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How do scientists perceive the current publication culture? A qualitative focus group interview study among Dutch biomedical researchers

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ABSTRACT

Objective: To investigate the biomedical scientist's perception of the prevailing publication culture.

Design: Qualitative focus group interview study.

Setting: Four university medical centres in the Netherlands.

Participants: Three randomly selected groups of biomedical scientists (PhD, postdoctoral staff members and full professors).

Main outcome measures: Main themes for discussion were selected by participants.

Results: Frequently perceived detrimental effects of contemporary publication culture were the strong focus on citation measures (like the Journal Impact Factor and the H-index), gift and ghost authorships and the order of authors, the peer review process, competition, the funding system and publication bias. These themes were generally associated with detrimental and undesirable effects on publication practices and on the validity of reported results. Furthermore, senior scientists tended to display a more cynical perception of the publication culture than their junior colleagues. However, even among the PhD students and the postdoctoral fellows, the sentiment was quite negative. Positive perceptions of specific features of contemporary scientific and publication culture were rare.

Conclusions: Our findings suggest that the current publication culture leads to negative sentiments, counterproductive stress levels and, most importantly, to questionable research practices among junior and senior biomedical scientists.

Strengths and limitations of this study

- This is the first empirical study that investigates in a more structural context Dutch biomedical scientists' personal views on and convictions about contemporary publication culture.
- The random selection of potential participants and the inclusion of half of the total of eight university medical centres in the Netherlands argue for generalisability of the findings.
- The qualitative approach suits the aim of the study best and the reporting quality is optimised by following authoritative guidelines for qualitative research (the COREQ-criteria).
- A quantitative approach could not study in-depth perceptions of the prevailing publication culture.
- The results show that Dutch biomedical scientists perceive serious detrimental effects of contemporary publication culture.

BACKGROUND

The biomedical scientific enterprise has changed dramatically over the past decades. The annual number of published papers and scientific journals doubles every 12 years.[1] There is an increasing imbalance between requested and available funding,[2 3] raising concerns about hypercompetitiveness with potential distorting effects on the quality of research, the amount of research waste produced, the selection of priority research areas, and talent development.[3–6] However, some argue that increased demands on and competition between scientists have more beneficial than detrimental effects, and that a transparent reward system based on quantitative parameters is better than its alternatives.[7] Regardless of how one evaluates these phenomena, the increasing emphasis on scientific productivity, authorships and citations by universities, grant agencies and indeed by the scientific community itself is undeniable.[8–10] The significant growth of the number of PhD dissertations puts an even greater pressure on the system.[11] All the aforementioned phenomena are part of what can be described as the 'publication culture'.

Earlier studies suggest that high publication pressure is associated with symptoms of burnout.[12–15] Also, scientific integrity may be related to culture aspects of biomedical science.[16–19]

Most of the aforementioned phenomena have been studied using quantitative survey methods, which provides some empirical basis for policy and future research, but may not capture all aspects and subtleties of scientists' views, thoughts and experiences. A qualitative approach, such as using focus group interviews, typically seeks to explore, understand and represent the subjective perceptions of people and to interpret their behaviour.[20] This approach uncovers thoughts and feelings that survey research could never have highlighted and this has never been studied before. Focus group interviews are group conversations in which participants address specific themes (by sharing perspectives, experiences and opinions).[21]

We set out to perform focus group interviews about the perception of publication culture among PhD students, postdoctoral fellows/staff members and full professors who are involved in biomedical research. Our aim is to learn what biomedical scientists regard as the most salient aspects of current publication culture and to discuss the major positive and negative aspects of these features.

MATERIALS AND METHODS

Selection of participants

The study consisted of 12 focus groups of biomedical scientists working in four university medical centres (UMCs) in The Netherlands. Scientists were eligible to participate if they were able to speak Dutch, were scientifically active (scientists who recently authored and published a scientific paper) and were willing to give informed consent.

Scientists were recruited with the help of the deans' offices of the participating medical centres, each of which provided the email addresses of all active scientists in nine departments (2 preclinical (microbiology, pathology), 2 supportive departments (methodology/epidemiology, anatomy/physiology), 3 clinical departments (internal medicine, surgery and psychiatry)), and the most and least publishing department (expressed as the average number of papers per active scientist). We used a tool specially designed by the Software Department of the VU University to randomly select the participants across the different academic ranks from the nine departments. We randomly selected one PhD student, one postdoctoral fellow or staff member (usually an MD with a PhD degree, involved in a combination of patient care and research), and one full professor per department and per UMC, and sent an invitation by email explaining the purpose of the focus group interviews. If the invited participant declined participation, we randomly selected a second participant of the same type from the same department, and so on, until we had 6–8 participants from different departments per focus group. This resulted in three focus groups (1 with PhD students, 1 with postdoctoral fellows and 1 with full professors) per UMC with 6–8 participating scientists per focus group.

Data collection and procedure

The focus groups were conducted between June 2013 and April 2014 by a multidisciplinary research team consisting of three of the authors of this article (JKT, JdJ and PMP) at the four medical centres. The research team formulated possible discussion themes about publication culture beforehand based on our previous quantitative research on publication pressure[12] and a pilot version of a focus group interview that was conducted with fellow scientists from the department of the lead author. The focus group interviews lasted approximately 1.5–2 h until the point when no new or relevant information emerged (attainment of saturation).[22 23]

The focus groups were led by a facilitator (JKT or PMP) with professional experience in (focus) group dynamics. A semistructured protocol (see online supplementary material) was used which included information on general aspects of focus groups, an introduction to the subject, and an initial exploration of the participants' motivation to be involved in research. After this, participants were invited to present themes they felt were relevant for the discussion on contemporary publication culture. From their answers, the facilitator, in consultation with the participants, prioritised 6–9 themes. Since it soon became clear that many comments and dominant opinions were negatively coloured, we explicitly encouraged participants to also name positive aspects of the present publication culture.

Finally, participants were asked to suggest ways to solve the experienced problems (not part of this report).

Each focus group was audiotaped and transcribed verbatim. In addition, members of the research team took notes during the sessions to capture important elements.

Analysis

An inductive content analysis was used to analyse the data. Inductive content analysis is mainly used in cases where there are no or few previous studies dealing with the subject. A deductive approach is useful if the general aim is to test a previous theory in a different situation or to compare categories at different time periods (but that is clearly not at issue for our rarely studied topic).[24] By using an inductive content analysis, we (JKT, JdJ and PMP) read through the data looking for recurring themes. First, the entire transcripts were read and emerging themes were coded. New themes in the transcripts were added to the list of codes and added to the previously analysed results. The transcripts of the focus groups were analysed and coded independently by three team members (JKT, PMP and JdJ) with different professional backgrounds (psychiatry, philosophy and sociology). Individual analyses of the team members were compared and discussed to achieve consensus and to increase reliability.[25]

To check validity, participants received a written interpretation of the focus groups in which they participated, asking them to reflect[26] on our interpretation and to

indicate if they recognised the analysis and coding. All participants agreed or had minor additional comments. Three team members (JKT, JdJ and PMP) interpreted each of these transcripts and formulated the major themes discussed. This process of coding yielded eight major themes. The results of the 12 focus groups were then compared, analysed and interpreted by the three investigators, using an inductive approach. The final result was a summary of the eight themes. Typical quotes were identified per theme and per scientific rank (PhD student, postdoctoral fellow/staff member and full professors) to clarify the coded themes. For review of the quality of reporting, the COREQ checklist was used.

Ethical considerations

All participants took part on a voluntary basis after giving consent by confirming participation through email. The study was not registered and reviewed by an ethics committee because the study only included scientists. Confidentiality was maintained using restricted, secure access to the data, destruction of audiotapes after transcription, and anonymous analysis of transcripts.

Inclusion of participants

We obtained 1810 email addresses of active scientists (stratified by department and by scientific rank) from four UMCs in the Netherlands (UMC 1, 2, 3 and 4).

The 12 focus groups involved 79 participants (table 1). The number of invitations that had to be sent out per included participant was: 1.75 for PhD students, 2.8 for postdoctoral staff members and 2.16 for professors. The main reasons for declining participation were lack of time or having conflicting agendas.

RESULTS

In the introduction of the focus group, participants were asked about their motivation for engaging in scientific research. Across all academic ranks and most strongly among PhDs, all participants most frequently reported curiosity and a quest for truth as their main driving force. Other less frequently described factors were to obtain funding and to show the world the results of your research. Among PhD students, an important motivation to start a PhD trajectory was to increase the chance of admittance to a residency programme for any of the medical specialties.

Table 1 Dividing 79 participants among 12 focus groups

	PhD students	Postdoctoral fellows/staff members	Full professors	Total
UMC 1	6 (3)	7 (3)	6 (2)	19 (8)
UMC 2	8 (3)	7 (4)	4 (0)	19 (7)
UMC 3	8 (5)	3 (1)	6 (1)	17 (7)
UMC 4	8 (4)	8 (4)	8 (0)	24 (8)
Total	30 (15)	25 (12)	24 (3)	79 (30)

The number of women within the group are shown in parentheses.
UMC, university medical centre.

We identified eight themes related to contemporary publication culture. Each theme is described below, and typical quotes that illustrate the opinions are reported in tables 2–4. Quotes in the tables are used as an illustration of the conclusions that were drawn per theme. Since the focus group interviews were conducted in Dutch, the quotes were translated into English by an official translation office for this report. The themes are presented in order of total frequency with which they were discussed in the 12 focus groups.

Research funding

A dominant perception across all focus groups was that there is hypercompetition for scarce funding. Furthermore, the procedures of funding agencies are generally perceived as being subjective and prone to manipulation, since participants felt that knowing the right people (committee members, reviewers of proposals) has a substantial impact on the chance of success.

To obtain funding, participants also mentioned the dominant role of the Impact Factors (IFs) of journals in which publications were published, the number of publications and the Hirsch index. Finally, a common perception was that preparing grant applications was highly time-consuming and thus expensive. Participants universally acknowledged that obtaining funding is a prerequisite for promotions and a bright career perspective.

Most participants believed that positive results are required to obtain funding.

By comparing different focus group interviews in different academic ranks, it was obvious that for postdoctoral fellows and full professors funding is the most important. It can generate jobs and future job opportunities.

Authorships and author sequence

The second theme was authorships and author sequence. A frequently reported negative experience was that of disagreement regarding authorships and authorship sequence. According to the participants, this is often an important cause for disputes in research groups.

This theme was also related to the importance of first and last authorships in the evaluation of institutions and individual scientists by funding agencies and universities. Also, most scientists considered the presence of gift authors (people who do not contribute significantly to a manuscript but are named in the author list) as a nuisance, even if it increases the chances of manuscript acceptance. ‘If you don’t contribute to a paper, you should not be on the author list’. Interestingly, rewarding team effort was hardly mentioned as a positive effect of the increased number of authors per paper.

A less frequently raised topic was the increasing number of authors. Some participants reported a sense of frustration, as multiple authors decreases the reward and value of an authorship.

No positive comments were identified on this theme.

Table 2 Quotations to illustrate the content of the publication culture themes in PhD students

Theme	Quote
Research funding	You get grants because of friends and luck. Grants are no measure of ability but of who is who, who do you know and how you present it
Authorships	Oh, we need to add that professor to the list of authors, because if he is on the list it will be easier to get accepted by such and such journal
Quantity vs quality	What they measure now is how much and where you publish, but that says nothing about your qualities as a scientist
Publication pressure	If the pressure on the number of publications decreases, the quality of the publications will increase
Scientific integrity	(with regard to scientific integrity) It is not very common that the voice of the PhD student supersedes the voice of the person who is hierarchically superior. The boss calls the shots
Publication bias	If you find a positive association it is much easier to get published than in case of a negative result
Impact factor	When you have an article published, the first question always is, what's the impact factor. And if it is not very high they generally react; oh, but it is a really nice journal
Competition, prestige, self-satisfaction and vanity	The loudest voice generally gets the best results
	People often begrudge the other person also having his name on a paper

Quality versus quantity

The perceived tension between quality and quantity was a recurrent theme. Most scientists experienced individual performance evaluations as frustrating because the primary evaluation tool was felt to be the quantity of their scientific output rather than its quality.

Table 3 Quotations to illustrate the content of the publication culture themes in postdoctoral fellows/staff members

Theme	Quote
Research funding	If you have no decent publications to put on your CV, you basically have no chance on the grants-market, that is what they look at, that is your fundraising capacity
Authorships	Authorship is a political game, sometimes you list someone as a co-author because you have to and you don't want an argument over something as trivial as one publication
	If you confront him about it my boss becomes really angry and so I just list him
	You often need a hotshot to be published in a high-impact journal. He often has to be the last author
Quantity vs quality	A lot of what is published is nonsense
Publication pressure	The stress of having to have at least 4–6 interesting and solid high-impact papers published each year; failure to produce means you will be judged to some extent
Scientific integrity	One is easily inclined to leave things out just to get it published
Publication bias	That (publication bias) is the reason that fraud exists because without positive results I can forget about my career
Impact factor	That is what a professor said, that he preferred not to publish in lower-impact journals because it wouldn't look good on his CV
Competition, prestige, self-satisfaction and vanity	I think it is a universal quality of scientists that they are vain people, especially when they start publishing, they are often people who like the limelight and to be admired

Table 4 Quotations to illustrate the content of the publication culture themes in full professors

Theme	Quote
Research funding	The willingness to take risks continues to decrease whereas I feel that scientists should be willing to take risks, you see this especially when grants are involved
Authorships	If you didn't feel so much pressure to publish you would also think more often that you don't need to have your name on a paper
Quantity vs quality	The highest goal of a professor is to deliver as many PhDs as possible, something I disagree with, by the way
Publication pressure	Too many publications are premature and slipshod
Scientific integrity	I think fraud and the pressure to publish are communicating vessels
Publication bias	People want to be absolute, so everything (in papers, red.) is described in such a way that the message is earth shattering and unique; I get so tired of that
Impact factor	The scientific system, especially the biomedical disciplines, is totally fixated on impact factors, it's like a religion, when it's actually outdated
Competition, prestige, self-satisfaction and vanity	We need to be careful we don't get bogged down in measurements and who is the best Publishing becomes such an idée fixe, such an important part of you…because you are published you are suddenly the man and then you may start to think you are a very important person

They expressed concerns regarding governmental policymakers who value journal IFs (JIFs) more than scientific quality.

Scientists also felt (albeit less often) that the number of publications is wrongly considered to be more important than societal impact or clinical relevance.

Apart from these frustrations, professors and postdocs also perceived pressure to employ as many PhD students as possible, stimulated by the financial rewards for a doctorate. (In the Netherlands, government funding allocates a weight of €90 000 to each PhD thesis.)

Some participants believed that the main motivation for biomedical PhD students to start a PhD trajectory was to improve their chance of obtaining a resident position in a medical specialty training programme. Such a lack of intrinsic scientific motivation could also affect scientific quality, according to focus group participants.

Except for occasional expressions of a sense of pride regarding Dutch 'publication efficiency' and number of publications per invested Euro, no positive comments were identified on this theme.

PhD students were more resentful that quantity is more important than quality in the present publication culture. This was of less concern to postdocs and professors.

Publication pressure

Although there is overlap between this theme and the theme quality versus quantity, participants identified publication pressure as a separate theme, mainly because publication pressure consists of more than quantity; it also includes the consequences for grant application success rates and position as a researcher. Publication pressure was also not directly linked to scientific quality by the participants.

Many focus group participants personally felt strong publication pressure, and had ideas about the underlying causes. They perceived a culture in which scientists are judged by the number of manuscripts published each year. Many felt a strong pressure to obtain funding and to publish in high-impact journals in order to maintain their position in academia. This pressure was perceived as an external as well as a self-inflicted pressure.

Publication pressure was reported to compromise attention to other tasks, such as patient care or educational activities.

A minority of focus group participants experienced no publication pressure, but did notice such pressure among their colleagues.

Scientific misconduct and integrity

Scientists perceived ample room and opportunity to engage in questionable research practices (QRP). A commonly expressed cause for this was that research is perceived as solitary work: data analysis is often performed alone. There is little auditing by colleagues or fellow researchers, making scientific work vulnerable to QRP and research misconduct.

The participants also acknowledged that many biomedical scientists are not properly educated as to how to

avoid the grey areas of QRP. Their perception was that much sloppy science is in fact due to a lack of sound methodological education, generating room for a grey area between responsible conduct of research and scientific fraud. According to virtually all participants, there is in most cases no intention to deceive readers.

All focus group participants felt that the pressure to publish positive results often stimulates a scientist to cross the line of responsible conduct of research.

The PhD students reported that, owing to the strict hierarchy, they are reluctant to bring up QRP and research misconduct with their supervisors; they experience a lack of trust and confidentiality to talk to a senior researcher about possible research misconduct.

Many participants—especially postdocs and professors—expressed that they can understand to some extent why some colleagues cannot resist the temptation of engaging in QRP or even research misconduct.

A positive comment was that most participants thought scientific fraud is very rare in their communities; they felt that there is almost never an intention to deceive.

Publication and reporting bias

Most participants felt that there is hardly any possibility to publish negative or 'no difference' results. For this they hold the scientists, reviewers, editors and other stakeholders that take part in the publication process responsible.

Many participants thought that 'sexiness of research results' (ie, popular research areas with spectacular findings), rather than scientific quality, is essential to achieve high-impact publications.

Some participants expressed severe doubt as to whether high-impact journals judge and select submissions objectively based on scientific quality only, or whether they also select based on sexy results or citability.

Most scientists were aware that it is tempting to exaggerate their research results as a consequence of this 'positivitis'. As one associate professor said: 'The sexier the research results, the easier it gets published'.

As a consequence of published results being skewed towards positive outcomes, these results become difficult to replicate, according to many participants. No positive comments were identified on this theme.

Impact Factor

Participants reported that when they have to decide which journal to publish in, the JIF is more important than the aim and scope of a journal. They felt, however, that judging a journal solely on its IF is wrong. Most participants emphasised that the IF is not a good index to measure scientific quality, as it predominantly measures impact based on recent citation scores, and does not necessarily reflect methodological rigour, let alone clinical relevance.

Some participants would not publish in journals with an IF<2 as they believed this could negatively impact their career. One professor felt he would be sanctioned by his superiors if he would publish in low-IF journals, because of effects on the ranking and prestige of his university.

Many PhD students expressed their outright anger about the extreme focus on the IF. They felt that this was damaging to the scientific enterprise. Such frustrations were not expressed by more senior scientists.

A positively perceived aspect of the IF was that, although it is not a good indicator, it can to some extent help when deciding where to publish your research.

Disputes, prestige, self-satisfaction and competition

Many scientists experienced disputes among colleagues working in the same department. They believed that this is often caused by disagreements about authorships, envy and the unwillingness of some researchers to cooperate. Many also felt that scientists begrudge their colleagues' scientific success. Some participants believed that resentment and envy could negatively influence the quality of scientific studies, compromise peer review and frustrate collaboration.

Recognition and prestige were considered to be important personal factors in this process. As one professor stated: 'scientists can get high on a high-impact publication'.

Recognition and prestige were perceived as problematic mostly by experienced postdocs and professors. PhD students did not perceive this to be a major problem but emphasised the problem that sometimes they become involved, (to some degree) involuntarily, in disputes among senior researchers in their department.

A few participants also underlined the beneficial effects of competitiveness. They see competition as an essential ingredient for a flourishing, productive scientific culture.

Differences between scientific ranks

Most PhD candidates have rather naïve opinions about contemporary publication culture. They argue that science should be a genuine quest for truth and see scientists as truth-seekers who focus on scientific quality. Anything that disrupts this perception is judged negatively. The present focus on the quantity of scientific output instead of scientific quality especially is a thorn in their side.

Postdoctoral fellows/staff members and professors hold more realistic or perhaps even slightly cynical views about the publication culture and are more sympathetic to the somewhat dubious elements in the scientific process. They accept these influences more readily.

Regarding publication pressure, the focus group interviews show that postdoctoral fellows/staff members feel the strongest pressure to publish. They experience the urge to produce in order to secure their positions and get the prestige and recognition for their publications, to get funded and prosper in their career (with a tenured professorship on the horizon). The present

credit cycle in biomedicine mainly focuses on first authorship papers for PhD students and last authorships for professors. Postdoctoral fellows feel that they were sometimes denied last authorships, which in their opinion they deserved because of their role in the research process.

PhD students do not feel this amount of pressure, unless they are at the end of their PhD trajectory. Professors perceive less pressure than postdocs, since they already have a successful career and plenty of recognition.

DISCUSSION

The purpose of our study was to identify and understand the perception of contemporary publication culture among Dutch biomedical scientists. Participants of the focus groups identified eight themes in contemporary publication culture as relevant for their daily work.

In general, the current publication culture has a negative connotation, which is apparent in all eight themes. With respect to research funding, participants expressed concerns over excessive competitiveness, unfairness, and lack of accessibility for newcomers and original concepts. Authorships and author sequence were commonly associated with disputes and conflicts among colleagues. Concerning quality versus quantity, it was generally felt that the focus on the quantity of scientific output affected scientific quality. Publication pressure was described as an external source of stress from funding agencies and institutions, as well as an internal urge to improve personal career perspectives.

Engagement in QRP and even in research misconduct was associated with pressure to publish, and participants did to some extent understand why colleagues could not resist the temptation to stray from a course of responsible conduct of research. The participants also believed that preferentially publishing positive findings (publication bias and positive outcome bias) in high-impact journals substantially improves scientific career perspectives.

The IF has become increasingly dominant in the current publication culture. Although the IF is not perceived as a quality predictor, it dominates the publication process. Participants regard the IF as one of the most important factors in deciding which journal they want to publish in.

Finally, the participants underline the important role of competition, prestige and vanity in scientists' motivation and conduct.

Comparison with existing literature

A previous focus group study among biomedical scientists in the USA[27] that investigated the role of competition in scientific practices found that competition has profound effects on the way science is performed. In that study, competitive experiences (such as prestige, grant application and pressure to publish) were perceived as detrimental and related to scientific integrity and personal job satisfaction. The results related to the theme competition are in line with these results.

Other research also supports the existence of a predominantly negative perception of publication culture. For example, competitiveness and a focus on productivity and citations have been related to perceived publication pressure.[12] Excessive competitiveness is believed to have potentially perverse effects.[27] Authors are reported to rush into print, cut corners, exaggerate their findings and overstate the importance of their results.[3] These findings are confirmed by our participants.

The possible effects of a hypercompetitive scientific environment on scientific integrity are visible in frequent anecdotal reports.[28] There is also empirical evidence in line with our findings; scientists who perceive high levels of pressure are more likely to withhold data or results,[17 19] and studies suggest a correlation between the level of perceived competition, publication pressure, observed misconduct, fears of retaliation and conflicts.[16 18 29] Nevertheless, the focus on publication culture as in the present study has never been systematically investigated.

Interpretation of the results

Our study addresses contemporary publication practices as seen through the eyes of biomedical scientists. However, what do the results mean for the biomedical scientific community? Our results suggest that perceptions of the current publication culture are mostly negative, causing a pessimistic and sometimes cynical view on (the validity of) scientific research.

Analysis of differences between job titles suggests that younger scientists hold a stronger view of science as a genuine quest for truth than many of their senior colleagues. Could this indicate a gradual decline of ideals over the course of a scientific career, caused by hypercompetitiveness? Or is the explanation found in the idealistic scientists preferring other career paths and leaving academia, causing selection of scientists as they become more senior? An answer can be found in the Cognitive Dissonance Theory (CDT).[30] Cognitive dissonance would mean that researchers who find themselves vested in a path that does not align with their ideals—hence in a state of conflicting attitudes, or cognitive dissonance—can either modify their behaviour (or quit) or modify their attitudes. The observed variation is congruent with the extent to which careers depend on publication pressure. Our study cannot differentiate between these and other possible explanations, but the finding itself calls for further research.

Limitations

Qualitative methods can be helpful when investigating complex, new or under-researched topics to generate hypotheses for further investigation.[31] However, such studies lack advantages of quantitative studies, such as precise measures of effect sizes and variation.

Moreover, group dynamics can lead to distorted perspectives. The idea behind the focus group method is that group processes can help people to explore and clarify their views in group discussions with peers. On the one hand, these dynamics may have caused exaggeration of some themes if an atmosphere of complaining and negativity in discussions develops in a group. On the other hand, group dynamics may have caused shyness to openly express every opinion, doubt or experience, thus causing under-reporting and underestimation of themes, experiences and perceptions. Group work can actively facilitate the discussion of taboo topics because the less inhibited members of the group break the ice for shyer participants.[32] This atmosphere was often created in the focus groups by our discussion leaders who have extensive experience with group dynamics.

Another factor that may have caused bias is prejudice in the group facilitators. Indeed, the facilitators were part of research groups or organisations involved in assessment of research culture, and concerns over some aspects of research culture are indeed part of their everyday work. Nonetheless, facilitators with strong prejudices regarding likely outcomes could not guide focus groups, and instructions to facilitators were to be as objective as possible. They were instructed not to participate in discussions and to make sure that the participants decided for themselves which subjects and themes were discussed.

Regarding gender aspects, males were overrepresented in the full professor group. This is in accordance with the male/female ratio among professors in the Netherlands.[12] Gender differences should be interpreted with caution in qualitative analysis. The study population was too small to draw firm gender-related conclusions.

Considering the generalisability of the results, the sample is large enough to draw conclusions. The results can be seen as reasonably valid, as we reached saturation per layer[22 23]. Nevertheless, the reader must decide, interpret and reflect whether the results are generalisable for their scientific practice. It can be questioned whether our findings apply to other countries. Academic structure and culture in other countries may certainly differ. Nevertheless, the problems that were presented in the focus group study by Melissa Anderson[27] showed similar results in the USA. Furthermore, publication pressure measured by the Publication Pressure Questionnaire (PPQ) was also high in a Flemish population.[18]

Finally, the influence of a response bias cannot be ruled out. The number of invitations that had to be sent per participant was 1.75 for PhD students, 2.8 for postdoctoral staff members and 2.16 for professors. Most of the invited scientists who did not participate were asked to explain their reasons for declining participation. Reasons such as lack of time, conflicting agendas, maternity leave or non-mastery of the Dutch language were mentioned. Nevertheless, we cannot exclude unwillingness to participate as a possible source of response bias.

Changing the culture

It is not easy to push an established culture in another direction. Academic structure is complex, which makes it hard to predict which interventions will work and to whom they should be directed. Nevertheless, change starts with increased awareness among all parties involved. In this light, the good news is that numerous initiatives across different scientific areas have recently emerged. (To name a few: METRICS, the DORA manifesto, Force11, ALTmetrics, Science in Transition, the REWARD alliance, etc.) These initiatives will eventually result in new values and forms to reshape current publication practices.

CONCLUSION

Active biomedical scientists from four UMCs in the Netherlands describe a publication culture with an extreme focus on IFs, funding, authorships and publishing positive papers. These factors intensify competition between them and emphasise the dominance of quantitative scientific output over methodological quality, especially over the replicability of findings. This raises serious concerns about the credibility of scientific results. Future research should identify alternatives and interventions to restore core values such as trust, credibility, integrity and collaboration.

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