 3
20. Field notes	Were field notes made during and/or after the interview or focus group?	Page 3
21. Duration	What was the duration of the interviews or focus group?	Page 3
22. Data saturation	Was data saturation discussed?	Page 3
23. Transcripts returned	Were transcripts returned to participants for comment and/or correction?	N/A
Domain 3: analysis and findings		
<i>Data analysis</i>		
24. Number of data coders	How many data coders coded the data?	Page 3
25. Description of the coding tree	Did authors provide a description of the coding tree?	Page 3
26. Derivation of themes	Were themes identified in advance or derived from the data?	Page 2-3
27. Software	What software, if applicable, was used to manage the data?	Page 3
28. Participant checking	Did participants provide feedback on the findings?	Not performed.
<i>Reporting</i>		
29. Quotations presented	Were participant quotations presented to illustrate the themes/findings? Was each quotation identified? e.g. participant number	Page 4-10
30. Data and findings consistent	Was there consistency between the data presented and the findings?	Page 11-13
31. Clarity of major themes	Were major themes clearly presented in the findings?	Page 4-10
32. Clarity of minor themes	Is there a description of diverse cases or	Page 4-10

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	discussion of minor themes?	
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For peer review only