



## Access to global health research. Prevalence and cost of gold and hybrid open access<sup>1</sup>

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### ABSTRACT

As it is a priority of global health research (GHR) to achieve equity in health worldwide, there is an increased demand and expectation that knowledge be shared freely and without barriers. Making research findings available for free to readers by publishing open access (OA) is thus central to GHR.

Several studies have assessed the extent to which different forms of OA prevail but despite the importance of free access to knowledge in GHR, particular empirical evidence is missing. This paper aims to fill this gap by analyzing the extent to which GHR papers indexed in PubMed are published OA and how much it costs to publish in gold and hybrid OA journals. Findings show that between 2010 and 2014 as few as 18% of papers were published in gold OA journals, 7% published as hybrid OA (i.e., OA papers in subscription journals), while more than 60% were behind paywalls. Costs for gold OA amounted to \$990,619 for 404 papers, whereas \$722,631 were spent on article processing charges (APCs) of 223 hybrid papers. The majority of APCs were obtained by large commercial publishing houses known for exorbitant profit margins.

### INTRODUCTION

The field of global health can be defined as an "area for study, research, and practice that places a priority on improving health and achieving equity in health for all people worldwide" (Koplan et al., 2009, p. 1995). To achieve this goal, global health research (GHR) partnerships or collaborations often include a myriad of players including researchers from various countries, key stakeholders, non-governmental organizations, governmental institutions and for-profit organisations (Szlezák et al., 2010). These players share knowledge and expertise to solve complex health issues of global importance. In such a context, there is an increased demand and expectation that knowledge be shared with all actors, promoting its use in knowledge translation and subsequent research. A commonly used method to provide improved access is to publish research findings open access (OA), making it free to all readers. However, substantial and ever increasing subscription fees of journals pose a cost barrier to individuals and organisations with limited resources. The use of OA publication in

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GHR has been promoted by various scholars and in policy initiatives as a method of facilitating knowledge transfer (Siriwardhana, 2015), and it is seen as a necessary method to "building science capacity in developing countries" (Chan, Kirsop, & Arunachalam, 2005, para. 1). Certain programs are specifically set up to provide institutions in low and medium income countries (LMICs) access to biomedical and health literature at no or very low cost. For example, through HINARI<sup>2</sup> publishers such as Wiley-Blackwell, Reed-Elsevier, Wolters Kluwer and Springer Nature provide access to 1,500 journals. Knowledge users in eligible countries can, however, only access the content if they are affiliated with a registered institution, which represents a restriction to access for many actors working in GHR.

Several studies have assessed the extent to which different forms of OA prevail (e.g., Björk, 2012; Björk et al., 2010; Dallmeier-Tiessen et al., 2010; Gargouri et al., 2010; Laakso et al., 2011; Laakso & Björk, 2012). These studies usually distinguish between green (i.e., self-archived pre- or post-prints) and gold OA papers. The latter can be further broken down into papers published in gold OA journals with and without article processing charges (APCs), delayed OA journals or hybrid journals (i.e., subscription journals offering article-based OA options in exchange for an APC). Björk et al. (2010) estimate that irrespective of the discipline 20.4% of papers published in 2008 were available online for free (8.5% gold or hybrid OA, and 11.9% Green OA). When comparing different disciplines of research, gold OA is particularly prevalent in medical journals (13.9%) (Björk et al., 2010). The most recent and largest OA study estimates that 12.1% of papers published between 2011 and 2013 appeared in gold or hybrid OA journals and 46.9% of papers were freely available online combining any type of unrestricted access (e.g., institutional repositories, personal websites) (Archambault et al., 2014). For the field of Public Health & Health Services, which represents the most comparable to GHR, Archambault and colleagues (2014) report even higher rates of overall OA (57.2%) and gold or hybrid OA (15.8%) rates.

Despite the importance of free access to GHR, there is no empirical evidence on the uptake of OA in the field. This paper aims to fill this gap by answering the following research questions:

1. What types of publication practices are prevailing in GHR?
  - a. To what extent do journals allow gold, hybrid or green OA?
  - b. To what extent do authors make use of various routes of OA?
2. What are the costs of gold and hybrid OA in GHR?
  - a. What are the average prices of gold and hybrid APCs?
  - b. Which publishers benefit most from gold and hybrid APCs?

## DATA AND METHODS

### *Defining relevant papers*

GHR papers were identified searching PubMed for documents indexed with the Medical Subject Heading (MeSH) term "Global Health" published between 2010 and 2014<sup>3</sup>. The result of 4,333 documents was restricted to document types reporting research results such as articles and reviews, excluding document types such as editorials and news items. The 3,461

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<sup>2</sup> <http://www.who.int/hinari/en/>

<sup>3</sup> Query "Global Health"[MeSH Major Topic] AND 2010[PDAT] : 2014[PDAT] carried out on PubMed on 16 February 2016.

remaining documents were downloaded from PubMed, 95 documents were further excluded as their publication year was outside the selected 5-year period or they turned out to be book chapters. The resulting data set includes 3,366 GHR journal articles, which were published in 909 journals.

*Determining access status for papers, journals and publishers*

Two types of OA can be identified for papers on Pubmed: “free article” or “free PMC article”. The former signifies gold or hybrid articles (i.e., articles that are freely available on the publisher’s site) and the latter indicates deposits in PubMed Central (PMC) made by publishers (often after an embargo period) or by authors. However, several gold OA journals deposit directly in PMC, in which case “free in PMC” indicates gold OA articles. In this study, OA was defined as Gratis not Libre OA and thus entails access to the content free of charge but possibly involving copyright and licensing restrictions (Suber, 2008). The journal status (gold, hybrid or subscription only) was initially determined using data from the Directory of Open Access Journals (DOAJ), Ulrich’s Periodicals Directory and journal lists from Reed-Elsevier, Sage, Springer, Taylor & Francis and Wiley-Blackwell. Since there was conflicting information between different data sources, it was decided to manually verify publication policies for all journals, classifying them in the following categories:

- **Gold OA journal (non-APC):** Open access journal which provides immediate access to all of their content free of charge to both readers and authors. Many of these journals were often financed or subsidized by scientific societies or associations.
- **Gold OA journal (APC):** Open access journal which provides free immediate access to all of their contents based on an author-pays model via APCs. APCs were collected in or converted to USD<sup>4</sup>.
- **Delayed OA journal:** Subscription journal which provides all content for free after an embargo or delay period of several months to years. Journals which provide delayed open access to only some of their content were classified as subscription journals and their free papers identified as delayed OA articles.
- **Hybrid journal:** Subscription journal which is primarily financed by reader-pays model based on subscriptions and pay-per-view fees but allows authors to pay an APC to make their article available free of charge for the reader without delay. APCs were collected in or converted to USD.
- **Subscription only journal:** Subscription journal which is financed by reader-pays model based on subscriptions and pay-per-view fees and does not offer author-pays OA options. Some subscription journals might decide to make single articles available for free temporarily or permanently to promote certain contents. If identified by PubMed, these free articles are coded as “other free access”.
- **Unknown:** Journals for which the access status could not be determined.

Combining PubMed’s article level information with the journal status, papers were classified as follows:

- **Gold OA article (non-APC):** “free article” and “free PMC article” published in gold OA journal (non-APC).

<sup>4</sup> If APCs were not provided in USD, currencies were converted using the mean of weekly historical conversion rates between 01.01.2010 and 31.12.2014 using OANDA (<http://www.oanda.com/currency/historical-rates>).

- **Gold OA article (APC):** “free article” and “free PMC article” published in gold OA journal (APC).
- **Delayed OA article:** “free article” published in delayed OA or subscription journal with delayed OA option.
- **Hybrid article:** “free article” published in hybrid OA journal.
- **Toll access:** “not free” article published in any type of journals.
- **Green OA article (PMC):** “free PMC article” published in hybrid OA or subscription journal.
- **Other free access:** “free article” in subscription journal or journal for which status is unknown.

Publisher affiliations were determined based on the above-listed sources and the Web of Science (WoS) and manual searches in case of conflicting information. Acquisitions and mergers of journals and publishing houses were accounted for by assigning journals to the most recent publisher using the method described in Larivière, Haustein, and Mongeon (2015).

#### *Limitations*

The analysis of green OA is limited to PMC deposits only, thus ignoring other forms on self-archiving in institutional repositories or on authors’ websites or academic social networks. The journal status and publisher affiliation was determined based on information provided on the journal website at the time of analysis. Publishers, journal policies and APCs might thus have been different at the time of publication.

Publishers of hybrid and subscription journals sometimes provide discounts for OA publication particularly to authors from LMICs which would change or cancel the APC. However, it remains impossible to identify the publications that have been published at discounted prices and thus it was assumed that the full APC was paid.

We rely on the paper status provided by PubMed and might thus mistake temporary free access for hybrid articles or disregard this form of transient OA altogether (Archambault et al., 2014). To ensure the reliability of the paper level OA status provided by PubMed, we manually verified 235 papers, for which the OA status contradicted the recorded journal policy. In 114 cases, the information was corrected changing the access status from “not free” to “free article”.

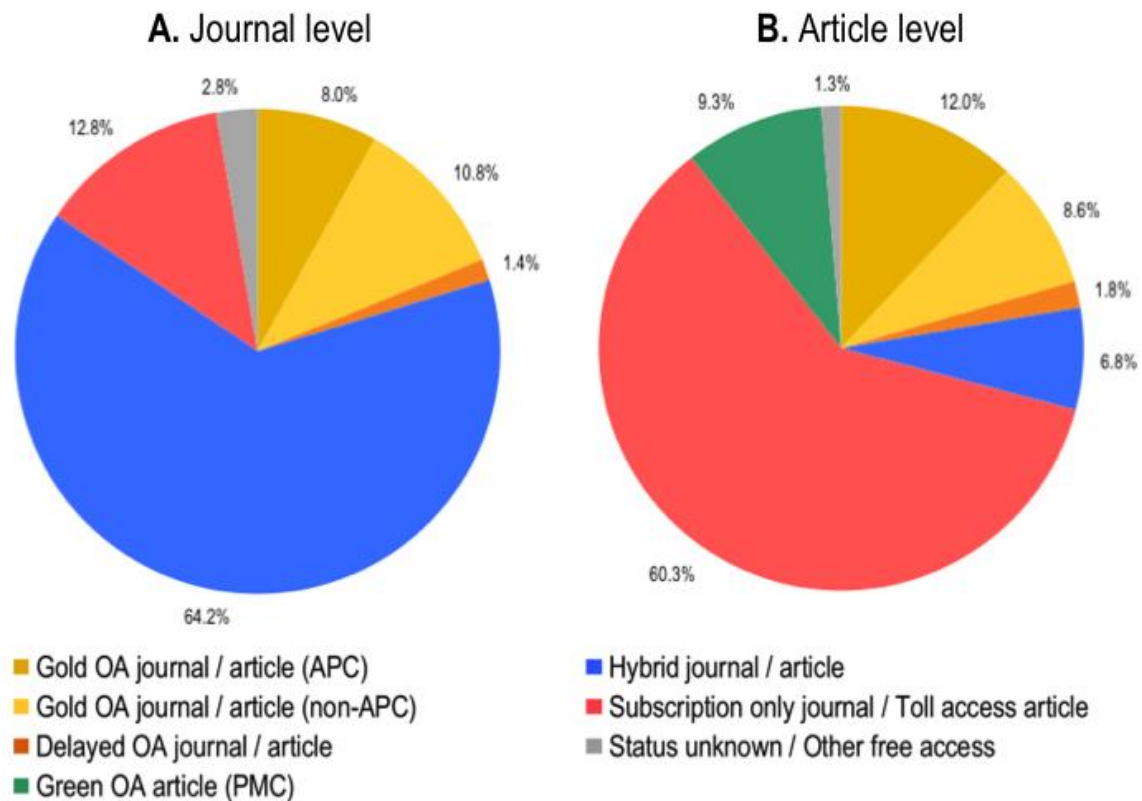
## **RESULTS AND DISCUSSION**

The majority of journals publishing GHR papers were hybrid journals (64.2%), which is mostly due to major publishers such as Reed-Elsevier and Wiley-Blackwell, who offer hybrid options for most of their journals. Around one fifth of journals were gold OA—more than half of which were actually not charging any publication fees—while 12.8% were subscription journals without open access options (Figure 1A). Prominent Gold OA journals without APCs included the *Bulletin of the World Health Organization* (38 GHR papers 2010-2014), *Morbidity and Mortality Weekly Report* (32) and *Weekly Epidemiological Record* (20), while *Lancet Global Health* (54), *PLoS Medicine* (53), *Global Health* (49), *Global Health Action* (36), *BMC Public Health* (24) and *PLoS One* (20) were publishing the largest number of GHR papers among gold OA journals with APCs. In the context of GHR, *Lancet* (315), *Global*

*Public Health* (55), *BMJ* (31) and *Social Science & Medicine* (30) were the most productive hybrid journals, while *Revue scientifique et technique* (49), *New England Journal of Medicine* (39), *JAMA* (26) and *Nature* (19) published the most papers among subscription journals without an author-paid OA option. This demonstrates the popularity of publishing in prestigious high-impact journals despite the lack of gold or hybrid OA.

At the article level it becomes apparent that the majority of authors do not make use of gold or hybrid OA (Figure 1B), as more than half of all articles (60.3%) are locked behind a paywall. Combining gold and hybrid access, more than one quarter (27.4%) of articles are available on the publisher's website at no charge for the reader and without a delay, which exceeds the 15.8% reported for Public Health & Health Services by Archambault et al. (2014). Among gold OA options, publishing in journals with an APC (12.0% of papers) is more popular than those without (8.6%), which might, at least to a certain extent, be caused by differences in journal reach, scope and quality. While hybrid OA was available for 2,102 papers, authors of 229 opted to pay the APC, which represents an uptake of 10.9%. This represents a particularly high rate compared to Björk (2012) who, based on the low uptake of hybrid OA, concluded that it was a failed experiment by publishers. Hybrid uptake differs between journals and publishers, which might be a result of both different APC rates and successful marketing strategies. For example, among the publishers offering hybrid for more than 35 papers in the GHR data set, hybrid uptake was 82.1% for Oxford University Press, 18.5% for Wiley-Blackwell, 13.8% for Wolters Kluwer, 6.1% for Taylor & Francis, 3.5% for Reed-Elsevier, 2.2% for the BMJ Group, 1.2% for Springer Nature, while no paper published in the GHR set used the hybrid option with Sage. The full text of 9.3% papers published in subscription or hybrid journals were available on PMC. Although this represents just one specific form of green OA for the GHR papers under analysis, it slightly exceeds the rate of 7.8% green OA for medical papers estimated by Björk et al. (2010).

**Figure 1:** Percentage of journals (A) and articles (B) per type of access category.



The total cost to publish OA GHR papers amounts to \$990,619 for 404 gold OA papers and \$722,631 for 223 hybrid papers<sup>5</sup>. Rates varied substantially per journal from \$10 (*Saudi Medical Journal*) to \$5,000 (*Lancet Global Health*) for gold OA journals and from \$774 (*The New Zealand Medical Journal*) to \$5,000 (12 journals including *Cell* and several *Lancet* journals) for hybrid journals. The presence of large for-profit publishing houses and hybrid journals among the highest APCs is striking: out of the 35 journals with APCs of \$4,000 and above, 17 are published by Wolters Kluwer, 9 by Reed-Elsevier and all but one are hybrid journals.

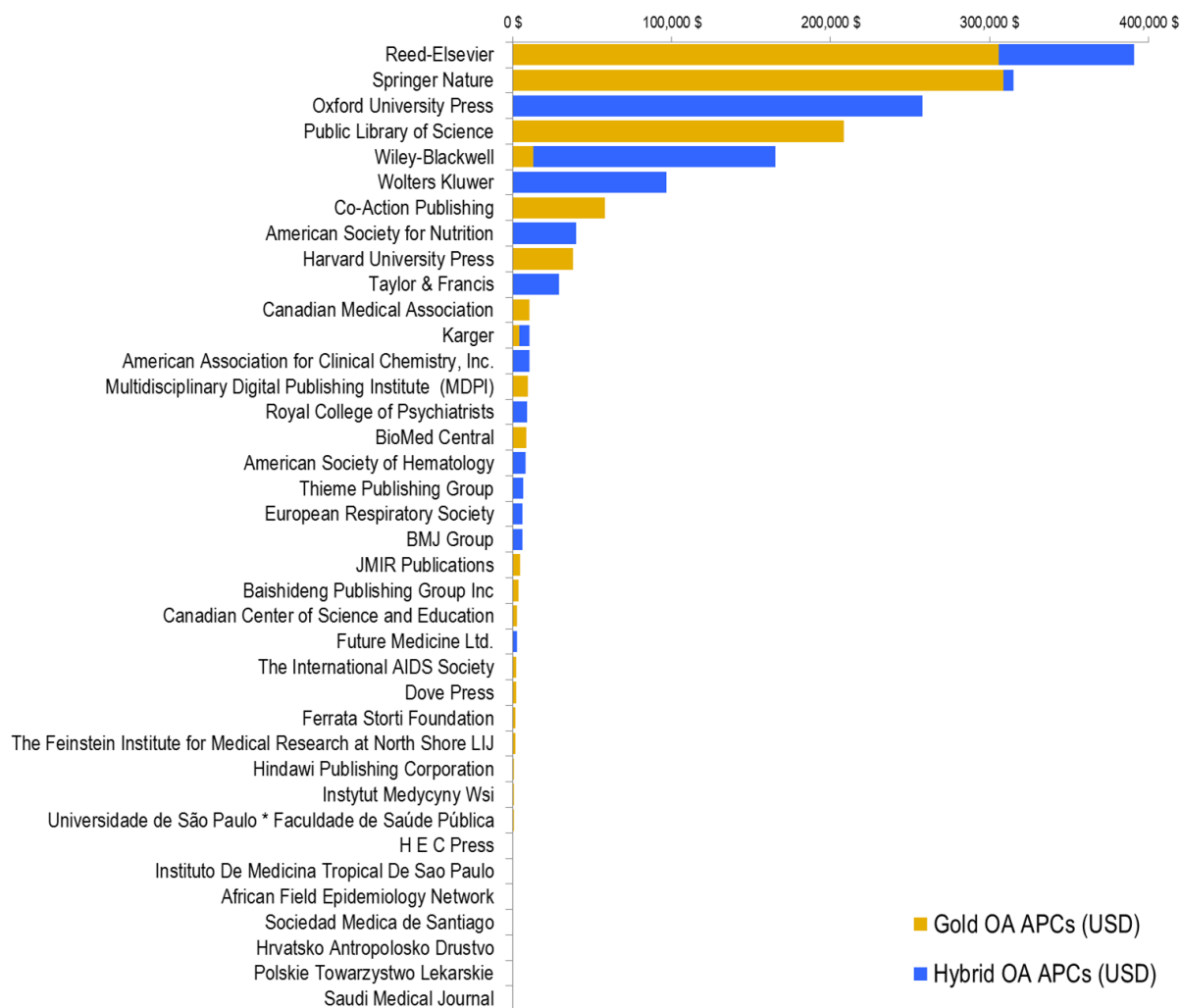
On average, APCs amounted to \$1,864 in gold OA journals, while hybrid fees were substantially higher at \$2,978. This is quite counterintuitive, as hybrid journals are already financed by subscriptions, while gold OA journals are solely based on APCs. These results corroborate findings by Solomon and Björk (2012) and van Noorden (2013) for all fields combined. Past research analyzing average APCs reported between \$660 (Outsell according to Van Noorden, 2013), \$906 (Solomon & Björk, 2012) and \$1,255 (Björk & Solomon, 2015) per paper.

Figure 2 shows the sum of APCs paid to the different publishers for gold and hybrid OA papers. The largest amounts were obtained by Reed-Elsevier (\$391,050), Springer Nature (\$307,165), Oxford University Press (\$265,695), PLOS (\$208,350), Wiley-Blackwell

<sup>5</sup> The cost for the 6 hybrid papers published in the *Journal of Dental Education* were excluded from the cost calculations, as the APC could not be determined;

(\$165,300) and Wolters Kluwer (\$96,600); most of these publishers have profit margins around 30% and belong to an oligopoly or academic publishing houses based on the number of articles published (Larivière et al., 2015).

**Figure 2:** Sum of gold and hybrid APCs per publisher.



## CONCLUSIONS AND OUTLOOK

Even if knowledge sharing is a central premise of GHR, this study shows that the majority of papers are hidden behind paywalls, and that OA rates are negligibly higher than that of other medical disciplines. Despite the importance of such knowledge to communities in the developing world, more than 60% of all papers are not freely available. Such lack of access has been recently discussed in light of the Ebola outbreak; which may have been mitigated, if scientific information had been freely available to Liberian researchers (Dahn, Mussah, & Nutt, 2015). Although hybrid OA solves the access problem, it makes the GHR community pay twice for the same content; hybrid APCs are added to the subscription fees already paid by research institutions. In fact, a significant amount of money goes into the pockets of big commercial publishers, who are known for their exorbitant profit margins.

In this study, the analysis of green OA did not extend beyond the PMC platform. Future research will examine whether the 909 journals allow self-archiving and the extent to which authors do so; this will help in understanding the broader picture of OA practices in GHR. Based on the WoS subset of papers, citation rates and citing countries will be analyzed to determine the extent to which the access status leads to different citation patterns.

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