

Open Access publishing around the globe. A two-tier study on the perspectives of international medical informatics researchers on a barrier-free communication of science

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Abstract

It is considered important or even necessary for a continuous exchange of scientific information that all relevant stakeholders can access the inner-scientific communication. The traditional publication model, however, does not provide an inclusive flow of communication but rather favours researchers affiliated with resource-strong institutions, oftentimes located in the Global North. Hence, there are increased efforts to establish an alternative, open access (OA) publication model. Since such a model can only be successful if scientists themselves support and use it, this paper presents a two-tier study examining the factors that might shape scientists' decision (not) to choose an OA option for disseminating their own work. Based on (semi-)standardized surveys of scientific organizations and individual researchers in the field of biomedical and health informatics, it provides an overview of individual and institutional frame conditions that influence the dissemination and reception of scientific knowledge. In order to account for regional differences, it draws on a global sample, comprising respondents from Africa, Asia and the Pacific, Europe, Latin America, Middle East and North America. Overall, the findings provide a heterogeneous picture of how OA is perceived and practiced. Respondents appreciate the convenient way to access OA articles as readers and the opportunity to reach broader (non-academic) audiences as authors. However, due to high publication fees and concerns regarding quality and reputation, a positive attitude towards OA does not necessarily translate into willingness to choose this publication model. Especially researchers from low-income countries benefit from a barrier-free communication mainly in their role as readers and much less in their role as authors of scientific information. This is also evident at the institutional level, as OA policies or financial support through funding bodies are most prevalent in Europe and North America. These findings call for more attention to inner-scientific communication as part of (science) communication research.

Keywords: academic publishing, inner-scientific exchange, open access, science communication, survey

Introduction

The growing demands on knowledge transfer between science and society and the high specialization within research fields require an inclusive global exchange of scientific information (Leßmöllmann, 2020; Weingart, 2001). Traditionally, however, inner-scientific communication is not visible to everyone but hidden behind a paywall. Many publications are accessible only for subscribers of the respective journal (Suber, 2012), excluding researchers from resource-limited settings as well as non-academic audiences. Open Access (OA), understood as the distribution of scientific content without financial, legal or technical barriers, is a key development in this respect. This became clear not least in the wake of the Covid-19 pandemic in 2020, where the relevance and prevalence of research circulating openly around the globe has sharply increased (Kwon, 2020).

Opening inner-scientific communication is nevertheless accompanied by controversial debates. For example, while preprint servers enable a rapid dissemination and exchange of knowledge, they lack traditional mechanisms of quality assurance and allow for public feedback via comment sections or direct messages to the authors instead. Consequently, scholars have raised concerns that preprints can be easily used to postulate misleading and speculative claims without sufficient supporting evidence (Kwon, 2020). Moreover, in the vibrant publication market, so-called predatory journals increasingly trap researchers via personalized advertising e-mails into paying a publication fee for rapid publication of one's scientific work. These fraudulent businesses do not provide any or only inadequate editorial and peer review services and researchers who – perhaps unwittingly – publish their work with them risk damaging their standing in the scientific community (Kurt, 2018). At the same time, the rise of large initiatives from political and scientific organizations (e.g., Science Europe 2019; Projekt DEAL 2019) has made OA a major issue at the crossroads of science, politics and the general public, with far-reaching consequences for how scientist do their work and communicate it to audiences within and beyond the scientific system. These profound changes in the scientific communication environment make it all the more important to understand the attitudes and behaviours towards OA of scientific organizations and individual researchers themselves.

This study addresses this need and provides a comprehensive overview of factors that might shape scientists' decision (not) to choose an OA option for publishing their own work. Following on from debates about the role of research funding bodies, universities and academic publishers within the context of OA (Tennant et al., 2016), this study examines both the individual and institutional conditions that influence the production, dissemination, and reception of scientific knowledge by surveying scientific organizations and individual researchers. While this study is not the first pursuing this objective (e.g., Rowley et al., 2017; Severin et al., 2020), it is innovative by taking the global nature of the OA development seriously. In particular, it sheds light on researchers' use and opinion of OA worldwide, divided into six global regions, namely Africa, Asia and the Pacific, Europe, Latin America, Middle East and North America. By doing so, it follows previous attempts (e.g., Jung, Rowley & Sbaffi, 2019) to further balance the strong focus on the publication behavior of scientific communities in Europe and North America, which prevails in the current literature. In addition, it aims to generate comparative insights considering that conditions for the development of OA are not the same everywhere and that OA thus might not unfold in all regions equally.

To date, natural science disciplines are leading the way of OA developments, with mathematics having the highest proportion of OA articles, followed by biomedical research, health and clinical medicine (Piwowar et al., 2018). The present study is discipline-specific in a sense that it focuses on scholars only in

the field of biomedical and health informatics. They are early adopters of OA and represent a research field with similar publication habits than the social sciences (Fry et al., 2009), which makes the results transferrable to disciplines such as media and communication, which are not yet as far along in OA. Hence, overall, this study provides valuable insights for stakeholders concerned with the communication of scientific knowledge within and beyond the scientific system.

Development and practices of OA publishing

The first steps towards opening the inner-scientific communication have already been taken in the late 1960s and early 1970s. 20 years later, in the 1990s, scholars took advantage of the new Internet technology and the first free online peer-reviewed journals emerged (Harnad, 1991). Through the launch of the Budapest Open Access Initiative in 2002, the concept of OA finally became known to a broader public. Besides a first definition of OA, the initiative includes different strategies to realize a free online sharing of research. In 2003, it was supplemented by the Bethesda Statement on Open Access Publishing and the Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities (Suber, 2012). The latter broadened the scope of OA contributions by including not only original scientific research results but also cultural heritage and provided legal specifications of the copyright (Max-Planck-Gesellschaft, 2003). These public statements are still regarded milestones of the OA development and have already been signed by hundreds of institutions worldwide.

As already described in the Budapest Open Access Initiative, barrier-free access to inner-scientific communication can be achieved through different practices. First, in *gold road* OA, scientific work is either published in a pure OA journal or in a subscription-based journal operating gold OA with publication. The gold road implies that the work is freely accessible to everyone online, from the moment it is published. Moreover, it grants readers wide-ranging exploitation rights (Suber, 2012). For gold road OA, many publishing houses charge their authors a publication fee, so-called article processing charges (APCs) ranging from less than hundred to a few thousand Dollars for top-ranked journals (Markin, 2017). Authors may thus receive funding from their institution or research grant to cover them, and publishers may provide discounts and waivers to support researchers from resource-limited institutions.

Second, *green road* OA calls authors to self-archive their scientific work in an institutional or disciplinary repository or on their own website (Suber, 2012). Self-archiving is usually free of charge and can be done before or after one's work is published in a scientific journal. The self-archiving of postprints – i.e., of manuscripts that have undergone external peer review and are accepted for publication or are already published – might be subject to legal provisions by the publishing house. In particular, publishers tend to impose an embargo period of at least six months after publication. A postprint can only be placed in a repository after the embargo is lifted. The self-archiving of preprints – i.e., of manuscripts that have not (yet) undergone external peer review and might have only been submitted to a publisher –, is usually not exposed to such legal restrictions. A cross-disciplinary survey among researchers however has revealed difficulties in distinguishing between manuscripts uploaded before and after they went through editorial and peer review services (Spezi et al., 2013).

Over time, the opening of the scientific publication system has also brought unintended consequences. Due to pirate sites such as Sci-Hub that share publications for which reuse rights have not been granted, *black OA* has become an emerging phenomenon (Björk, 2017). Popular academic social networking sites such as Research Gate or Academia.edu further perpetuate black OA by encouraging researchers to make their full-text work available. To a weaker extent, black OA can also be found on Twitter, where users post the title of a publication and add relevant hashtags in the hope that researchers with access to the respective journal will send them the paper. While black OA has mainly legal implications, *predatory journals* affect the perceived quality of OA publications and thus the reputation of this publication model in general. The risk of publishing in a fraudulent journal is transferred to authentic OA journals, leading to a perceived lower quality of this publication model, especially among less experienced researchers (Swanberg et al., 2020). Highlighting the need of an international perspective, there is evidence that many authors of predatory publications are young scholars located in the Global South (Truth, 2012). Besides unawareness, publication pressure and a lack of research proficiency as potential explanatory factors, Kurt (2018) showed that researchers from the Global South assume that journals from the Global North would not understand or appreciate their work and thus reject them, which makes them look for alternative publication opportunities, including predatory journals.

Attitudes towards OA publishing: individual and institutional factors

Although the opening of inner-scientific communication involves very different practices, they all have one thing in common: "Establishing open access as a worthwhile procedure ideally requires the active commitment of each and every individual producer of scientific knowledge and holder of cultural heritage." (Max-Planck-Gesellschaft, 2003). In other words, the future development of OA depends on individual researchers' decision where to publish their scholarly work and thus on their underlying perceptions and attitudes towards this publishing model.

From the beginning of their careers, researchers are required to achieve visibility in the scientific community. The possibility of gaining greater visibility and impact for one's own work is therefore recognized as a key advantage of the OA publication model (Heaton et al., 2019; Joung et al., 2019; Dalton et al., 2020). The actual net effect of OA on citation rates is yet unclear and often dependent on discipline (McKiernan et al., 2016). The majority of empirical studies, however, shows that OA articles tend to be more immediately recognized by peers and gain higher citation rates than their subscription-based counterparts (e.g., Eysenbach, 2006). Besides these more strategic, career-oriented motives, researchers' publication habits are guided by normative beliefs (Heaton et al., 2019; Joung et al., 2019; Dalton et al., 2020). OA enables scientists from resource-limited regions or institutions to easily access relevant literature and thus to take part in the academic discourse. Moreover, it supports the democratization of science by allowing non-academic audiences (i.e., members of the general public) to observe the research work they fund with their tax money and, in some cases, even participate in.

The positive attitude towards the principles of OA is opposed by a critical perception of its practices (Xia, 2010; Morris & Thorn, 2009). Access to scientific information is no longer paid for by readers, but by authors through article processing charges. Although there are mechanisms to alleviate APCs, these costs

make publications in OA outlets unequally accessible, putting a disadvantage on researchers without adequate institutional and financial support (Schroter et al., 2005) and are thus a major barrier to a wide adoption of OA (Dallmeier-Tiessen et al., 2011; O'Hanlon et al., 2020). In addition, reputation and quality are central criteria for choosing a publication outlet (Schroter et al., 2005; Joung et al., 2019). Hence, several studies demonstrate that researchers eschew away from the OA publication model due to negative perceptions of the editorial and peer review process together with uncertainties about plagiarism and copyright (Lwoga&Questier, 2015), in particular regarding commercial reuse (Joung et al., 2019). These uncertainties might also be related to the fact that overall, researchers appear to be rather unfamiliar with OA as an alternative publishing model (Morris & Thorn, 2009).

The financial aspect highlighted above already points to influencing factors that are outside the individual sphere and cannot be easily altered by researchers themselves. These institutional frame conditions comprise at least three players that are decisive for the generation and publication of scientific knowledge, namely the scientific system, publication services providers, and national or international Open Access policies developed, for example, by funding bodies. Particularly OA policies might consider it mandatory for researchers to publish in an outlet that allows for OA, irrespective of their personal attitude towards this publication model. Moreover, in terms of the scientific system, publication habits that favor a specific publication model might prevail in one's scientific community. As a consequence, researchers are afraid that OA publications might have a negative impact on their careers, as in the academic tenure and promotion system, publication strategies aimed towards openness are not specifically rewarded yet (Peekhaus, 2020). Yet not least in this domain, there may be regional differences that need to be taken into account. In order to further explore these influencing factors and thus to gain a better understanding of the conditions and characteristics of inner-scientific communication, we conducted a two-tier study on the perceived drivers and obstacles of OA publishing in the field of biomedical and health informatics.

Objectives and research questions

Grounded in the exemplary field of biomedical and health informatics, the overall aim of this study is to supplement existing research on attitudes and behaviours towards OA publishing. In particular, we aim to identify factors that help or hinder researchers' decision to turn to OA, located on two different levels: the individual and the institutional level. The overarching research question therefore reads:

RQ: What do researchers perceive as the drivers and obstacles of OA publishing?

Starting with the individual level, first of all, we are interested in how familiar researchers in the field of biomedical and health informatics are with OA. Building on studies that revealed limited familiarity with OA (Morris & Thorn, 2009), we ask:

RQ1: How experienced are the researchers with OA?

Publication models can be evaluated from the perspective of authors and of readers of scientific work. As this differentiation has hardly made explicit before, in this study, we aim to further explore these two perspectives, asking:

RQ2: How does the reading of OA articles compare to subscription-based articles?

RQ3: What criteria are most important when choosing a publication medium and model?

RQ4: How do researchers differ between a reader's and an author's perspective regarding OA?

On an institutional level, OA is subject to a variety of (science-)policy efforts, which are reflected in recommendations and guidelines issued by actors of the scientific system, the publication system or the funding system (e.g., Science Europe 2019). We therefore specifically ask about institutional aspects that might affect the publication habit of biomedical and health informaticians:

RQ5: What influence do institutional frame conditions have on the decision for a publication model?

Moreover, we are interested in the anticipated future of OA publishing in order to understand how OA is envisioned in a particular research field:

RQ6: How do researchers appraise the development of the publication landscape in the near future and what are their wishes in this regard?

Finally, aiming to paint a more nuanced picture of OA and take the global aspect of this movement seriously, we consider potential regional differences, asking:

RQ7: Are there regional differences in the state and standing of OA?

Methods

Research design

In order to answer the research questions outlined above, we conducted two surveys of different target groups in the field of biomedical and health informatics: scientific organizations (Module A) and individual researchers (Module B). The scientific organizations under study are member societies of the International Medical Informatics Association (IMIA¹), which is the worldwide umbrella organization of biomedical and health informatics. It is a Non-Governmental Organization in official relation to the World Health Organization (WHO) and has approximately 70,000 members. The individual researchers are members of these IMIA member societies. Both Module A and Module B are based on a shortpreparational survey that we conducted at an international meeting of biomedical and health informaticians (Kuballa et al., 2017).

Table 1: Research design

Module A	Scientific organizations (IMIA member societies)
Module B	Individual researchers (members of IMIA member societies)

¹ For more information on IMIA visit <https://imia-medinfo.org/wp/>. For information on IMIA member societies visit: <https://imia-medinfo.org/wp/imia-member-societies/>

Module A

Module A is based on a semi-standardized online survey of scientific organizations in the field of biomedical and health informatics. The basic population comprises all 56 member societies of the IMIA in 2018, represented by their presidents and CEOs. The target group for investigation were these representatives. We had the privilege to inform them in the IMIA's General Assembly Meeting in 2018 about the upcoming survey and were supported by a statement of IMIA's Board strongly recommending member societies to participate in this survey. The online survey was fielded in May and June 2019. The participants (i.e., presidents and CEOs representing the IMIA member societies) were invited via email and instructed that each member society should answer the questions once.

The online survey² consisted of eight questions, seven of them were open-ended. They asked about the current situation of OA publishing in the member society's country of origin, with a special focus on the prevalence of gold and green OA (informing RQ1), the perception of scientists' attitudes towards OA (informing RQ2, RQ3 and RQ4), guidelines and policies on OA by the government, funding bodies or academic institutions (informing RQ5), and, finally, predictions of the future development of OA (informing RQ6, see Appendix 1 for the original question wording). Based on Mayring's (2014) approach of the qualitative structuring content analysis, the open-ended answers were systematically annotated and condensed by three authors of this study. They followed an iterative procedure based on a mutual understanding agreement. From the 56 IMIA member societies invited to participate in the study, 22 returned the survey³ (response rate = 39.9%). Table 2 displays their regional composition. Since we did not force respondents to answer all questions, some decided to leave single questions blank. If the number of respondents deviates from 22, we highlight this when reporting the results.

² For convenience, both online surveys presented in this paper were designed and conducted via "eSurvey Creator" (<https://www.esurveycreator.com>)

³Two member societies returned more than one questionnaire. In the analysis, we only included the one that was returned first.

Table 2: Origin of participating IMIA member societies

Africa	Asia and the Pacific	Europe	Latin America	Middle East	North America	Total
		Austria				
	Hong Kong	Croatia		Iran		
Côte d'Ivoire	New Zealand	Finland	Brazil	Jordan		
Morocco	Philippines	Germany	Venezuela	Turkey	United States of America	
Nigeria	Sri Lanka	Ireland		United Arab Emirates		
		Spain				
		Ukraine				
		United Kingdom				
3 of 10 participated	4 of 11 participated	8 of 21 participated	2 of 5 participated	4 of 7 participated	1 of 2 participated	22 of 56 participated

Module B

Module B is based on a standardized online survey of researchers in the field of biomedical and health informatics. The basic population comprises the members of the 56 IMIA member societies. The target group for investigation were these individual members (i.e., individual researchers). The online survey was conducted in August and September 2019. We used the IMIA Newsletter mailing list as well as a mailing list from MEDINFO 2019, the biggest bi-annual international conference on biomedical and health informatics, for recruitment. Here, we also received significant support from the IMIA leadership as the introductory letter of the questionnaire was co-signed by the then President of IMIA. Since some members have subscribed to both lists, we cannot say how many individuals ultimately received the invitation to take part in the survey.

The online survey complements the picture of OA publishing in the field of biomedical and health informatics by focusing on researchers' attitudes, behaviours and needs regarding OA in their country. In order to inform all research questions stated above, it consists of 13 questions (four of them are open-ended), asking for experiences with OA, perceptions of OA from the perspective of an author and of a reader, relevant factors for choosing a publication outlet, support from institutional players, and, finally, predictions of the future development of OA (see Appendix 2).

In total, 155 biomedical and health informaticians participated in the online survey; 144 of them completed it. As in Module A, we did not force respondents to answer the questions, which is why the sample size differs between them. 125 respondents provided information on their sociodemographic and academic status. Most of them are researchers with long experience (e.g., professors or department chairs, 45%), followed by researchers with intermediate (e.g., post-docs, 33.3%) and little experience (e.g., PhD students, 21.7%). This is also reflected in the age distribution: More than 70 percent of respondents are between 30 to 59 years old. 40.8% are female. Our sample covers all six global regions

as defined by the IMIA (see table 3). However, a broad share of respondents is based in Europe (47.2%), followed by North America (24%) and Asia and the Pacific (16%).

Table 3: Composition of the sample (n = 125)

Region	Number of participants
Africa	5
Asia and the Pacific	20
Europe	59
Latin America	7
Middle East	4
North America	30
Total	125

The analysis mainly relies on descriptive statistics. In order to illustrate and enrich the descriptive reports with statements from the various global regions, we further provide quotes of the 548 free text responses obtained in the survey.

Results

For better reading, we break down the module structure in this section and report the results of Module A and Module B together, following the order of the research questions.

Experience with OA publishing

First, among the individual researchers under study, more than 92% of the respondents (133 of 144) are familiar with OA publishing. A subsequent open-ended question, however, reveals that the meaning of the term “familiar” differs widely: almost 50% of the 99 statements obtained explicitly refer to experiences with OA journals as authors. 25% indicate that the respondents came into contact with OA only as readers and have not yet chosen this publication model themselves. Hence, with regard to the first research question (RQ1), we see that OA is a well-known concept among biomedical and health informaticians around the globe, but with varying depth of experience. 20% of all statements refer to article processing charges, with some respondents outlining that they would actually like to publish in OA, but can’t afford the fees. Those who already have authored an OA publication reported to have made good experiences

with this model, in particular regarding speed of publication and visibility in the research field. Predatory journals, however, might impair this positive attitude, which is why appropriate solutions are required:

"The so-called predatory journals should be diminished, and we have to all fight against them as they present a bad image of OA" (Middle East)

Since OA can be practiced in different ways, we asked the IMIA member societies about the prevalence of the green and gold road to OA in their country of origin. Eight of the 19 responding societies could not identify a preferred model in their country, followed by six societies who report that the gold road is followed most often. The green road was selected by five societies. It appears that the IMIA societies located in Asia and the Pacific mainly refer to the gold model of OA, while most of the societies located in Europe believe that both routes are used equally (see table 4).

Table 4: Prevalence of OA models per region (number of mentions, n = 19 IMIA member societies)

Region	Mainly gold road	Mainly green road	Both roads about equally
Africa	0	2	2
Asia and the Pacific	3	1	0
Europe	1	2	3
Latin America	–	–	–
Middle East	2	0	2
North America	0	0	1
Total	6	5	8

Note: Answers refer to the question "In your opinion, do open access publications in your country follow mainly the green or gold road to open access or are both roads used about equally?"

Individual-level drivers and obstacles

Turning to the sentiment of researchers in biomedicine and health informatics with regard to Open Access in their country, the majority of the responding societies rated it as positive (77.3%, 17 of 22) or mainly positive (13,6%, 3 of 22). However, they assume differences between seniority levels: the most positive attitude towards OA was attributed to early-career researches (e.g., PhD students), the least positive to researchers with long experience (e.g., professors or department chairs). No country differences were observed in this respect.

When asking individual researchers in their role as readers of OA publications (RQ2), our data reveals that 70 percent of the respondents (99 of 142) recognized a difference between open access and closed-access articles⁴. 65 percent (92 of 141) further agreed to be more likely to read an open access article than a closed-access article. This aligns with the fact that 78 percent of the respondents (110 of 141) note that OA simplifies their literature research and only 15 percent (21 of 140) think that the information upon new published articles is more difficult for OA. The statement that it is much easier and more convenient to access OA articles also receives overwhelming approval (83%, 118 of 142); only 2.8 percent strongly disagree with it. Interestingly, respondents from North America are least likely to agree that OA makes it easier to search for and access literature. In addition, they are least likely to read an OA article rather than a closed-access article and – together with respondents from Asia and the Pacific – indicate the strongest perceived difference between the two publication forms. In this respect, they markedly differ from participants from Africa and the Middle East. Table 5 displays the regional comparisons in detail.

Table 5: Researchers as readers: perception of OA publications (mean values and standard deviations, n = 125)

Region	There is no difference between open access and closed-access articles for me.	It is much easier and more convenient for me to access OA articles.	OA articles for me simplify literature research.	It is more likely that I read an open access article than a closed-access article.	The information upon new published articles is more difficult for OA articles I think.
Africa	1.2 (0.4)	5.0 (0.0)	4.2 (1.8)	4.6 (0.9)	3.2 (1.3)
Asia and the Pacific	2.6 (1.4)	4.5 (0.9)	4.2 (0.9)	3.5 (1.3)	3.0 (1.1)
Europe	2.2 (1.4)	4.5 (0.9)	4.5 (0.8)	4.0 (1.0)	2.5 (1.1)
Latin America	2.4 (1.9)	4.6 (1.1)	4.6 (1.1)	4.3 (1.1)	2.6 (1.5)
Middle East	1.3 (0.5)	5.0 (0.0)	5.0 (0.0)	4.0 (1.2)	2.0 (1.2)
North America	2.7 (1.6)	3.7 (1.4)	3.5 (1.6)	3.1 (1.4)	2.3 (1.1)
Total	2.3 (1.5)	4.3 (1.1)	4.2 (1.2)	3.7 (1.2)	2.5 (1.1)

Note: All items were measured on a 5-point scale, with 5 indicating approval.

⁴ Please see Appendix 3 for the results in tabular form and, additionally, grouped by seniority level.

From the perspective of researchers as authors (RQ3), OA was also highly valued by the biomedical and health informaticians participating in our study: the majority (61%, 83 of 136) would rather choose an OA model for their next publication. The approval rates are particularly high among respondents from Africa (M = 4.8, SD = 0.4), followed by the Middle East (M = 4.5, SD = 1.0). Respondents from North America and Asia and the Pacific, by contrast, agree less strongly with this statement (M = 3.5, SD = 1.4 and 1.6, respectively; all items measured on a 5-point scale, with 5 indicating approval). The open-ended question tapping into the rationale for this decision supports previous literature on drivers and obstacles of OA publication models (Greussing et al., 2020). Researchers preferring an OA publication predominantly emphasized the notion that publicly funded work should be publicly available, as well as the increased accessibility and visibility of their work for both scientific and non-scientific audiences:

"The field of health informatics is a fast changing field and the more we can share research and publications the more benefit the sector gains." (Asia and the Pacific)

When asked about obstructive factors, costs appeared to be the main barrier of OA for the minimum 124 participants who answered this question (M=4.0, SD=1.1), followed by the reputation (M=3.1, SD=1.4) and range of journals (M=3.0, SD=1.2; all items measured on a 5-point scale, with 5 indicating approval). Acceptance in one's own field of research, however, was considered less a problem (M=2.7, SD=1.2), just as experiences with open access (M=2.3, SD=1.1). If we look at the answers of participants from different regions separately, some discrepancies become apparent (see table 6). First, the reputation of the journal seems to be least obstructive for Latin American researchers (M=2.0, SD=1.5), followed by researchers from the Middle East (M=2.8, SD=2.1). Here, they differ clearly from researchers from Africa, where the average approval is 4.2 (SD=1.3). Costs are also not perceived as such a major hurdle in the Middle East (M=2.3, SD=1.9) as in other regions, especially in Africa (M=4.4, SD=0.5).

Accordingly, for the 15.5 percent of respondents (21 of 136) who would rather choose a closed-access publication, the absence of APCs together with the reputation, impact factor and quality of a journal are of highest importance. Also, mutual trust with the system appears to be a decisive factor, as one respondent states in an open-ended question:

"(l)ong term experience with closed access gives me confidence" (North America).

Table 6: Researchers as authors: obstructive factors (mean values and standard deviations, n >= 120)

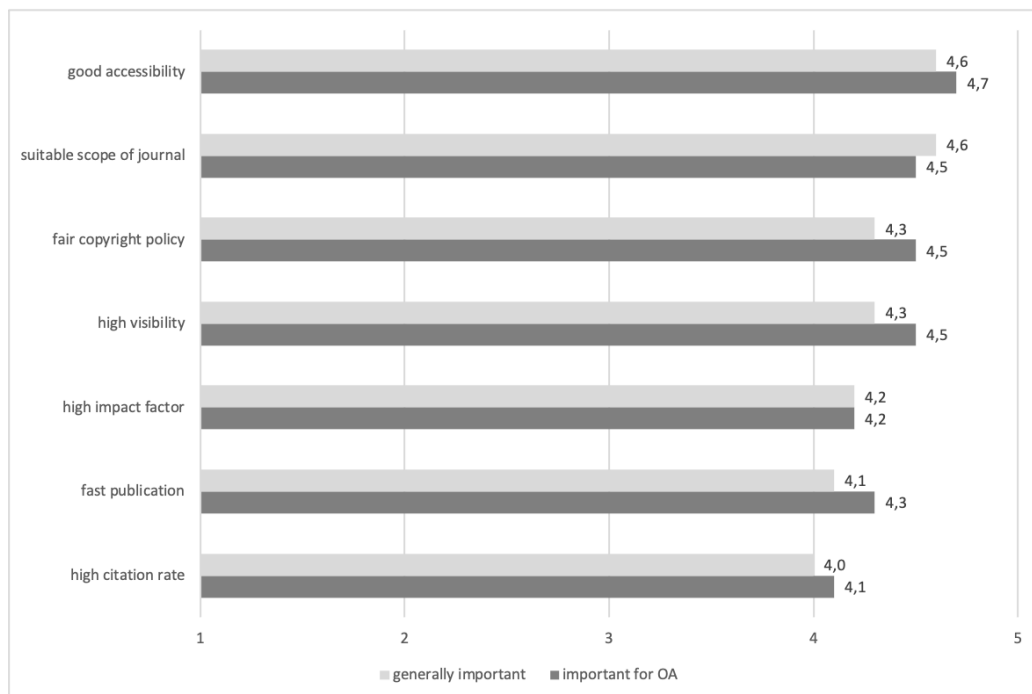
Region	Range of journals	Acceptance in your field	Reputation of journals	Experiences with open access	Costs of publication
Africa	2.8 (1.6)	1.6 (0.9)	4.2 (1.3)	1.4 (0.9)	4.4 (0.5)
Asia and the Pacific	2.9 (1.2)	2.7 (0.9)	3.2 (1.3)	2.7 (1.0)	4.2 (0.9)
Europe	3.0 (1.1)	2.7 (1.2)	3.2 (1.4)	2.3 (1.0)	3.8 (1.2)
Latin America	3.0 (1.6)	3.0 (1.7)	2.0 (1.5)	2.6 (1.4)	4.3 (1.0)

Middle East	2.8 (1.7)	2.3 (1.9)	2.8 (2.1)	1.5 (0.6)	2.3 (1.9)
North America	2.9 (1.3)	2.9 (1.4)	3.2 (1.4)	2.6 (1.2)	4.2 (0.9)
Total	3.0 (1.2)	2.7 (1.2)	3.1 (1.4)	2.4 (1.1)	4.0 (1.1)

Note: Items refer to the question "Are the following factors obstructive for an open access publication in your opinion?" All items were measured on a 5-point scale, with 5 indicating approval.

Moreover, in Module B we investigated whether factors that are generally considered important for the choice of a publication medium also apply to OA publications. As depicted in Figure 1, for the minimum 130 participants that answered this question, the most important factors when thinking about a publication in general are good accessibility ($M = 4.6$, $SD=0.7$) and a suitable scope of the journal ($M=4.6$, $SD=0.6$), followed by high visibility ($M=4.3$, $SD=0.8$), a fair copyright policy ($M=4.3$, $SD=0.9$) and a high impact factor ($M=4.2$, $SD=0.9$). Interestingly, the high citation rate receives the least agreement, but is still considered important with a mean value of 4.0 ($SD=0.9$). Applying these factors to an OA publication, our data based on minimum 126 participants shows that the order of the factors is very similar, but mostly considered even more important for OA publications. In terms of speed of publication, high visibility and fair copyright policy - three core aspects of OA - the difference between factors considered important when thinking about a publication in general and in an OA journal is slightly more pronounced. Overall, however, there do not seem to be any factors that are specifically important to OA. There are also no notable differences between researchers from different global regions.

Figure 1: Importance of factors for publishing (mean values, $n \geq 126$)



Note. Items refer to the question "How important are the following factors for you when you think about a publication?" All items were measured on a 5-point scale, with 5 indicating approval.

Taken together, the analyses so far disclose that the *reading* of OA articles is regarded as more positive than the reading of subscription-based articles, which is mostly due to their ease of access and perceived higher visibility. However, the tenor is more heterogeneous when it comes to *actually publishing* one's own work in an open access journal. Here some barriers are perceived, which leave researchers rather with the traditional system of closed-access publications. Hence, in reference to our fourth research question (RQ4), we see a difference between a reader's and an author's perspective regarding OA.

Institutional-level drivers and obstacles

A more in-depth picture emerges regarding institutional-level influencing factors, in particular guidelines or recommendations on OA issued by the government, academic institutions or publishing houses (RQ5). As can be seen in table 7, our data show that IMIA member societies from Asia and the Pacific as well as from the Middle East do not mention any governmental regulations or recommendations on Open Access publications. Such regulations seem also to be rare in Africa – only one society mentions them. By contrast, 6 out of 7 European societies reported to have such guidance in their country, as well as the only society from North America and Latin America respectively. However, the examples cited refer less to initiatives by the government than by funding agencies. Accordingly, when asked about regulations or requirements on OA issued by funding organisations, 5 out of 7 societies in Europe and the one in North America stated to have them in their country. Among societies in Asia and the Pacific, however, only one in four did so. The same ratio applies to societies in Africa. In the Middle East and Latin America there seems to be no regulations in this area at all. Moreover, 6 out of 7 respondents from Europe reported that research institutions (e.g., universities) in their countries do have OA policies. From a global perspective, policies at this institutional level seem to be the most common, as indicated by at least one positive confirmation in each region. Hence, overall, it appears that institutional frame conditions are important determinants for academic publishing behaviour.

Table 7: Institutional-level frame conditions in the IMIA member society's country of origin (number of mentions, n = 21 IMIA member societies)

Region	Guidance or recommendations by the government	Regulations or requirements by funding organizations	Policies by research institutions (e.g., universities)
Africa	1 of 4	1 of 4	1 of 4
Asia and the Pacific	0 of 4	1 of 4	1 of 4

Europe	6 of 7	5 of 7	6 of 7
Latin America	1 of 1	0 of 1	1 of 1
Middle East	0 of 4	0 of 4	1 of 4
North America	1 of 1	1 of 1	1 of 1
Total	9 of 21	8 of 21	11 of 21

The 84 responses of individual researchers in the field of biomedical and health informatics to the question of how the scientific system, funding bodies, and academic institutions could support them with Open Access, provide us with more details in this respect. Not surprisingly, the desire for financial support to pay the article processing fees took a prominent place in the open-ended answers. Respondents – especially from North America and Europe – state that there are already funds available, for example, from universities or university libraries or that a special amount of grant money from funding bodies is reserved for OA publications. However:

"The university has paid the publication fees, but the payment process has been long. The university policy is to avoid publishing in open access journals." (Latin America)"

Others mentioned regional and international initiatives driven by the scientific community in support of OA, such as the funding programme "Horizon 2020" in Europe or the international "Plan S", an initiative for accelerating OA publishing. Respondents nevertheless miss support from the scientific system and complain that there is no infrastructure available to support the costs of OA publishing. They are dissuaded by the fees of publishers for an OA publication and demand them to be lowered, alongside the implementation of effective funding structures, for example by universities or funding bodies. A French respondent suggests:

"We could, as a community, stop entertaining the big publishers by submitting our research to them, paying them to read our own work, and doing gratis review work for them. We, instead, could create and promote publication services that are really community-driven and serve the scientific community as well as the general public, and not some private interests held by a small group of people." (Europe)

While there were various ideas mentioned about how scientific institutions could support the OA development in their research field, respondents found it more difficult to answer this question for publishing houses. Overall, costs remained the central issue: the researchers in our sample want publishers to lower the fees for OA publications and to launch a model for reduced prices. According to the respective open-ended survey question, this could be realized by expanding the waiver model for low- and middle-income countries, by waiving the fees of journals for a specific time, by reducing the fees for early researchers, or by providing discounts for researchers serving as reviewers for the journal. Another factor is missing information on OA possibilities, as one participant notes:

"Publication service providers do sometimes offer open access. When the price is too high, it discourages this choice. Why don't the publishers support themselves by advertising, like other web services do?" (North America).

Perceived future developments of OA

Turning to RQ6, we were interested in the perceived future of OA in the field of biomedical and health informatics. Although their institutional frame conditions vary greatly, 81% (17 of 21) of the IMIA member societies under study agree that the relevance and prevalence of OA publications in their country will grow in the near future: while none of them predicts a decrease, only one is indifferent and two believe that there will be no change in the next five years. However, overall, changes in academic publishing are expected just in the long term and with a rather slow development pace.

In accordance with the opinion of member societies' representatives obtained in Module A, the survey of individual researchers reveals that 86 percent of 128 respondents predict a consistent rise of OA. However, 34.3 percent also think that a complete change of the publication system to OA will not be feasible. This perception may also have to do with the fact that 71.9 percent of the 128 respondents themselves state that – regardless of the future development – authors should retain the right to choose between the publication models. For almost two thirds of the respondents, however, the authors' preference should nevertheless be for OA. This is in line with the perception that there are no fixed publication habits in the field of biomedical and health informatics.

A comparison of responses from the six different IMIA regions under study reveals further differentiations (see table 8). For example, respondents from Asia and the Pacific agree more strongly to the notion that a traditional closed-access publication is more common in the field of biomedical and health informatics, leading them to prefer this publishing model (M=2.9, SD=1.0) than respondents from other regions do, especially from Africa (M=1.4, SD=0.9) and the Middle East (M=1.5, SD=1.0). This may also be related to the fact that researchers from Asia and the Pacific are the least likely to think that OA will be constantly growing in the future (M=3.8, SD=1.1). Researchers from the Middle East, by contrast, have the highest approval ratings on this notion (M=5.0, SD=0) and they are most likely to believe that a complete change of the publication system to open access will be feasible (M=2.0, SD=2.0).

Table 8: Perceived future of OA per region (mean values and standard deviations, n = 125)

Region	A traditional closed-access publication is more common in my area of research, so I also prefer this publishing model.	The percentage of open access articles will consistently grow.	I do not think that a complete change of the publication system to open access will be feasible.	Regardless of the future development, authors should retain the right to choose between the publication models.
Africa	1.4 (0.9)	4.6 (0.5)	4.0 (1.0)	4.0 (0.7)
Asia and the Pacific	2.9 (1.0)	3.8 (1.1)	3.4 (1.2)	4.3 (0.8)

Europe	2.3 (1.1)	4.5 (0.7)	2.6 (1.3)	3.8 (1.3)
Latin America	1.9 (1.2)	4.0 (1.2)	2.6 (1.3)	4.0 (1.5)
Middle East	1.5 (1.0)	5.0 (0.0)	2.0 (2.0)	4.5 (1.0)
North America	2.3 (1.2)	4.3 (0.6)	3.0 (1.3)	4.4 (0.9)
Total	2.3 (1.2)	4.3 (0.8)	2.9 (1.3)	4.0 (1.1)

Note: Answers refer to the question "In your opinion, do open access publications in your country follow mainly the green or gold road to open access or are both roads used about equally?". All items were measured on a 5-point scale, with 5 indicating approval.

Regional differences

Finally, in this study we are interested in potential differences between global regions (RQ7). The findings of both surveys (Module A and Module B) revealed some patterns in this respect. However, it needs to be considered that the results are only descriptive and based on a small number of participants. Taken together, our study highlights that OA is handled very differently in any region across the globe. The most striking differences were found with regard to the institutional level. While in Europe and North America, political institutions and funding bodies have issued regulations to drive OA forward, such approaches do not seem to be prevalent in other regions, especially in Asia and the Pacific and the Middle East. This difference is less clear when asking about regulations issued by academic institutions: on this level, each region seems to have at least some guidelines and recommendations. These findings lead to reason that frame conditions from public authorities are a determining factor for choosing a publication model, at least in Europe and North America.

It may be related to the extensive access to subscription-based literature that North American medical informaticians are the least likely to believe that OA facilitates discovery and access to scientific publications, and therefore also the least likely to read an open access article rather than its closed-access counterpart. Individual researchers from Asia and the Pacific further report to prefer subscription-based publishing over OA publishing, as the traditional model is more common in their biomedical and health informatics community. Accordingly, they are the least likely to predict an increase of OA publications in the future. Respondents from the Middle East are more optimistic in this respect, as they are most likely to believe that a complete change of the publication system to open access can be achieved. In contrary to researchers from Africa, they also do not regard publication fees and the reputation of the journals as key hurdles to OA publications.

Discussion

Science draws from a constant exchange of information between all its members. However, an inclusive flow of communication can only be guaranteed if all relevant persons can access this inner-scientific

exchange. Since the traditional publication model does not guarantee this inclusivity but rather favours researchers who are affiliated to resource-strong institutions that can cover the subscription fees, there are increased efforts to establish an alternative, barrier-free publication model (Suber, 2012). Following the notion that such an alternative model can only be successful if individual researchers actively decide to disseminate their work open access (Mulligan & Mabe, 2011), this study aims to investigate the drivers and obstacles of OA publishing in the exemplary field of biomedical and health informatics. To enrich existing research, we are not only interested in factors located on the individual level (e.g., individual attitudes and motivations) but also in factors located on the institutional level (e.g., implications of national or international OA policies). Moreover, we aimed to diminish the strong focus on publication habits of researchers located in the Global North by surveying scientific organizations as well as individual researchers worldwide, divided into six regions: Africa, Asia and the Pacific, Europe, Latin America, Middle East and North America. Overall, the two (semi-)standardized surveys presented in this paper reveal a heterogeneous picture of how OA is perceived and practiced in this exemplary research field. In the following, we emphasize three central findings and discuss them in more detail.

First, tapping into influencing factors located on the individual level, it appears that most respondents are familiar with the basic principles of OA and are sympathetic to them. In line with recent evidence (Dalton et al. 2020; Heaton et al., 2019), they appreciate the easy and convenient way to access OA articles as readers and highlight the opportunity to reach broader (also non-academic) audiences as authors. However, only a few respondents have already chosen this model for publishing their own scholarly work, supporting the notion that a positive attitude towards OA does not necessarily lead to increased action in this respect (Rowley et al., 2017). Limited financial resources to pay the publication fees might be a central reason for this (Dallmeier-Tiessen et al., 2011). In addition, researchers in our study express concerns about OA that let them eschew away from this alternative publishing model. These concerns mainly involve aspects of quality and reputation of OA, also against the background of an increasing prevalence of predatory journals. The criteria guiding the choice for a journal nevertheless seem to be similar for OA and subscription journals: good accessibility and a suitable scope are most important. The statements from scientific organizations further indicate that less experienced researchers (i.e., PhD students or postdocs) might be more willing to embrace alternative publication models than more experienced professors or department chairs. This generation gap can serve as another explanation for the discrepancy between attitudes and behaviours to OA: while young researchers are more interested in opening up the existing inner-scientific communication arena, at the same time, they do not have the autonomy to design their publication strategy completely freely, but are dependent on their mentors, PIs or committee members (Dalton et al., 2020).

The power of academic hierarchies and evaluation criteria already points to the second notable aspect of our study, namely influencing factors located on the institutional level. Our study shows that from the perspective of biomedical and health informaticians, the actual influence of the scientific system, funding bodies and publishing houses on a researcher's decision to choose a publication model is limited to a few main factors revolving around costs and resources. Taking regionality into account, it appears that resource-strong western countries provide the most potent funding regimes with regard to OA publication fees. Consequently, researchers from low-income countries benefit from a barrier-free communication mainly in their role as readers and much less in their role as authors of scientific information. In addition,

our study shows that in the field of biomedical and health informatics, policies, regulations and recommendations regarding OA are more prevalent in Europe and North America than in Asia and the Pacific as well as in the Middle East. These pronounced differences between western and eastern world regions could be an important subject of future research, as they imply different drivers and obstacles for researchers when choosing a publication model and thus different preconditions for the global development of barrier-free inner-scientific communication.

Third, the majority of our respondents envisions a constant rise in the relevance and prevalence of OA options on the publication market in the near future. Interestingly, however, quite a few also indicate that in their view, a complete change of the publication system of OA will not be feasible. Related, almost three quarters of our respondents argue in favour of retaining a mixed system where authors can choose in which model to publish their work. In this context we also found some regional differences: in contrast to researchers from Asia and the Pacific, researchers in the Middle East envision a profound change of the publication system with a broad share of open inner-scientific communication. This result might also be an interesting starting point for future studies that focus more closely on researchers' underlying motivations and needs in different global regions.

The findings obtained in this study need to be considered in light of their limitations. Most importantly, the number of respondents in some of the global regions under study are small and do not allow for more in-depth investigations of regional differences. Hence, our surveys need to be regarded a starting point for further comparative investigations. Another limitation refers to the generalizability of the field of biomedical and health informatics to other fields of research. While empirical studies demonstrate great similarities with how Social Sciences deal with journal-based publications (Fry et al., 2009), the transferability to Arts and Humanities, for example, remains questionable. Therefore, in order to deepen our understanding of OA publication habits, more research in fields with distinct practices and cultures is advisable.

Besides public communication about scientific publications via journalistic mass media or social media, a direct access to scientific publications for anyone who might be interested – irrespective of institutional affiliations – is seen as important or even necessary for the future effectiveness of science (Funtowicz&Ravetz, 1993). This aspect of science communication is still underexplored from a communication science perspective, especially since empirical research is mainly conducted in related fields such as scientometrics or information science. However, current developments in the communicative environment such as the increasing proliferation of preprints or predatory journals lend it significant importance. Our study therefore aims to be a starting point for a systematic examination of inner-scientific communication by focusing on the perspective of the main actors: the scientists and science organizations themselves. Importantly, as we have shown in this study, the attitudes and behaviors within one global scientific community cannot be considered homogeneous, but regional differences need to be accounted for in order to deepen our understanding of the drivers and obstacles of alternative publication models on both, the individual and institutional level.

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Appendix 1.**Original question wording of the eight open-ended questions asked in the survey of Module A.**

1. In which country is your society operating?
2. In your opinion, do open access publications in your country follow mainly the green or gold road to open access or are both roads used about equally?
3. How would you describe the sentiment of scientists in biomedical and health informatics regarding open access in your country?
4. Has your government provided guidance or recommendations regarding open access in your country?
5. Have funding organizations provided regulations or requirements with regard to open access in your country?
6. Do research institutions in your country (e.g. universities) have open access policies?
7. What is your prediction how open access will develop in your country in the next five years?
8. Are there any further aspects regarding open access in your country that you would like to discuss?

Appendix 2.

Original question wording of the questions asked in the survey in Module B.

1. Are you familiar with open access publishing? (yes - no - n.a.)
2. What do you think about the following statements in regard of reading open access articles? (10-point scale ranging from disagree to agree):
 - a. There is no difference between open access and closed-access articles for me.
 - b. It is much easier and more convenient for me to access open access articles.
 - c. Open access articles for me simplify literature research.
 - d. It is more likely that I read an open access article than a closed-access article.
 - e. The information upon new published articles is more difficult for open access articles, I think.
3. If you want to publish your current research, would you rather choose a traditional closed-access publication model or an open access publication model? (10-point scale ranging from closed-access to open access).
4. Why have you made this decision? (open-ended question)
5. What experiences do you have with open access? (open-ended question)
6. In general, how important are the following factors for you when you think about a publication? (5-point Likert scale ranging from not important to important)
 - a. Fast publication
 - b. good accessibility
 - c. high impact factor
 - d. suitable scope of journal
 - e. high citation rate
 - f. high visibility
 - g. fair copyright policy
 - h. other: _____
7. How important are these factors for you if you intend to publish open access? (5-point Likert scale ranging from not important to important)
 - a. Fast publication
 - b. good accessibility
 - c. high impact factor
 - d. suitable scope of journal
 - e. high citation rate
 - f. high visibility
 - g. fair copyright policy
 - h. other: _____
8. Are the following factors obstructive for an open access publication in your opinion? (5-point Likert scale ranging from not important to important)
 - a. range of journals
 - b. acceptance in your field
 - c. reputation of journals
 - d. experiences with open access
 - e. costs of publication
 - f. other: _____
9. What do you think about the following statements regarding the choice of a publication model?

- a. A traditional closed-access publication is more common in my area of research, so I also prefer this publishing model. (10-point scale ranging from disagree to agree)
 - b. In future the following publication model should be preferred. (open access - closed access - both - n.a.)
 - c. Open access allows me to spread my research also to people who would otherwise not have the possibility to read the latest research results. (10-point scale ranging from disagree to agree)
10. How could or already does the scientific system support you in open access publications? (open-ended question)
11. How, in return, could or already do publication service providers support you in an open access publication? (open-ended question)
12. What is your prediction how open access will develop in the next five years? (10-point scale ranging from disagree to agree)
 - a. The percentage of open access articles will consistently grow.
 - b. I do not think that a complete change of the publication system to open access will be feasible.
 - c. Regardless of the future development, authors should retain the right to choose between the publication models.
13. At the end, please allow us to ask you some questions regarding your person.
 - a. Are you (male - female - n.a.)
 - b. How old are you?
 - c. From which country do you come from?
 - d. What describes your professional experience best? (early scientist (e.g. Ph.D. students) - scientist with intermediate experience (e.g. postdocs) - scientist with long experience (e.g. department chairs) - n.a.)
 - e. How have you received the invitation for taking this online survey? (via email by IMIA - via IMIA newsletter - via email by Medinfo 2019 - n.a.)

Appendix 3.

Table A1a: Researchers as readers: perception of OA publications

	There is no difference between open access and closed-access articles for me.	It is much easier and more convenient for me to access OA articles.	OA articles for me simplify literature research.	It is more likely that I read an open access article than a closed-access article.	The information upon new published articles is more difficult for OA articles I think.
Strongly disagree	59 (41.5%)	4 (2.8%)	9 (6.4%)	10 (7.1%)	34 (24.3%)
Disagree	40 (28.2%)	9 (6.3%)	8 (5.7%)	17 (12.1%)	27 (19.3%)
Neither agree nor disagree	5 (3.5%)	11 (7.7%)	14 (9.9%)	22 (15.6%)	58 (41.4%)
Agree	22 (15.5%)	28 (19.7%)	28 (19.9%)	44 (31.2%)	13 (9.3%)
Strongly agree	16 (11.3%)	90 (63.4%)	82 (58.2%)	48 (34.0%)	8 (5.7%)
Total	142 (100%)	142 (100%)	141 (100%)	141 (100%)	140 (100%)

Table A1b: Researchers as readers: perception of OA publications (mean values and standard deviations, n= 120)

	There is no difference between open access and closed-access articles for me.	It is much easier and more convenient for me to access OA articles.	OA articles for me simplify literature research.	It is more likely that I read an open access article than a closed-access article.	The information upon new published articles is more difficult for OA articles I think.
Early scientist	1.9 (1.2)	4.4 (1.0)	4.4 (1.2)	4.0 (1.2)	2.6 (1.0)
Scientist with intermediate experience	2.7 (1.6)	4.3 (1.2)	4.2 (1.2)	3.7 (1.3)	2.5 (1.0)
Scientist with long experience	2.3 (1.4)	4.2 (1.1)	4.0 (1.3)	3.5 (1.2)	2.3 (1.2)
Total	2.3 (1.5)	4.3 (1.1)	4.2 (1.2)	3.7 (1.3)	2.5 (1.1)

Note: All items were measured on a 5-point scale, with 5 indicating approval.

Table A2a: Researchers as authors: obstructive factors

	Range of journals	Acceptance in your field	Reputation of journals	Experiences with open access	Costs of publication
Not obstructive	21 (16.9%)	27 (21.6%)	24 (19.0%)	36 (28.6%)	6 (4.7%)
Rather not obstructive	17 (13.7%)	29 (23.2%)	21 (16.7%)	36 (28.6%)	10 (7.9%)
Indifferent	44 (35.5%)	34 (27.2%)	23 (18.3%)	34 (27.0%)	16 (12.6%)
Rather obstructive	31 (25.0%)	25 (20.0%)	34 (27.0%)	16 (12.7%)	44 (34.6%)
Obstructive	11 (8.9%)	10 (8.0%)	24 (19.0%)	4 (3.2%)	51 (40.2%)
Total	124 (100%)	125 (100%)	126 (100%)	126 (100%)	127 (100%)

Note: Items refer to the question "Are the following factors obstructive for an open access publication in your opinion?"

Table A2b: Researchers as authors: obstructive factors (mean values and standard deviations, n >= 116)

	Range of journals	Acceptance in your field	Reputation of journals	Experiences with open access	Costs of publication
Early scientist	3.0 (1.2)	2.7 (1.2)	3.4 (1.3)	2.5 (1.0)	4.2 (1.0)
Scientist with intermediate experience	3.1 (1.2)	2.9 (1.3)	3.2 (1.5)	2.2 (1.2)	4.1 (1.1)
Scientist with long experience	3.0 (1.2)	2.6 (1.3)	3.0 (1.4)	2.4 (1.1)	3.8 (1.2)
Total	3.0 (1.2)	2.7 (1.2)	3.1 (1.4)	2.3 (1.1)	4.0 (1.1)

Note: Items refer to the question "Are the following factors obstructive for an open access publication in your opinion?" All items were measured on a 5-point scale, with 5 indicating approval.

Table A3a: Importance of factors for publishing in general

	Fast publication	Good accessibility	High impact factor	Suitable scope of journal	High citation rate	High visibility	Fair copyright policy
Not important	1 (0.8%)	1 (0.8%)	3 (2.3%)	0 (0%)	3 (2.3%)	1 (0.8%)	2 (1.5%)
Rather not important	5 (3.8%)	0 (0%)	4 (3.0%)	0 (0%)	4 (3.1%)	1 (0.8%)	1 (0.8%)
Indifferent	12 (9.1%)	9 (6.8%)	16 (12.1%)	4 (3.1%)	26 (19.8%)	18 (13.7%)	22 (16.9%)
Rather important	70 (53.0%)	35 (26.5%)	45 (34.1%)	51 (38.9%)	55 (42.0%)	51 (38.9%)	41 (31.5%)
Important	44 (33.3%)	87 (65.9%)	64 (48.5%)	76 (58.0%)	43 (32.8%)	60 (45.8%)	64 (49.2%)
Total	132 (100%)	132 (100%)	132 (100%)	131 (100%)	131 (100%)	131 (100%)	130 (100%)

Note: Items refer to the question "In general, how important are the following factors for you when you think about a publication?"

Table A3b: Importance of factors for publishing in general (mean values and standard deviations, n >= 118)

	Fast publication	Good accessibility	High impact factor	Suitable scope of journal	High citation rate	High visibility	Fair copyright policy
Early scientist	4.3 (0.8)	4.7 (0.6)	4.2 (0.8)	4.7 (0.5)	3.9 (0.8)	4.1 (0.8)	4.3 (0.9)
Scientist with intermediate experience	4.1 (0.8)	4.5 (0.6)	4.6 (0.6)	4.6 (0.6)	4.2 (0.7)	4.3 (0.8)	4.3 (0.8)
Scientist with long experience	4.2 (0.7)	4.6 (0.8)	3.9 (1.1)	4.5 (0.6)	3.9 (1.1)	4.4 (0.8)	4.2 (1.0)
Total	4.2 (0.8)	4.6 (0.7)	4.2 (1.0)	4.5 (0.6)	4.0 (0.9)	4.3 (0.8)	4.2 (0.9)

Note: Items refer to the question "In general, how important are the following factors for you when you think about a publication?" All items were measured on a 5-point scale, with 5 indicating approval.

Table A4a: Importance of factors for publishing open access

	Fast publication	Good accessibility	High impact factor	Suitable scope of journal	High citation rate	High visibility	Fair copyright policy
Not important	1 (0.8%)	0 (0%)	3 (2.4%)	0 (0%)	2 (1.6%)	1 (0.8%)	0 (0.0%)
Rather not important	3 (2.4%)	0 (0%)	4 (3.1%)	1 (0,8%)	4 (3.1%)	1 (0.8%)	0 (0.0%)
Indifferent	11 (8.7%)	9 (7.1%)	17 (13.4%)	7 (5.6%)	22 (17.3%)	10 (7.9%)	17 (13.4%)
Rather important	52 (40.9%)	22 (17.3%)	47 (37.0%)	48 (38.1%)	51 (40.2%)	39 (30.7%)	35 (27.6%)
Important	60 (47.2%)	96 (75.6%)	56 (44.1%)	70 (55.6%)	48 (37.8%)	76 (59.8%)	75 (59.1%)
Total	127 (100%)	127 (100%)	127 (100%)	126 (100%)	127 (100%)	127 (100%)	127 (100%)

Note: Items refer to the question "How important are these factors for you if you intend to publish open access?"

Table A4b: Importance of factors for publishing open access (mean values and standard deviations, n >= 117)

	Fast publication	Good accessibility	High impact factor	Suitable scope of journal	High citation rate	High visibility	Fair copyright policy
Early scientist	4.3 (0.9)	4.5 (0.7)	4.2 (1.0)	4.6 (0.6)	4.0 (0.9)	4.3 (0.8)	4.4 (0.9)
Scientist with intermediate experience	4.4 (0.7)	4.7 (0.6)	4.4 (0.7)	4.5 (0.6)	4.2 (0.7)	4.6 (0.6)	4.5 (0.7)
Scientist with long experience	4.3 (0.8)	4.7 (0.6)	3.9 (1.1)	4.4 (0.7)	4.0 (1.1)	4.5 (0.8)	4.4 (1.1)
Total	4.3 (0.8)	4.7 (0.6)	4.1 (1.0)	4.5 (0.7)	4.1 (0.9)	4.5 (0.8)	4.4 (0.7)

Note: Items refer to the question "How important are the following factors for you when you think about a publication?" All items were measured on a 5-point scale, with 5 indicating approval.

Table A5a: Perceived future of OA per region

	A traditional closed-access publication is more common in my area of research, so I also prefer this publishing model.	The percentage of open access articles will consistently grow.	I do not think that a complete change of the publication system to open access will be feasible.	Regardless of the future development, authors should retain the right to choose between the publication models.
Strongly disagree	41 (31.5%)	0 (0%)	23 (18.0%)	4 (3.1%)
Disagree	34 (26.2%)	4 (3.1%)	31 (24.2%)	11 (8.6%)
Neither agree nor disagree	31 (23.8%)	14 (10.9%)	30 (23.4%)	21 (16.4%)
Agree	18 (13.8%)	48 (37.5%)	25 (19.5%)	32 (25.0%)
Strongly agree	6 (4.6%)	62 (48.4%)	19 (14.8%)	60 (46.9%)
Total	130 (100%)	128 (100%)	128 (100%)	128 (100%)

Note: Answers refer to the question "In your opinion, do open access publications in your country follow mainly the green or gold road to open access or are both roads used about equally?"

Table A5b: Perceived future of OA per region (mean values and standard deviations, n = 120)

	A traditional closed-access publication is more common in my area of research, so I also prefer this publishing model.	The percentage of open access articles will consistently grow.	I do not think that a complete change of the publication system to open access will be feasible.	Regardless of the future development, authors should retain the right to choose between the publication models.
Early scientist	2.4 (1.2)	4.2 (0.7)	3.0 (1.5)	3.9 (1.2)
Scientist with intermediate experience	2.3 (1.2)	4.4 (0.9)	3.1 (1.3)	4.0 (1.2)
Scientist with long experience	2.3 (1.2)	4.3 (0.8)	2.8 (1.3)	4.2 (1.1)
Total	2.3 (1.2)	4.3 (0.8)	2.9 (1.3)	4.1 (1.1)

Note: Answers refer to the question "In your opinion, do open access publications in your country follow mainly the green or gold road to open access or are both roads used about equally?". All items were measured on a 5-point scale, with 5 indicating approval.