RESEARCH ARTICLE

REVISED Top health research funders' guidance on selecting journals for funded research [version 2; peer review: 2 approved]

Larissa Shamseer[1-4], Kelly D. Cobey[1,3], Matthew J. Page[5], Jamie C. Brehaut[1,4], Jeremy M. Grimshaw[4,6], Sharon E. Straus[2], Lesley A. Stewart[7], David Moher[1,3]

[1]School of Epidemiology and Public Health, University of Ottawa, Ottawa, Ontario, K1G 5Z3, Canada
[2]Li Ka Shing Knowledge Institute, Unity Health Toronto, Toronto, Ontario, M5B 1T8, Canada
[3]Centre for Journalology, Ottawa Hospital Research Institute, Ottawa, ON, K1H 8L6, Canada
[4]Centre for Implementation Research, Ottawa Hospital Research Institute, Ottawa, ON, K1H 8L6, Canada
[5]School of Public Health and Preventive Medicine, Monash University, Melbourne, VIC, 3004, Australia
[6]Department of Medicine, University of Ottawa, Ottawa, Ontario, K1H 8M5, Canada
[7]Centre for Reviews and Dissemination, University of York, UK, York, YO10 5DD, UK

v2 **First published:** 11 Feb 2021, **10**:100
https://doi.org/10.12688/f1000research.27745.1
Latest published: 16 Apr 2021, **10**:100
https://doi.org/10.12688/f1000research.27745.2

Abstract

Background: Funded health research is being published in journals that many regard as "predatory", deceptive, and non-credible. We do not currently know whether funders provide guidance on how to select a journal in which to publish funded health research.
Methods: We identified the largest 46 philanthropic, public, development assistance, public-private partnership, and multilateral funders of health research by expenditure, globally as well as four public funders from lower-middle income countries, from the list at https://healthresearchfunders.org. One of us identified guidance on disseminating funded research from each funders' website (August/September 2017), then extracted information about selecting journals, which was verified by another assessor. Discrepancies were resolved by discussion. Results were summarized descriptively. This research used publicly available information; we did not seek verification with funding bodies.
Results: The majority (44/50) of sampled funders indicated funding health research. 38 (of 44, 86%) had publicly available information about disseminating funded research, typically called "policies" (29, 76%). Of these 38, 36 (95%) mentioned journal publication for dissemination of which 13 (36.11%) offer variable guidance on selecting a journal, all of which relate to the funder's open access mandate. Six funders (17%) outlined publisher requirements or features by which to select a journal. One funder linked to a document

Open Peer Review

Reviewer Status ✓ ✓

	Invited Reviewers	
	1	**2**
version 2 (revision) 16 Apr 2021		✓ report
version 1 11 Feb 2021	✓ report	? report

1. **Shubhada Nagarkar**, Savitribai Phule Pune University, Pune, India
Savitribai Phule Pune University, Pune, India

2. **Nicholas Devito**, University of Oxford, Oxford, UK

Any reports and responses or comments on the article can be found at the end of the article.

providing features of journals to look for (e.g. listed in the Directory of Open Access Journals) and to be wary of (e.g., no journal scope statement, uses direct and unsolicited marketing).
Conclusions: Few funders provided guidance on how to select a journal in which to publish funded research. Funders have a duty to ensure that the research they fund is discoverable by others. This research is a benchmark for funder guidance on journal selection prior to the January 2021 implementation of Plan S (a global, funder-led initiative to ensure immediate, open access to funded, published research).

Keywords
journals, journal selection, health research funders, publishing

This article is included in the Science Policy Research gateway.

Corresponding author: Larissa Shamseer (Larissa.Shamseer@unityhealth.to)

Author roles: Shamseer L: Conceptualization, Data Curation, Formal Analysis, Investigation, Methodology, Project Administration, Supervision, Validation, Visualization, Writing – Original Draft Preparation, Writing – Review & Editing; **Cobey KD**: Conceptualization, Investigation, Validation, Writing – Review & Editing; **Page MJ**: Conceptualization, Investigation, Validation, Writing – Review & Editing; **Brehaut JC**: Conceptualization, Writing – Review & Editing; **Grimshaw JM**: Conceptualization, Methodology, Writing – Review & Editing; **Straus SE**: Conceptualization, Writing – Review & Editing; **Stewart LA**: Conceptualization, Writing – Review & Editing; **Moher D**: Conceptualization, Methodology, Resources, Writing – Review & Editing

Competing interests: When this work was undertaken JMG (Trials), LAS and DM (Systematic Reviews) were Editors-in-Chief for the open access published Biomed Central, for which they received stipends'; MJP was an (unpaid) editorial board member for PLOS Medicine and Journal of Clinical Epidemiology; and LS was an (unpaid) associate editor for BMC Systematic Reviews.

Grant information: SES is supported by a Tier 1 Canada Research Chair in Knowledge Translation and Quality of Care; JMG is supported by a Tier 1 Canada Research Chair is Health Knowledge Transfer and Uptake; DM is supported by a University Research Chair. MJP is supported by an Australian Research Council Discovery Early Career Researcher Award (DE200101618).
The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

How to cite this article: Shamseer L, Cobey KD, Page MJ *et al.* **Top health research funders' guidance on selecting journals for funded research [version 2; peer review: 2 approved]** F1000Research 2021, **10**:100 https://doi.org/10.12688/f1000research.27745.2

First published: 11 Feb 2021, **10**:100 https://doi.org/10.12688/f1000research.27745.1

REVISED **Amendments from Version 1**

We have addressed/responded to the suggestions from reviewers with the following changes:

- simplified the wording/sentence structure in the introduction and discussion sections.

- clarified the relevance of this research to health research funders in the introduction (i.e., discoverability, uptake).

- added more detail on how extraction items were devised.

- indicated the name of an excluded funder in Figure 1.

- acknowledged, in the limitations section, the potential benefit of engaging funders in the study process.

Any further responses from the reviewers can be found at the end of the article

Introduction

Biomedical research studies supported by well-known funding organizations such as the National Institutes of Health (NIH), are published in so-called "predatory" journals[1]. Predatory journals are regarded as non-credible and are criticized for failing to provide typical or expected publishing services and their lack of transparent operations[2,3]. Such services include peer review, long term preservation of content, and indexing in scientific, bibliographic databases. Among their many shortcomings, the potential failure of predatory journals to ensure permanent discoverability of research threatens the integrity of the scientific record. Such research cannot contribute to science, thus wasting time, money, and resources[1,4]. Even if discovered, the potential impact and uptake of funded research in predatory journals may be limited due to being published in a perceived untrustworthy source. While benefits from investments in research are difficult to quantify[5]. One way funders measure returns on investments is by tracking research outputs, including scholarly journal publications[6]. Predatory journals may limit returns on funders' investments by undermining the intended promise of scholarly publishing – to enable the results of research to be known for others to build upon[7].

Health research funders ought to be concerned that the funds they provide may be wasted or contribute to research waste as a result of funded research being published in predatory journals. They may be supporting research that is not identifiable or able to be found if published in predatory journals, potentially wasting millions of dollars of research funding. When research is easily identifiable it can reduce unintentional redundancies in research efforts and investments. Additional wastage occurs when funder investments are used to pay for article processing charges (APCs). In biomedicine, research grants and national funding agencies are the largest source of funds supporting publication of at least 50% of open access articles[8].

Funders & open access

Most major health research funders mandate that funded research outputs be open access[9]. Open access mandates typically require researchers to ensure that research (and sometimes data) is published in an open access journal or is deposited in a publicly accessible digital repository (regardless of whether the publication was published in an open access journal), or both. Some journals may impose an embargo period only after which an article is made publicly available or can be archived in a repository (i.e., delayed-access journals). Many funders' policies allow for such delays in open access to accommodate publishers' preferences.

Open access policies are one way for funders to direct funded researchers towards publishing in credible journals abiding by established open access tenets[10]:

1. Research is/should be freely available and accessible to anyone.

2. The copyright accompanying published work should be open, allowing for free use and re-use (i.e., allowing research to be freely built on/adapted with attribution).

To facilitate researcher adherence with funder open access policies, many biomedical journals offering open access have agreements with the PubMed Central (PMC) repository to automatically deposit their published content on authors' behalf[11]. Additionally, researchers funded by the NIH and 13 partner funding organizations in the USA can upload funder-supported publications to PMC from journals without PMC agreements[12]. Likewise, 29 funders from across Europe can submit funder-supported research to Europe PMC (which is mirrored in PMC)[13]. For some of these organizations, such as the NIH and Wellcome Trust, archiving in PMC or Europe PMC, respectively, is mandatory.

In a possible attempt to attract submissions, predatory journals appear to market themselves as 'open access'[14,15]. While research in them may indeed be free to access, discovery of their content in scientifically-curated databases is sparse and inconsistent[16–18]. Predatory journal articles may haphazardly appear in search engines such as Google Scholar (which indexes anything that appears formatted as a scholarly article) or in PubMed (since it includes author-uploaded articles from PMC)[19]. Additionally, we do not know whether the contents of unindexed/unarchived journals will be perpetually available if a journal ceases to operate. Such preservation is typically achieved through journal/publisher agreements with digital preservation providers (e.g. Lots of Copies Keep Stuff Safe, LOCKSS). For journals indexed in Medline, for example, this is a prerequisite of indexing[20]; PMC functions as a preservation service (i.e., has a remit to preserve content funded by public money)[21]. It is unknown whether predatory journals, not formally indexed in Medline, PMC, or other databases with similar requirements, have digital preservation arrangements.

Most researchers have a limited understanding of what open access means beyond making research free to read[22–25]. Free use and unrestricted re-use of research is a fundamental component of open access, and licensing that permits this is a regular component of open access journals[26]. Journals running nefarious and deceptive publishing operations have likely benefited from or exploited authors' lack of awareness[27]. Indeed, few

predatory journals mention licensing for articles or provide information on the use and re-use of published research[26]. Without explicit licensing for published articles, the legalities around distributing or building on research in predatory journals, for example, is uncertain. Whether researchers are deceived by predatory journals or are knowingly seeking easy and rapid publications in them (these journals tend to deliver quicker turnaround time than credible journals due to subpar or non-existent peer review[28,29]), they are likely breaching the open access policies set by their funders.

In January 2017, the Bill & Melinda Gates Foundation implemented a policy mandating open access to research publications and data, without delay for all funded research[30]. In February 2017, they initiated a one-year partnership pilot with the American Association for the Advancement of Science (AAAS) to enable Gates-funded research to be published as open access in five AAAS journals, including *Science*[31]. The Gates-AAAS partnership seemed to inspire several other influential journals (i.e., *New England Journal of Medicine*, *Proceedings of the National Academy of Sciences*) to introduce policies ensuring permanent open access for Gates-funded research[32].

In January 2021, a number of international funders (including UK Research and Innovation, the Gates Foundation, Wellcome Trust, and the World Health Organization), led by Science Europe (a group representing funders across Europe), delivered a radical change to the way that funded research is published, via Plan S (coalition-s.org). Plan S, in part, requires research funders to mandate open access to funded research through publication in an open access journal or platform; requiring publications to be immediately available through an open access repository upon publication. To support this, agreed funders will pay the cost of article publishing charges (APCs) (up to a yet unannounced limit) to journals that are immediately and wholly open access (sometimes referred to as 'gold' open access).

Whether health research funding bodies, prior to Plan S, provide funded researchers with guidance or support towards selecting publishing journals in line with their policies and which facilitate proper (and permanent) access to research, and whether they monitor such policies, is unknown. Previous studies confirm that many non-commercial health research funders' have policies requiring open access to completed research or results via publication or otherwise[33,34]. Yet none seem to have assessed whether funders provide any specific information to researchers to facilitate their choice of publishing journal. For public or charitable funders, providing such guidance or support may be one way of ensuring responsible stewardship of public or donor funds. While research publication routes exist beyond scientific journals (e.g., preprint servers, repositories) the present project examines journals as the primary vehicles of research dissemination due to funders' and academia's reliance on them as a gauge of research impact/productivity. The current work will establish a pre-Plan S baseline of health research funders' guidance on selecting journals in which to publish funded research.

The aim of this research is to describe the policies and recommendations of major health research funding bodies regarding suitable journals for funded research.

Methods

We considered the public websites of 50 health funding bodies for statements, guidance, or policies specifically mentioning the publication of funded research. Detailed methods and rationale for this study are elaborated in an *a priori* study protocol (https://doi.org/10.17605/OSF.IO/J6CSK) and summarized below.

Data source

Global funding bodies with the largest documented health research expenditures were sampled from the curated Health Research Funder's list found at: www.healthresearchfunders.org[35]. The list was developed as part of an unfunded post-doctoral project by researchers in the Netherlands[35]. It was last updated in 2016; expenditure data are reported in 2013 US dollars (USD, accounting for inflation/deflation rates by country). A detailed account of the systematic process used to identify funders and obtain expenditure data is found here: http://www.healthresearchfunders.org/faq/. At the time of retrieval for this study (August 2017), 287 health research funding bodies from 30 countries were included on the list. The list distinguishes five categories of funders: [1] philanthropic funders (n=194), [2] public funders (n=77), [3] public funders who fund health research through Official Development Assistance (public ODA)[1] (n=8), [4] multilateral funders (funding across countries) (n=7), and [5] public-private partnerships (PPP) (n=1) (Table 1). While there are some inequities in its coverage (e.g. public funders were selected from only G20 countries; paucity of funders from low income countries), the list is likely the most comprehensive source of global health research funder expenditure information in existence (personal communication, Dr. Beverley Holmes, CEO, Michael Smith Foundation for Health Research) and has been used to construct samples in at least two other studies[34,36]. This study excludes commercial funders since their expenditure data are not publicly or readily available.

Sampling

To construct our sample, we sought up to 15 funders with the largest expenditures from each of the five funder categories from the list at www.healthresearchfunders.org, and aimed to include all listed lower income countries (n=4) if they were not otherwise represented in the sample. We included the latter group of funders in order to ensure representation from lower income countries, since researchers and journals from these countries have been disproportionately implicated in predatory publishing[26,37]. Working with the available number of funders in each category (Table 1), we ended up with 50 funders: 15 philanthropic, 15 public, eight public ODA, seven multilateral, one PPP, and four lower-middle income country funders.

[1]ODA is a term coined by the Development Assistance Committee of the Organisation for Economic Co-operation and Development (https://data.oecd.org/oda/net-oda.htm)

Table 1. Annual Expenditure across health research funders (in 2013 USD millions) by World Bank income level and type of funder.*

World Bank Income Level 2014	Type of Funder annual expenditure in 2013 USD millions (# of funders) [range]				
	Philanthropic	**Public**	**Public-ODA**	**Multilateral**	**PPP**
high income: non-OECD†	None listed	274.31(5)‡	None listed	None listed	None listed
high income: OECD	4995.25 (194)§	39847.47 (50)**	344.40 (8)	None listed	None listed
upper middle income	No data (1)	1540.87 (13)††	None listed	None listed	None listed
lower middle income	None listed	140.26 (4) ‡	None listed	None listed	None listed
low income	None listed	None listed	None listed	None listed	None listed
Income level not stated	None listed	6111.78 (5)	None listed	137.09 (7) **	455.36 (1)

*Created from data at healthresearchfunders.org.
† OECD: Organisation for Economic Co-operation and Development.
‡ Includes 3 funders with no expenditure data available.
§ Includes 11 funders with no expenditure data available.
** Includes 1 funder with no expenditure data available.
†† Includes 5 funders with no expenditure data available.

In line with previous investigations into health research funder policies[34,38], we expected that guidance for funded researchers would be publicly available and easily obtained. For each included funder, one of us (LS) visited the website using the URL provided by www.healthresearchfunders.org, or if the URL was not working, found it through a Google search using the funder name. When a funder's website could not be located/did not work or when the funder was a duplicate, the next largest funder on the list was used. For each funder, we sought and downloaded the website section on policies for funded research in August-September 2017. If no specific policies were found, we searched the SHERPA (Securing a Hybrid Environment for Research Preservation and Access)/Juliet database (www.sherpa.ac.uk/juliet/index.php), which lists and links conditions for open access publication for some funders (though this is incomplete as it is reliant on voluntary contributions from funders and other organizations [e.g., libraries] tracking funder policies). If a funder's website did not mention funding health research (i.e., funded other scientific research) or if the funder did not specifically award grants for research, the funding body was excluded from the sample and replaced with the next largest funder (by expenditure), where possible. Reasons for exclusion are documented in Figure 1.

Data extraction

One assessor (LS) extracted information from the downloaded policy documents into an online form in Distiller SR, and a second assessor (KDC or MJP) verified the extracted data. Discrepancies were resolved by discussion. If additional documents were identified during extraction, we saved them and searched them for the desired data. The verification process led to clarifications in collected data or provided additional information. Since no reference standard for funder policies on publishing exists, the extracted items were derived de novo by the study team; no formal consensus process was used. The following information was assessed or extracted, as available:

- Any statement(s) about the dissemination of outputs from funded research
- Policy or recommendations about publication of funded research
- Policies or recommendations on research/data accessibility
- Policies or recommendations on journal quality, impact factor or other metric, ethical standards, and indexing of funded research;
- Whether/what information is provided to researchers about predatory or substandard journals, or about journal credibility
- Strength of any aforementioned policies/recommendations ('must', 'should', or 'suggested')
- For publication policies, whether adherence will be monitored
- For publication policies, whether consequences of non-adherence are listed

If non-English websites or documents were encountered and an English-language version was not available on the website, Google Translate was used to automatically translate the websites and documents. Google Translate has recently shown 85%–97% accuracy across nine languages for translating health research studies[39], including the languages encountered in this study (French and German).

Data analysis

We summarized data descriptively by calculating proportions for dichotomous data; the date of funder policies/recommendations were summarized as medians and interquartile range.

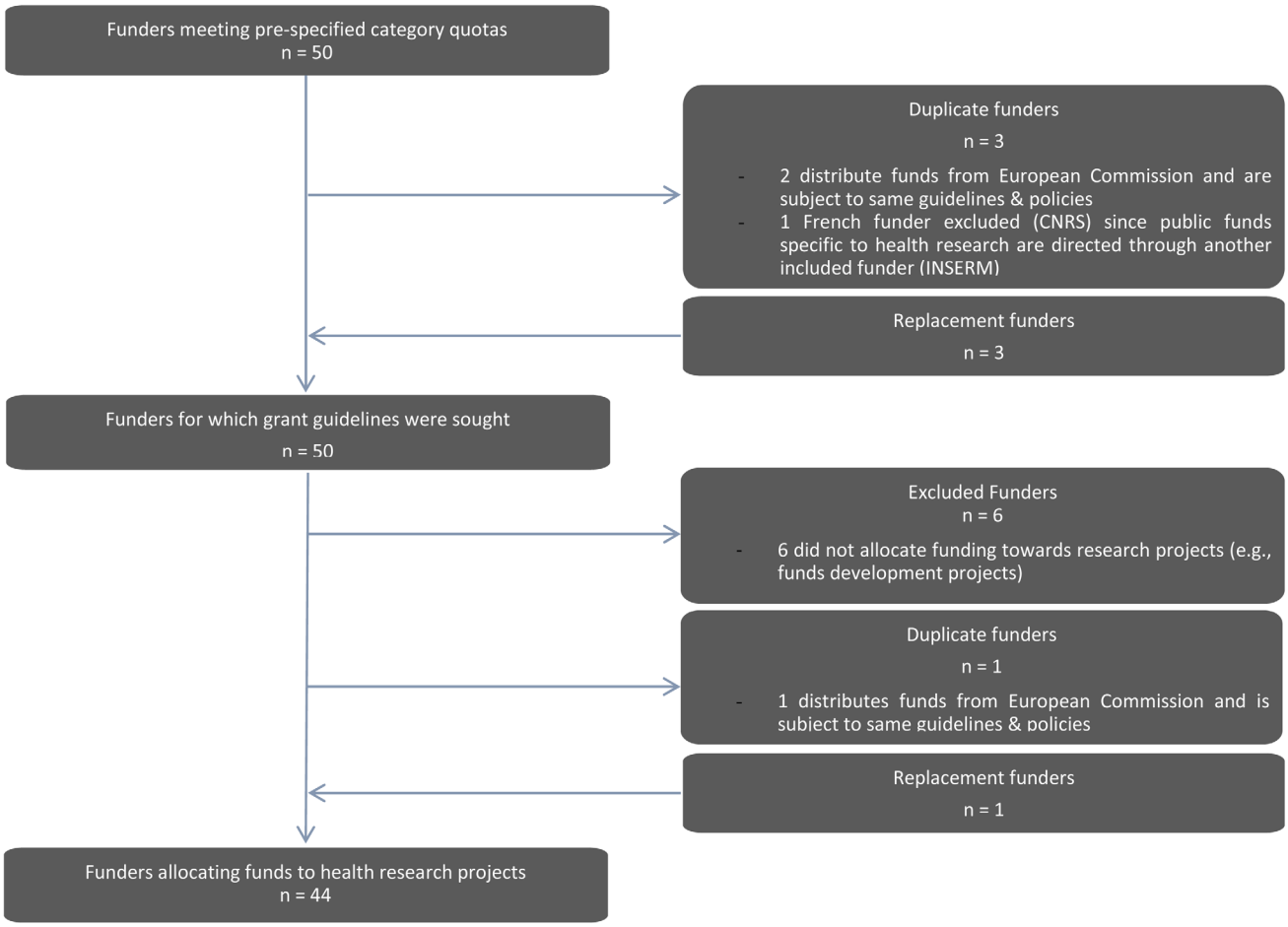

Figure 1. Flow diagram for selection of included funders.

Protocol deviations

In the protocol for this study, we stated that we wanted to determine whether there were differences in the number of funders with policies/statements about journal quality and predatory publishing based on the income-level of the funder country or country being funded. However, as only four funders from lower-middle income countries and none from low income countries were on the list we sampled from, there were not enough funders to enable meaningful comparisons between higher income and lower income countries.

Results

For the 50 funding bodies originally identified using the described sampling technique, three allocated money from a funder (European Commission[2]) already in the sample and were replaced with the next organizations on the list. One of the replacement funders also allocated money from an included funder and was also replaced. Two funders funded non-health research and four funders did not list any research grants (and appeared to fund health development initiatives) and could not be evaluated for our purposes. Overall, six funders were excluded and lacked replacements in the categories they belonged to. 44 funders remained in the sample for which grant policies and guidelines were sought (Figure 1). 35 funders are from high income countries, one from upper-middle income (China), three are from a lower-middle income country (India), and five are not classified by income level because they are multilateral (n=3) or fund across the European Union (EU) (n=2, Table 2).

38 of 44 funders (86%) had publicly available information for grantees about disseminating funded research outputs (Table 3). Of the six funders that did not have publicly available information, five are from high-income countries (US, Germany, France, UK) and one funds research in the EU through public-private partnership. Three are philanthropic organizations and

[2]Any European Commission funding program that explicitly stated using the European Horizon 2020 guidelines for grantees were jointly represented as "European Commission". (Figure 1)

Table 2. Description of funders (n=44).

Descriptor		
Type of funder, n(%)	Philanthropic	15 (34%)
	Public	18 (41%)
	Public ODA	7 (16%)
	Multilateral	3 (7%)
	Public Private Partnership	1 (2%)
Country Income Level, n(%)	High income	35 (80%)
	Upper-middle[i]	1 (2%)
	Lower-middle	3 (7%)
	Low income[ii]	0 (0%)[iv]
	N/A[iii]	5 (11%)
Annual expenditures (in million 2013 USD), mean (n)	High income	$1,113.191 (35)
	Upper-middle	$621.273 (1)
	Lower-middle	$140.261 (1)
	Low income[iv]	-
	N/A[iii]	$862.024 (5)

[i] China.
[ii] All funders from India.
[iii] Income-level not available since funders distributing funds across multiple countries (3 multilateral funders and 2 European Union funders).
[iv] No funders from "Low income" countries in sample.

Table 3. Funder Policies on publishing.

		n(%)
Publicly available webpage or document(s) on funder website discussing dissemination of research outputs[a]		38 (86%)
Type of statement about research outputs[b,c]	Policy	29 (76%)
	Recommendation/ Guideline	8 (21%)
	Other	1 (3%)[d]
Dissemination pertains to specific research output[b]	Research	37 (97%)
	Data	25 (66%)
	Other materials[e]	14 (39%)
Date of effect[f] [median (IQR)]		Sept 2014 (Apr 2012–Apr 2016)

[a] Denominator = 44 funders with grant guidelines.
[b] Denominator = 38 funders with statements about research outputs.
[c] Policy: uses the words "policy", "must", "require"; Recommendation/ Guideline: uses the words "recommendation" "recommend", "suggest", "should", "guideline".
[d] Other - described as "Code of Conduct".
[e] Verbatim: activities of funded organizations; all research outputs, news releases; photos; any and all other published material referencing the research project or grant; code; research materials; protocols; research resources including, but are not limited to, the full range of tools that scientists and technicians use in the laboratory, such as cell lines, antibodies, reagents, animal models, growth factors, combinatorial chemistry, DNA libraries, clones and cloning tools (such as PCR), methods, laboratory equipment and machines; presentations; media interviews; and other professional activities; 'research tools'; metadata; bibliographic metadata; supplementary materials; other supporting artefacts, research resources/tools.
[f] Out of 35 funders listing this information. Date of implementation was used if available, otherwise, date of document or last update was used. When only year was given, January was used as default month; when a date range was given the most recent date was used.

two are public-ODA funders. Information about disseminating research was contained within "policies" for 29/38 (76%) funders, "recommendations" (suggestions and guidance) for 8/38 (21%) of funders, and as a "code of conduct" for one funder (Table 3). All but one policy/recommendation referred to funded research (including results) as the unit of dissemination (37/38, 97%). Over a third of policies/recommendations also specifically mentioned the dissemination of "data" (25/38, 66%). The median implementation date or date listed on collected documents was September 2014 (IQR: Apr 2012 to Apr 2016, n=35).

Open access and journal selection

36 of 38 policies/recommendations (95%) specifically referred to publication in a journal as one form of dissemination for completed research (Table 4). 31 of these (86%) mentioned that research should be open access, either through journal publication (n=24, 77%) or through self-archiving the final report or accepted manuscript in a freely accessible repository (such as PMC) (n=30, 97%). One funder from India (Indian Council of Medical Research), one from France (Institut National de la Santé Et de la Recherche Médicale, INSERM), and three from the USA (US Department of Defense, Congressionally Directed Medical Research Program, and the American Cancer Society) did not mention open access in their policies about research dissemination.

13 of 36 (36%) policies recommending publication contained some guidance on how to select a journal and six (17%) listed features or requirements of publishers or journals for researchers to look for (Table 5). These six are described here. Only one funder policy (NIH) included a definition of a journal (i.e., either a publication listed in the journal section of the National Library of Medicine or one meeting stated criteria). And only one funder policy (Canadian International Development Research Council, IDRC) appeared to provide any information about 'questionable' journals in a guidance document entitled "Publishing in Open Access Journals". The document lists journal features to "look for" and to "be wary of" and mentions Beall's List[3] as a resource (Table 5). One policy (Deutsche Forschungsgemeinschaft/German Research Foundation, DFG) linked to Think, Check, Submit (www.thinkchecksubmit.org) – an initiative to facilitate researchers' assessment of the credentials of a journal – on a page supplementing their open access policy listing open access resources. Two funders distributing APC fees through the Charitable Open Access Fund (Cancer Research UK and Wellcome Trust) list the

[3]Beall's List is an archived listing of potential predatory journals and publishers, as determined by librarian Jeffrey Beall between 2011 and 2017, https://web.archive.org/web/20170103170903/https://scholarlyoa.com/

Table 4. Funder position and information provided about journal publication of funded research (n=38).

		n (%)
Mentions journal publication of research outputs	Yes	36 (95%)
	Mandatory	0
	Suggested/encouraged	36
	Can't tell	0
	No (but sharing of research mentioned)	2 (5%)
Offers guidance on journal selection[1]	Yes	13 (36%)[2]
	No	23 (64%)
Mention of journals' or publishers' integrity or credibility.[1]	Yes	6 (17%)[3]
	No	30 (83%)
Journal practices or characteristics mentioned[1]	Open Access	31 (86%)
	Journal Impact Factor (JIF)	0
	Any measure/description of journal quality[4]	4 (11%)[5]
	Peer review	30 (83%)
	Any transparency or ethics standards	11 (31%)[6]
	Database indexing (excluding PMC)	0
	Other	2 (6%)[7]
	Nothing specific about journals mentioned	4 (11%)

[1] Denominator: 36 funders mentioning journal publication.
[2] See Table 5 for verbatim text of statements about journal selection.
[3] See Table 5 for verbatim text of statements about journal credibility.
[4] excluding JIF.
[5] 2 funders indicate journal should be "high quality, peer reviewed journal"; 1 funder indicates journal should be "quality peer-reviewed journal"; 1 funder indicates what a good journal is: "Good journals have guidelines for reviewers of manuscripts committing them to strict confidentiality/ to disclose conflicts of interest and promise to respond to submitted manuscripts within a specified, short time limit, and correspondingly set their reviewers short time limits for their comments."
[6] See Table 6 for transparency or ethics standards for publications.
[7] Other: 1 funder encourages publication in "primary scientific journals"; 1 funder states "models and mechanisms for publication and access to research must be both efficient and cost effective";.

requirements of journals whose APCs are eligible for payment through the fund. The Bill and Melinda Gates Foundation provide researchers with a portal (called Chronos) through which to submit manuscripts directly to pre-selected journals whose standards are in line with their requirements.

The policies of at least three funders (German Federal Ministry of Education and Research Indian [BMBF], Indian Department of Biotechnology [DBT], Indian Department of Science & Technology [DST]) include a statement that further to making research freely accessible, researchers' choice of journal was unrestricted.

Other journal characteristics mentioned by funders

Most funders mentioned that funded research should be peer reviewed or published in a peer reviewed journal (Table 4). Four funders made non-specific reference to selecting a "good" or "quality" journal in relation to publication of funded research; none mentioned the journal impact factor. Eight funders made statements about publication transparency or ethics. For instance, one funder discussed reproducibility in published research, three mentioned adherence to reporting guidelines, and at least six asked that metadata accompany published articles (Table 6).

Adherence to policies/recommendations

Of 38 policies/recommendations providing information about disseminating research outputs, only nine (24%) stated that they monitor adherence to either a policy (n=7) or recommendation (n=2); two philanthropic funders (Wellcome Trust and Bill & Melinda Gates Foundation) specified that they would evaluate publications of funded research reported to them to ensure they are published in journals meeting the funder's outlined publishing requirements (Table 7). No monitoring or adherence data appears to be publicly available. Only five (13%) funders with policies or recommendations about journal publication indicated that there would be consequences for non-adherence. And only two of those (Wellcome Trust and NIH) stated that they would withhold or suspend payments if articles are not made open access.

Discussion

Most health research funders appear to have active policies about the dissemination of funded research, typically about open access which often include statements about journal publication. Few policies contain guidance on how to select journals, list features of journals meeting funder requirements, or about the credibility of publishing outlets. Only one health research funding organization (IDRC) made specific reference to the "questionable journals" at the time of data collection (August-September 2017). Additionally, few policies describe whether funded outputs are monitored for compliance with funders' dissemination policies, and few describe any consequences for researchers' non-adherence to their policies. Information is not available on whether the NIH or Wellcome Trust, both of whom promise to withhold or suspend grant funds for breaching their open access policies, have actually ever done so[9].

For many of the funders in our sample, information to guide research publication was found across multiple documents and not always within open access policy statements/documents where publication is mentioned. For example, the only guidance we identified that referred to predatory journals (IDRC) was contained in a PDF (entitled "Publishing in Open Access Journals") separate from the funders' main open access policy. The policy did not flag that the document contained information about predatory/questionable/non-credible journals. This unobvious placement of guidance or expectations around journal selection relies on researchers' curiosity or knowledge that important

Table 5. Funder statements on journal selection, requirements & credibility.

Funder	Journal Selection	Specific publisher/journal requirements or acceptability/credibility features	Name of webpage/source document
Bill & Melinda Gates Foundation	"Open access publishing is a non-negotiable term included in all grant agreements as of January 1, 2015. Please log into Chronos to search and find journals that offer open access options as required by the foundation's policy." "Our Open Access policy contains the following elements: 1. Publications Are Discoverable and Accessible Online. Publications will be deposited in a specified repository(s) with proper tagging of metadata. 2. Publication Will Be On "Open Access" Terms. All publications shall be published under the Creative Commons Attribution 4.0 Generic License (CC BY 4.0) or an equivalent license. This will permit all users of the publication to copy and redistribute the material in any medium or format and transform and build upon the material, including for any purpose (including commercial) without further permission or fees being required. 3. Foundation Will Pay Necessary Fees. The foundation would pay reasonable fees required by a publisher to effect publication on these terms. 4. Publications Will Be Accessible and Open Immediately. All publications shall be available immediately upon their publication, without any embargo period. An embargo period is the period during which the publisher will require a subscription or the payment of a fee to gain access to the publication. We are, however, providing a transition period of up to two years from the effective date of the policy (or until January 1, 2017). During the transition period, the foundation will allow publications in journals that provide up to a 12-month embargo period…"	"Chronos will list the most current information about which journals offer these [open access] options, i.e., the listing for Science will reflect the current agreement between the Gates Foundation and the American Association for the Advancement of Science (AAAS)."	Open Access Policy - Frequently Asked Questions
Bloodwise	"If the journal is not compliant with our open access policy, grant holders can request from Bloodwise that grant underspend is used to cover the cost with a justification for publishing in a non-compliant journal"/"Researchers can determine which publishers are compliant with this policy by referring to the SHERPA/FACT database and checking against the Wellcome Trust's policy, which has the same stipulations."	None stated	Project grants – guidance for applicants
British Heart Foundation	All of our Grantholders submitting manuscripts to journals should find out in advance whether the publisher supports open access and how they can comply with paragraph 2 above.	None stated	Open Access Policies
Cancer Research UK	"The journal you publish in must be published by a publisher who has agreed to the COAF/Wellcome Trust publisher requirements. Cancer Research UK and the Charity Open Access Fund (COAF) will only fund APCs where the publisher has agreed to the COAF/Wellcome Trust publisher requirements. These publisher requirements set out the open access services that publishers must agree to provide when they charge APCs for COAF-funded researchers. Most major publishers and many smaller publishers have signed up to these requirements. If you would like to check that the publisher of your chosen journal is compliant, search the SHERPA/FACT database here. Select the name of the relevant journal and Cancer Research UK as your funder – as long as the results show at least one 'tick' (✓), the journal is compliant by that route."	"Publishers who want to provide open access publishing services for Wellcome and Charity Open Access Fund (COAF) grantholders through peer-reviewed journals based on article processing charges (APCs) must commit to providing a service that meets our requirements. Our open access policy (/funding/managing-grant/open-access-policy) states that when Wellcome funds are used to pay an APC, the article must be deposited, at the time of publication in PubMed Central (PMC). It will then be mirrored to Europe PMC. All deposited articles must be made available under the Creative Commons Attribution (CC-BY) Licence. COAF follows the same policy. Wellcome and COAF's open access policies and requirements are designed to maximise the availability and reuse of publications. We hope that publishers will continue to support us and our grantholders in this endeavour. We recognise that relationships in the publication process are not straightforward – we have grant-funding relationships with researchers, who then establish relationships with publishers. This can lead to confusion about what Wellcome and COAF expect from publishers. Our requirements clarify the service that publishers who receive Wellcome or COAF funds need to provide."	Open Access Policy/Publisher Requirements

F1000Research 2021, 10:100 Last updated: 23 APR 2021

Funder	Journal Selection	Specific publisher/journal requirements or acceptability/credibility features	Name of webpage/source document
Deutsche Forschungsgemeinschaft /German Research Foundation	"The approved funds are only for the publication of essays in original Open Access journals. The funds may only be spent provided that the following conditions are met:...The articles to be published appear in journals whose contributions are all accessible to users free of charge ("genuine open access journals") immediately after their publication on the Internet, and which apply the strict quality assurance procedures recognized in the relevant subject... The funds provided by the DFG may not be used to publish open essays in journals subject to subscription (according to the "Open Choice" model etc.) for Open Access."* "Guiding ideas for choosing appropriate means of publication: http://thinkchecksubmit.org"	"Recommendation 12: Scientific journals shall make it clear in their guidelines for authors that they are committed to best international practice with regard to the originality of submitted papers and the criteria for authorship."/ "all good scientific journals report when a manuscript has been received and when – usually following peer review – it has been accepted"	Further information on Open Access
German Federal Ministry of Education and Research (BMBF)	"Scientific articles from projects funded by the BMBF should either be published directly under an open access model or be put into a suitable document server after expiry of an embargo deadline. The researchers remain free in their choice, whether and in which journal they want to publish"	None stated	Press Release announcing Open Access Strategy
Howard Hughes Medical Institute	"HHMI strongly encourages all HHMI laboratory heads to publish their original, peer-reviewed research in journals that make publications freely available and downloadable on-line immediately after publication (i.e. open access journals). If a laboratory head chooses to publish an original, peer-reviewed research publication on which he or she is a major author in a journal that is not open access, the laboratory head is responsible for ensuring that the publication is freely available and downloadable on-line as soon as reasonably possible after publication, and in any event within twelve months of publication."	None stated	Public Access to Publications
Indian Department of Biotechnology (DBT)	"The DBT and DST recognize the right of researchers to publish their work in journals of their choice, because researchers are the best judges of where to publish their work. The DBT and DST expect that the recipients of funding will publish their research in high quality, peer-reviewed journals." AND "Results should be published in an appropriate form, usually as papers in refereed journals, with copies being made available through PubMed Central (PMC) and UK PubMed Central (UKPMC) as soon as possible and in any event within six months of the journal publisher's official date of final publication."	None stated	DBT and DST Open Access Policy
Indian Department of Science & Technology (DST)	*same as Indian Department of Biotechnology (DBT)*	None stated	DBT and DST Open Access Policy

Funder	Journal Selection	Specific publisher/journal requirements or acceptability/credibility features	Name of webpage/source document
IDRC/Global Affairs Canada	"Authors should carefully consider the quality standards of publications and ensure that appropriate peer review mechanisms are followed. The Directory of Open Access Journals, maintained by Infrastructure Services for Open Access (IS4OA), lists open access journals that have been reviewed for quality. Authors can also refer to the information guide Publishing in Open Access Journals, which lists journal quality indicators to evaluate potential publication outlets."	While most open access journals are peer-reviewed and high quality, there are a number of questionable journals, i.e. journals that do not subscribe to most or any of the practices of legitimate, academic journals. There is no single rule or test to indicate whether an open access journal is reputable. But here is what you should look for and what you should be wary of to avoid publishing in a questionable journal: Look for ... • Journal scope is well-defined and clearly stated • Journal is affiliated with or sponsored by an established scholarly society or academic institution • Editor, editorial board are recognized experts in the field • Articles are within the scope of the journal and meet the standards of the discipline • Any publishing fees or charges are easily found on the journal website and clearly explained • Rights for use and re-use of content at article level (e.g., Creative Commons CCBY licence) are clearly indicated • Articles have DOIs (Digital Object Identifier, e.g., doi:10.1111/j.1742-9544.2011.00054.x) • An ISSN (International Standard Serial Number e.g. 1234-5678) has been assigned • Publisher is a member of Open Access Scholarly Publishers Association (OASPA) • Journal is listed in the Directory of Open Access Journals (DOAJ) • Journal is included in established subject databases and/or indexes (e.g., Academic Search Complete, Medline, etc.) Be wary of ... • No journal scope statement or one that is vague • Website mimics other well-known publishers' site, or links or uses logos of recognisable entities although there is no actual connection • Journal title is very similar to title of a more established journal • Poorly maintained Web presence, including dead links, multiple spelling and grammatical mis- takes (on website and in articles) • No editor, editorial board, or editorial staff is listed, or they lack affiliation • Publisher is also the editor of the journal and/or editorial boards members serve on the board of multiple titles from the same publisher • Authors have several articles in the same issue • Publisher uses direct and unsolicited marketing (i.e., spamming) or advertising is obtrusive (to publish articles or serve on editorial board) • No information is provided about the publisher or location; either information is missing or does not match geographical area covered by the journal (e.g., "American Journal of ...." but published in Croatia) • Instructions to authors regarding peer review, copyright and/or fees (APCs), are not listed on web- site or are unclear • Publisher promises unusually rapid peer review and publication schedule Open Access • New (but self-proclaimed "leading") publisher with a large number of journals • Journal not listed in the Directory of Open Access Journals (DOAJ) • Claims to be indexed by Google and Google Scholar (or other search engines that crawl the Web) • Refers to bogus metrics meant to mimic Impact Factor (e.g., Journal Influence Factor, Global Impact Factor, etc.) • Publisher has a negative reputation (e.g., documented examples in Chronicle of Higher Education, list-servs, etc.) • Journal or publisher appears on Beall's List of Predatory Journals and Publishers Tools to find and evaluate open access journals: • Directory of Open Access Journals: http://doaj.org/ Online index of open access, peer-reviewed journals • Beall's List of Predatory Journals and Publishers: http://scholarlyoa.com/ List of potential, possible or probable questionable scholarly open access publishers and standalone journals • SHERPA/RoMEO: http://www.sherpa.ac.uk/romeo/ Online index of publisher copyright and self-archiving policies	Open Access Policy for IDRC-Funded Project Outputs/IDRC Publishing in Open Access Journals

F1000Research 2021, 10:100 Last updated: 23 APR 2021

Funder	Journal Selection	Specific publisher/journal requirements or acceptability/credibility features	Name of webpage/source document
National Health & Medical Research Council (Australia)	"NHMRC acknowledges that researchers take into account a wide range of factors in deciding on the best outlets for publications arising from their research. Such considerations include the status and reputation of a journal, book, publisher or conference, the peer review process of evaluating their research outputs, access by other stakeholders to their work, the likely impact of their work on users of research and the further dissemination and production of knowledge. Taking heed of these considerations, NHMRC wants to ensure the widest possible dissemination of the research supported by NHMRC funding, in the most effective manner and at the earliest opportunity.	None stated	NHMRC OA policy
National Institutes of Health	"Awardees must ensure that any publishing agreement allows the paper to be posted to PMC in accordance with the NIH Public Access Policy. NIH does not dictate the means by which awardees must do so, but does offer guidance in an FAQ on suggested wording for publishing agreements."	"If a publication is in the journal section of the NLM catalog, NIH considers it to be a journal. Search the journal section of NLM Catalog (http://www.ncbi.nlm.nih.gov/nlmcatalog/journals) for the journal by title, title abbreviation, or ISSN. Automatic suggestions will display as you type. If the publication is not on the list, NIH will consider it a journal for policy purposes if it meets all of the following criteria: Publication must meet the requirements for ISSN assignment; Publication content is issued over time under a common title; Publication is a collection of articles by different authors; Publication is intended to be published indefinitely; You may also submit the manuscript to NIHMS upon acceptance for publication for a determination."	National Institutes of Health Plan for Increasing Access to Scientific Publications and Digital Scientific Data from NIH Funded Scientific Research/NIH FAQ on Public Access Policy
Wellcome Trust	"We expect Wellcome-funded researchers to select publishing routes that ensure the work is available immediately on publication in its final published form, wherever such options exist for their publisher of choice and are compliant with our policy." "The [Charitable Open Access Fund] fund can only be used for APCs where the publisher has agreed to our publishing requirements." "Check that your journal of choice has a publishing policy compliant with our grant conditions. Wellcome-funded authors can use the SHERPA Funders' and Authors' Compliance Tool (http://www.sherpa.ac.uk/fact/) (SHERPA FACT) to check this."	*Same as Cancer Research UK*	Open Access Policy/Publisher Requirements

* "Open Choice" is a term used by the publisher *Springer* to refer to hybrid journals.

Table 6. Transparency tools/activities mentioned by funders.

Funder	Additional publication transparency actions/initiatives mentioned	Source
Bill & Melinda Gates Foundation	"Publications Are Discoverable and Accessible Online: Publications will be deposited in a specified repository(s) with proper tagging of metadata."	Open Access Policies
Bloodwise (formerly Leukaemia & Lymphoma Research)	"Grant holders should make use of the ARRIVE guidelines when designing their experiments, and ensure that they report in vivo studies in accordance with the ARRIVE guidelines as far as possible."	Project Grants Guidance
Deutsche Forschungsgemeinschaft / German Research Foundation	Recommendation 7: Safeguarding and Storing of Primary Data. "Experiments and numerical calculations can only be repeated if all important steps are reproducible. For this purpose, they must be recorded. Every publication based on experiments or numerical simulations includes an obligatory chapter on "materials and methods" summing up these records in such a way that the work may be reproduced in another laboratory."	Safeguarding Good Scientific Practice
European Commission	"To be able to easily find the deposited publication, beneficiaries must also ensure open access – via the repository – to the bibliographic metadata that identify the deposited publication. This metadata must include a persistent identifier (such as the Digital Object Identifier, DOI) in order to allow easy and persistent referencing."	European Research Council (ERC) Guidelines on Implementation of Open Access to Scientific Publications and Research Data
Indian Council of Medical Research	Researcher's Relations with the Media and Publication Practices: "The term 'misconduct in research' means fabrication, falsification, plagiarism, selective omission of data and claiming that some data are missing, ignoring outliers without declaring it, not reporting data on side effects/ adverse reactions in a clinical trial, publication of post-hoc analysis without declaring it, gift authorship, not citing others' work, not disclosing conflict of interest, redundant publication, and failure to adequately review existing research. The Commission on Research Integrity in US created by US Congress addresses the scientific, ethical, social and legal issues involving scientific misconduct in research. Consolidated standards of reporting trials (CONSORT) guidelines have been prescribed for publishing results of clinical research especially RCTs (Randomised Controlled Trials) and are available at http://www.consort-statement.org/."	Ethical Guidelines for Biomedical Research on Human Participants
Institut Pasteur	"To be able to easily find the deposited publication, beneficiaries must also ensure open access – via the repository – to the bibliographic metadata that identify the deposited publication. This metadata must include a persistent identifier (such as the Digital Object Identifier, DOI) in order to allow easy and persistent referencing."	European Research Council (ERC) Guidelines on Implementation of Open Access to Scientific Publications and Research Data
Medical Research Council (UK Research and Innovation since 2018)	G.8. Reporting Guidelines: "Agreed standards for reporting the outcomes of research in specific areas have been developed and should be observed. Standards endorsed and supported by the MRC include the CONSORT Statement (CONsolidated Standards of Reporting Trials)[40] and the ARRIVE guidelines (Animal Research: Reporting in-vivo experiments)[41]."	MRC ethics series. Good research practice: Principles and guidelines
NIH	5.a. Access & Discoverability: Meta Data. "Ensure full public access to publications' metadata without charge upon first publication in a data format that ensures interoperability with current and future search technology. Where possible, the metadata should provide a link to the location where the full text and associated supplemental materials will be made available after the embargo period; Ensure that attribution to authors, journals, and original publishers is maintained (OSTP memo, elements 3c, 3e)"	Plan for Increasing Access to Scientific Publications and Digital Scientific Data from NIH Funded Scientific Research
U.S. Agency for International Development	"Metadata [from a research dataset or publication] should be made accessible as soon as possible after final acceptance of a paper and appropriate review, even if the full text is subject to an embargo period."	Public Access Plan
World Bank	"Requires electronic copies of complete, final manuscripts, as defined above, as well as the associated metadata, to be deposited in the Open Knowledge Repository"	World Bank Open Access Policy for Formal Publications
World Health Organization	Summary of the open-access policy options and requirements: "Publisher deposits XML version of the article and metadata in PubMed Central, which automatically appear in Europe PubMed Central"	WHO open-access policy: Frequently asked questions for recipients of WHO funding

Table 7. Monitoring and consequences.

Funder Name	Adherence-monitoring strategy	Consequences for non-adherence
American Heart Association	(From OA policy) "In situations where the AHA or members of the research community feel that AHA-funded researchers are not sharing data in a manner consistent with our policy, you may be asked by the AHA to demonstrate your compliance."	"If you cannot do so [demonstrate compliance with OA policy], this may affect future funding."
Bill & Melinda Gates	(From FAQ about OA Policy) "The foundation checks and tracks compliancy through Chronos, a new service to help you manage the process of publishing under the policy's terms."	*None stated/identified*
Canadian Institutes for Health Research	*Nothing stated/identified*	*not specific to journal publication - but have consequences for breaches in policy, including breaches around dissemination of research*
Centers for Disease Control and Prevention	(From...) " Supervisors of publishing authors are responsible for ensuring compliance with the CDC Public Access Policy."	*None stated/identified*
Institut Pasteur	(From OA intentions) "The deposit is checked by the CeRIS library's Hal team, in particular when it comes to the rights of authors on their files and their affiliations to a lab and and institution."	*None stated/identified*
JRDF	*Nothing stated/identified*	(From Award Terms and Conditions) *not specific to publication* "JDRF may place the PI and/or his/her Grantee Institution on administrative probation if ...the Grantee Institution is non-compliant as outlined in this document. JDRF administrative probation may include, but is not limited to, the following actions: 1. Withholding of all payments for the grant/project in question 2. Changing to a payment reimbursement schedule 3. Withholding of all JDRF payments for the PI, for any JDRF grant 4. Withholding of all JDRF payments for the Grantee Institution, for any JDRF grant 5. Any combination of the above"
National Institutes of Health	(NIH Public Access Policy) "Compliance with this Policy remains a statutory requirement and a term and condition of the grant award and cooperative agreement, in accordance with the NIH Grants Policy Statement."	(NIH Public Access Policy - FAQ) "A grantee's failure to comply with the terms and conditions of award may cause NIH to take one or more enforcement actions, depending on the severity and duration of the non-compliance. NIH will undertake any such action in accordance with applicable statutes, regulations, and policies. NIH generally will afford the grantee an opportunity to correct the deficiencies before taking enforcement action unless public health or welfare concerns require immediate action. However, even if a grantee is taking corrective action, NIH may take proactive action to protect the Federal government's interests, including placing special conditions on awards or precluding the grantee from obtaining future awards for a specified period, or may take action designed to prevent future non-compliance, such as closer monitoring. See Enforcement Actions in the NIH Grants Policy Statement (10/12).."
Pan American Health Organisation	"Research commitments shall be reflected in institutional policies and program budgeting and planning, implementation, monitoring, and evaluation; human resource management; and knowledge management."	*None stated/identified*

Funder Name	Adherence-monitoring strategy	Consequences for non-adherence
UK Department for International Development	(From DFID Research Open and Enhanced Access Policy) "As part of its monitoring and evaluation framework, DFID Research and Evidence Division (RED) collects data on the extent to which researchers fulfil the requirements and recommendations of this policy. RED researchers are required to report open access activity, usually during the annual review."	*None stated/identified*
US Agency for International Development	(From Public Access Plan) "Potential future monitoring plans are suggested: "Further criteria/metrics for compliance and evaluation will be developed through consultations with M/OAA/P, GC, and other USAID Operating Units. This may include: A) requesting offerors to submit within their proposals a list of USAID-funded peer-reviewed publications (and the corresponding DEC-issued unique identifier number for publication) that resulted from their prior USAID awards when deemed appropriate by the CO; B) importing the metadata and links to the authors' manuscript or the publically available version of record of publications that resulted from USAID support, but were published after completion of the award in partnership with third-party reference services such as CHORUS and FundRef; and C) including compliance with open data and public access requirements of awards as a measure of past performance."	*None stated/identified*
Wellcome Trust	(From Complying with our OA policy) "We actively monitor research papers authored by our funded researchers to ensure they comply with our policy. This includes the review of publications listed in ongoing grant reporting and in end of grant reports. In addition, Wellcome-funded research papers detailed in applications submitted to us are reviewed to ensure compliance."	(From Complying with our OA policy) "When Wellcome-funded researchers do not comply with our open access policy, we will apply these sanctions: Applicants will be required to ensure that all their Wellcome-funded original research papers resulting from current or previous grants are compliant before we issue formal notification of any funding renewals or new grants. Where non-compliant research papers, book chapters and scholarly monographs are identified in an end of grant report, we will withhold the final 10 per cent of the total grant budget until all outputs comply. See our 10 per cent retention policy."

information may be located outside of the main policy webpages or documents. If funders wish to provide guidance about journal credibility and predatory publishing, they may reach more researchers (and increase the likelihood of them reading it) by including such information within their main policies.

Comparison to other research

At least four previous studies examining health research funder policies on clinical trial transparency have collected information on funder's recommendations for disseminating research.

Two studies using similar methods evaluated trial transparency policies (i.e., those related to trial registration, access to summary results, individual data availability) for non-commercial health research funders globally (n=18)[34] and in the USA (n=9)[36]. After accounting for three common funders across studies, 21 of 24 (87.5%) funders (16 of which are represented in our study) either required or supported publication or registration of trial results (neither study or their available data distinguished between publication or registration). This is in line with our findings in which 86% (38 of 44) funders had such policies/recommendations.

A third study, published in 2017 which examined research waste-reducing policies of 11 non-commercial funders (six of which are represented in our study) reported six to be explicit in requiring publication of full reports of funded research[33]. In comparison, 36 of 38 policies/recommendations (95%) in our study referred to journal publication as one form of dissemination for completed research but did not indicate that it was mandatory. There may be differences in how authors of that study and interpreted language in documents or policies. The names of the six funders 'requiring' publication in that study were not obvious in either the publication or available data, so we are unable to investigate this further.

A study published in 2008 examined 73 UK and international non-commercial health research funders' guidance for reporting funded clinical trials[42]. 49 funders (67%) explicitly stated that trials could or should be published. Of the three funders appearing in the 2008 sample and ours, all have maintained recommending (but not requiring) the publication of trial results. Whether funders provided any guidance on selecting a journal to publish in was not collected in the study.

No previous studies appear to have investigated whether health research funders' provide guidance to help funded researchers select a journal for publication. Our study appears to be the most comprehensive investigation on this matter. This is surprising since our findings suggest that funders in our sample regard publication as the primary means of disseminating funded research. Further, studies show that researchers view journal publication as the primary way of disseminating research[43,44].

Strengths and limitations

This study is the first to examine the information funders provide researchers about selecting a journal in which to publish funded research. All funders in our sample that mention journal publication or provide guidance on selecting journals, do so within their open access policies. In a time where the scholarly publishing landscape has been infiltrated and confused by predatory journals, inadvertently resulting in some researchers trying to achieve open access to publish in predatory journals[45], funders can play a critical role in steering researchers in the right direction. Funders can be specific and explicit with regards to which journal features researchers should look for in order to select one that meets their open access requirements.

This study provides a benchmark by which to monitor how major health research funders are performing pre and post Plan S implementation (January 2021). Data collection occurred in August & September 2017, prior to the September 2018 announcement of Plan S. So far, 24 funders have committed to implementing Plan S, five of which were considered in this research (European Commission, Gates Foundation, MRC/UK Research and Innovation, Wellcome Trust, and the World Health Organization). Two of these, the Wellcome Trust and Gates Foundation, provided guidance (in the form of tools) to facilitate selecting a journal in line with their open access policies at the time of sampling. At least one funder (Wellcome Trust) has made changes to their open access policies in anticipation of Plan S[46].

Our study relied on publicly available information about funder expectations of funded research and was abstracted by a single person with verification by a second (i.e., not two independent people). Six funders in our sample did not provide any relevant public information. We did not seek verification on policies from funders. Data were collected at a time when publishing activities, particularly open access, was rapidly changing, in part in response to funded research being published in predatory journals[45,47]. We are aware that the NIH issued a notice on their Public Access Policy in November 2017 (outside of our sampling and data collection period) with recommendations to publish funded research in journals with 'credible practices'[48]. Engaging funders in our study may have had the added benefit of increasing uptake of our findings/recommendations into practice.

The focus of this research is limited to health research funders. We have not accounted for or evaluated other potential scientific publishing gatekeepers such as academic institutions, governments, or companies carrying out scholarly research, despite the important role they can play[49].

Implications and recommendations for funders

Explicit funder policies on publication expectations. Selecting a journal in which to publish research is not a straightforward undertaking[40], particularly since the emergence of predatory journals. For funders looking to make their expectations around publishing funded research more explicit and more transparent, we propose several recommendations on how this might be achieved in Box 1, based on findings of this research and on the expertise of authors. Providing specific information about journal considerations in funders' policies to funded researchers may facilitate more thoughtful and responsible selection

of journals. Several recommendations in Box 1 pertain to the explicitness of article/journal considerations mentioned in Plan S (e.g., persistent identifiers for publications; long-term preservation/archiving; article-level metadata). All health research funders may wish to consider making aspects of their policies that pertain to publishing more explicit, whether or not they intend to implement Plan S.

Box 1. Recommendations for providing explicit/transparent guidance on journal selection in health research funders' open access policies

1. Use precise wording to describe your agency's expectations that funded research be published
   - Indicate whether researchers are expected to publish their research (e.g. use of "must" vs "should")
   - indicate whether open access publication is one of several options for meeting the agency's open access requirements.
2. Provide a definition of a journal that is suitable to your agency
   - Decide what essential features a publishing entity should and should not have in order to be considered a suitable place for publication.
   - Consider referring to/including the Committee on Publication Ethics (COPE) list of Core Practices all journals and publishers should follow: https://publicationethics.org/core-practices
   - The NIH definition of a journal is[41]:
     - Publication meets the requirements for ISSN (International Standard Serial Number) assignment;
     - Publication content is issued over time under a common title;
     - Publication is a collection of articles by different authors;
     - Publication is intended to be published indefinitely.
3. Indicate your agency's requirements for access and discoverability of published articles
   - Distinguish between free vs open access:
     - Published articles are free to access; AND additionally, for open access,
     - Licensing for published articles permit reuse and building on (typically through a Creative Commons Attribution License, CC BY).
   - Ensure that published research can be accessed in perpetuity
     - Researchers can determine whether the publishing journal has a permanent archival arrangement in place either through automatic deposition to PMC (https://www.ncbi.nlm.nih.gov/pmc/journals/), or to another archive (via the Keepers Registry: https://keepers.issn.org/keepers-registry)[xxv]
     - PMC-partnered funders can require that researchers upload published research directly to PMC
   - Journal provides unique permanent identifiers (e.g. digital object identifier [DOI]) (can check if journal/publisher is registered with CrossRef: https://www.crossref.org/06members/51depositor.html)
4. Be clear about your agency's support for article processing charges arising from publication of funded research
   - Indicate how much money is available each open access publication (e.g. maximum APC amount)
   - Indicate who will receive APC payment from the funder – the author (institution) or the journal
   - Indicate when funding will be distributed to support article processing charges
   - Indicate whether there are any conditions on distribution of APC funds
5. Indicate whether your agency requires archiving in a repository alongside publication
   - Indicate whether the publication, data, or both, are expected to be deposited in a repository
   - Indicate when deposition is expected to occur (i.e., immediately or within a specified time frame)
   - Indicate whether you have a dedicated repository for research publications (e.g., PMC for NIH-funded research), and if not, suggest one or more repositories that are considered acceptable by your agency
   - Be clear that it is the authors' responsibility to ensure publications are deposited in a repository
   - Provide instructions/link to resources on how to deposit research in the suggested repository.
6. Indicate how your agency will monitor that funded research is published in appropriate journals, in line with agency recommendations/mandates
   - For ease of monitoring, Provide instructions for researchers about where and how to include the funding agency name and grant number in published articles (guidance here: https://www.ukri.org/wp-content/uploads/2020/10/RIN-251020-FundersAcknowledgementInScholarlyjournalArticles.pdf)
   - Provide instructions on if, how, and when to submit publications of funded research to the funding agency, or state how publications will be monitored otherwise
   - Provide specific actions/consequences that the agency will carry out when funded research is published in a journal that does not meet agency requirements

The NIH is the only funder in our sample to clearly describe what it considers a journal – either those listed in the journal section of the National Library of Medicine (NLM) (https://www.ncbi.nlm.nih.gov/nlmcatalog/journals) or those meeting a comprehensive set of criteria[41]: (1) meets the requirements for ISSN (International Standard Serial Number) assignment; (2) content is issued over time under a common title; (3) is a collection of articles by different authors; and (4) is intended to be published indefinitely. All but the final criterion are straightforward to judge;

[xxv] provides global monitoring of archiving arrangements for electronic journals.

presumably it is meant to distinguish a journal from a book or a monograph however NIH or NLM do not provide guidance on how to judge this criterion. Whether and how we can predict journals' intentions to publish indefinitely has not been described. A more meaningful criterion for distinguishing journals from non-journals may be whether the publishing entity has archival arrangements in place (e.g., with LOCKSS, Portico, PubMed Central) to ensure perpetual access to content in the event a journal ceases to operate. Since preserving publisher content may have associated costs[50], predatory or non-credible journals (which some describe as "primarily fee-collecting operations"[51]) may be unlikely to seek this service.

We surprised that the three funders from India in our sample (Indian Council for Medical Research, DBT, and DST) did not mention journal credibility or predatory journals, and further, that a common policy for two Indian funders (DST and DBT), dated December 2014, recognizes "the right of researchers to publish their work in journals of their choice, because researchers are the best judges of where to publish their work". Since at least 2016, there has been an ongoing national initiative combat predatory journals and to support researchers in their choice of journals across higher education institutes in India. The main product of this work has been a list of approved journals in which academic researchers are permitted to publish in as well as standard templates for researchers when communicating with journals[52]. The University Grants Commission (UGC), the regulator and funder of high education, has been leading the initiative. It is uncertain whether the country's largest health research funders are on board due to their lack of guidance in this space. A coordinated approach by a range of stakeholder groups[49], which includes funders (who have innate authority to implement mandates about publishing), may facilitate improved publication decisions by researchers. Importantly, however, UGC's list of approved journals has been plagued with numerous credibility concerns in its short existence[53,54]. Explicit recommendations from India's funders regarding credible and non-credible features of journals in which to publish may be warranted in the absence of a trusted and comprehensive list.

Facilitating and monitoring adherence to funder policies. Funders are well-positioned to provide researchers with resources and tools to help ensure that results from funded research are published in credible and discoverable journals, in line with their policies. Several organizations in our sample consistently offer more information about potential publishing routes and tools to facilitate adherence to their policies. We provide a list of tools to facilitate the development of funder policies on research outputs, adherence to such policies, and monitoring of policy adherence (Table 8).

Monitoring researchers' adherence to their policies may help funders understand the extent to which researcher's publishing practices are guided by their policies[55]. Informing researchers that their adherence to open access policies is being monitored may facilitate better awareness of such policies and potentially increase adherence to them[56]. A 2018 study examining the accessibility of research supported by 12 research funding agencies across North America and Europe with open access policies, found that 62% of almost 1.3 million articles over nine years were freely available[9]. In 2016, 90% of published research supported by the NIH and Wellcome Trust was free to access (via journal, repository, or both)[9]. Both agencies mandate the deposit of published research by publishing journals or funded authors into dedicated repositories (PMC for NIH; PMC Europe for Wellcome Trust). The remaining 10 funders in the sample did not mandate depositing in a repository alongside publication and had lower rates of freely accessible articles. For example, for the Canadian Institutes of Health Research (CIHR) only 55% of published research was freely accessible in 2016, even though the funder had a dedicated repository (PMC Canada) until 2018 (it closed due to low usage and high upkeep costs)[57]. The study's authors conclude that funders with low compliance rates used less enforcement and had less infrastructure to support compliance with their open access mandates[9].

Areas of future research

An important area of future study is whether researchers are being funded on the basis of grant applications that include research published in predatory journals – or in journals that may not be indexed in trusted databases. Predatory journals have made their way into consideration (via CVs submitted by researchers or through institution-initiated database searches) into applications for academic career advancement[58–60]. Some have called for such publications to either be discounted from consideration or for researchers who submit them for consideration to be prevented from career advancement overall[61,62]. It is unknown whether researchers are including publications in predatory journals as part of their funding applications. This should be evaluated. If they are, funders may wish to consider whether this is an important consideration for awarding funding.

Conclusion

Most large health research funders mandate open access to funded research outputs, typically by way of open access journal publication and by deposition of published research in digital repositories. Few funders provide guidance on what constitutes a journal (or an open access journal) or are checking to ensure that published research that they have funded is indeed meeting specified requirements about how research should be shared. Health research funding organizations have an obligation to support researchers in meeting their mandates so that research can, as intended, contribute to the broader evidence base. The publishing community needs to provide guidance to funders and researchers on universally acceptable and transparent standards for journal operations. Many solutions to improve policies, facilitate adherence, monitor compliance and work with other funders on large-scale improvements exist and should be implemented.

Journals that fail to make research discoverable breach the basic trust that researchers and their funders have in the current publishing system. Most funded researchers publish their work under the basic assumption that their journal or publisher is following best practices to ensure future use[7]. Bodies funding health research have a responsibility to protect their investments and even more importantly, to ensure that funded research is not wasted by being published in non-credible and non-discoverable sources.

Table 8. Resources and tools that funders can use to support development of, adherence to, and monitoring of open access publishing policies.

Resource/Tool	URL	Origin	Description	Relevance & Implementation	Limitations
CHORUS	https://www.chorusaccess.org/	Association of American Publishers	A service that utilizes metadata from CrossRef Funder Registry and partner publishers to monitor the # of published articles and % that are freely accessible; prompts free article access if required by funder policies; ensures digital preservation.	FACILITATING ADHERENCE & MONITORING: Encourage researchers to include funder name and grant number in published articles. Ensure funder information is registered and correct in CrossRef Funding Registry.	Fee-based Only able to facilitate open access & preservation for publisher partners (paid service).
Chronos	https://chronos-oa.com/	The Bill & Melinda Gates Foundation	A service facilitating funders' management and tracking of the publication process for funded research outputs, through which pay APCs, and by which to manage subsequent archiving. Automatically collects information on where research was published, whether, when, and in which repositories published research and data were deposited, and the type of license research was published under.	FACILITATE ADHERNCE: Require that researchers use Chronos to submit any funder-supported research for publication; pay APCs directly to publishers instead of distributing as grant funding. MONITOR ADHERENCE: Use to monitor # of open access publications. Use as grant reporting tool to alleviate researchers of administrative responsibility.	Fee-based Only tracks publications submitted through Chronos.
CrossRef Funder Registry[xxvi]	https://search.crossref.org/funding	CrossRef	Tracks any published articles with a digital object identifier (DOI) issued by Crossref (main DOI registration organization) and for which funder metadata is available	MONITOR ADHERENCE: Ensure funder information is registered and correct in the Registry; use to search for publications and other research outputs with DOIs funded by a specific grant or by a funder overall.	No distinction between freely available vs. subscription content. Only able to track articles for which publishers have registered DOIs and funding metadata with Crossref (paid service). Dependent on authors reporting funding information during the submission process or on publishers extracting from article.
HowOpenIsIt? Guide to Research Funder Policies	http://www.orfg.org/policy-development-guide/	Open Research Funders Group; SPARC	Freely available framework for designing funders' open access policies. Provides policy examples along a spectrum of openness for five aspects of research outputs: article access, data and code access, reuse, costs, and compliance.	POLICY DEVELOPMENT: Use to facilitate design of a policy that includes recommendations on one or more aspects of openness of research outputs, that are feasible/desired.	None

Resource/Tool	URL	Origin	Description	Relevance & Implementation	Limitations
OpenAire	https://monitor.openaire.eu/	European Commission/ Horizon 2020	Uses metadata provided by a funder (i.e., grant number) to search for funded research outputs deposited in digital archives/repositories.	MONITOR ADHERENCE: Use to collect data on research outputs (including publications) that are available in repositories.	Only sees freely available outputs. Dependent on researchers including grant numbers within research outputs deposited in repositories. Relies on repositories being compliant/ providing necessary metadata.
PubMed Central (PMC)	https://www.ncbi.nlm.nih.gov/pmc	NIH	The US National Library of Medicine's (NLM) repository of freely available, full-text, published biomedical and life sciences articles; Dedicated repository for published NIH-funded research and for select other US and international funders. Publications can be deposited by journals with agreements with PMC or by researchers reporting NIH (or other agreed funder-) supported research.	FACILITATE ADHERNCE: Take appropriate steps to partner with PMC, Europe PMC, or the Health Research Alliance (NLM partner): https://www.ncbi.nlm.nih.gov/pmc/about/public-access/. Require that all publications from funded research are deposited in PMC via a publishing journal or by authors.	Relies on journals agreeing to deposit to PMC or on authors to deposit published research for journals without PMC agreements.
SHERPA/FACT (Funder & Author Compliance Tool)	http://sherpa.ac.uk/fact/	Jisc; Wellcome Trust; Research Councils UK	Free online tool for researchers funded by the Wellcome Trust and members of Research Councils UK to check whether their intended journal meets funder open access requirements.	FACILITATE ADHERNCE: Request inclusion to be listed in FACT from Jisc. Direct funded researchers to use FACT to select a journal in which to publish in.	Relies on authors to use. Restricted to searching journals for which open access policies that have been collected
Think, Check, Submit	https://thinkchecksubmit.org	Publishing community led (collaboration among many publishing professionals/ organizations)	Freely available checklist to facilitate researchers in selecting a relevant and trustworthy journal in which to submit their research for publication consideration	FACILITATE ADHERNCE: Encourage authors to use checklist to facilitate selection of credible journal.	Relies on authors to read/understand/use Uncertain development process and validity of checklist items.

[xxvi]Previously known as FundRef (until Nov 2015).

Data availability

Underlying data

Open Science Framework: Audit of health research funder policies and recommendations on journal publication of research: Extracted Data, https://doi.org/10.17605/OSF.IO/YUDP4[63].

This project contains the following underlying data:

- Funders Data analysis data - clean 2020Apr21.dta

Extended data

Open Science Framework: Audit of health research funder policies and recommendations on journal publication of research: Study Forms, https://doi.org/10.17605/OSF.IO/FSUQ2[64]

This project contains the following extended data:

- Level 1 - Searching funder websites form 2017Nov23.pdf
- Level 2 - Data extraction form 2017Nov23.pdf

Open Science Framework: Audit of health research funder policies and recommendations on journal publication of research: Protocol, https://doi.org/10.17605/OSF.IO/J6CSK[65]

Registration of overarching OSF project: https://doi.org/10.17605/OSF.IO/Z59U6[66].

Acknowledgements

We would like to thank Dr. Beverley Holmes of the Michael Smith Foundation for Health Research for providing valuable insight into global health research funder operations and policies at the outset of this project.

Author contributions

The study was conceived of by LS, JG, and DM. LS drafted the initial protocol, with approval from the study team. LS managed the research project. LS, KDC, and MJP carried out the research. LS cleaned and analysed the data, prepared tables and figures, and drafted the manuscript. All authors provided feedback and gave their approval prior to submission.

#	Role	Author(s)	Definition
1	Conceptualization	LS, DM, JG	Ideas; formulation or evolution of overarching research goals and aims.
2	Data curation	LS	Management activities to annotate (produce metadata), scrub data and maintain research data (including software code, where it is necessary for interpreting the data itself) for initial use and later re-use.
3	Formal analysis	LS	Application of statistical, mathematical, computational, or other formal techniques to analyse or synthesize study data.
4	Funding acquisition	n/a – not funded	Acquisition of the financial support for the project leading to this publication.
5	Investigation	LS, KDC, MJP	Conducting a research and investigation process, specifically performing the experiments, or data/evidence collection.
6	Methodology	LS	Development or design of methodology; creation of models.
7	Project administration	LS	Management and coordination responsibility for the research activity planning and execution.
8	Resources	DM	Provision of study materials, reagents, materials, patients, laboratory samples, animals, instrumentation, computing resources, or other analysis tools.
9	Software	n/a	Programming, software development; designing computer programs; implementation of the computer code and supporting algorithms; testing of existing code components.
10	Supervision	LS, DM, JG	Oversight and leadership responsibility for the research activity planning and execution, including mentorship external to the core team.
11	Validation	LS, KDC, MJP	Verification, whether as a part of the activity or separate, of the overall replication/reproducibility of results/experiments and other research outputs.
12	Visualization	LS	Preparation, creation and/or presentation of the published work, specifically visualization/data presentation.
13	Writing – original draft	LS	Preparation, creation and/or presentation of the published work, specifically writing the initial draft (including substantive translation).
14	Writing – review & editing	LS, KDC, MJP, JCB, JG, DM, LAS, SES	Preparation, creation and/or presentation of the published work by those from the original research group, specifically critical review, commentary or revision – including pre- or post-publication stages.

References

1. Moher D, Shamseer L, Cobey KD, *et al.*: **Stop this waste of people, animals and money.** *Nature.* 2017; **549**(7670): 23–5.
PubMed Abstract | Publisher Full Text

2. Beall J: **Predatory publishers are corrupting open access.** *Nature.* 2012; **489**(7415): 179.
PubMed Abstract | Publisher Full Text

3. van Dyck C: **The Long-Term Preservation of Open Access Journals.** *DOAJ News Service.* 2018. [cited 2019 Oct 23].
Reference Source

4. Macleod MR, Michie S, Roberts I, *et al.*: **Biomedical research: increasing value, reducing waste.** *Lancet.* 2014; **383**(9912): 101–4.
PubMed Abstract | Publisher Full Text

5. Lane J: **Let's make science metrics more scientific.** *Nature.* 2010; **464**(7288): 488–9.
PubMed Abstract | Publisher Full Text

6. Macilwain C: **Science economics: What science is really worth.** *Nature.* 2010; **465**(7299): 682–4.
PubMed Abstract | Publisher Full Text

7. De Solla Price DJ: **Little science, big science.** Columbia Univ. Press. 1963; 119.
Publisher Full Text

8. Solomon DJ, Björk BC: **Publication fees in open access publishing: Sources of funding and factors influencing choice of journal.** *J Am Soc Inf Sci Technol.* 2012; **63**(1): 98–107.
Publisher Full Text

9. Larivière V, Sugimoto CR: **Do authors comply when funders enforce open access to research?** *Nature.* NLM (Medline); 2018; **562**(7728): 483–6.
PubMed Abstract | Publisher Full Text

10. Suber P: **Open Access Overview. Focusing on open access to peer-reviewed research articles and their preprints**. 2015. [cited 2017 Sep 29].
Reference Source

11. US National Institutes of Health: **How Papers Get Into PMC**. 2015. [cited 2020 Jan 24].
Reference Source

12. US National Institutes of Health: **PMC and Research Funder Policies**. 2019. [cited 2020 Jan 24].
Reference Source

13. E PMC: **Funders - About - Europe PMC.** [cited 2020 Jan 24].
Reference Source

14. Moher D, Srivastava A: **You are invited to submit...** *BMC Med.* 2015; **13**(1): 180.
PubMed Abstract | Publisher Full Text | Free Full Text

15. Clemons M, de Costa E Silva M, Joy AA, *et al.*: **Predatory Invitations from Journals: More Than Just a Nuisance?** *Oncologist.* 2017; **22**(2): 236–40.
PubMed Abstract | Publisher Full Text | Free Full Text

16. Nelson N, Huffman J: **Predatory Journals in Library Databases: How Much Should We Worry?** *Ser Libr.* 2015; **69**(2): 169–92.
Publisher Full Text

17. Somoza-Fernández M, Rodríguez-Gairín JM, Urbano C: **Presence of alleged predatory journals in bibliographic databases: Analysis of Beall's list.** *El Prof la Inf.* 2016; **25**(5): 730–737.
Publisher Full Text

18. Topper L: **RE: How predatory journals leak into PubMed.** *CMAJ.* 2018. [cited 2020 Jan 8].
Reference Source

19. Manca A, Moher D, Cugusi L, *et al.*: **How predatory journals leak into PubMed.** *CMAJ.* 2018; **190**(35): E1042–5.
PubMed Abstract | Publisher Full Text | Free Full Text

20. US National Library of Medicine: **Fact Sheet MEDLINE® Journal Selection.** U.S. National Library of Medicine. [cited 2019 Dec 5].
Reference Source

21. DOAJ: **Applications: a note about Archiving and Preservation.** *DOAJ Blog.* 2015.
Reference Source

22. Carpenter J: **Researchers of Tomorrow: The research behaviour of Generation Y doctoral students.** Hlava MMK, editor. *Information Services & Use.* 2012; **32**(1–2): 3–17.
Publisher Full Text

23. Dallmeier-Tiessen S, Darby R, Goerner B, *et al.*: **Highlights from the SOAP project survey. What Scientists Think about Open Access Publishing.** *Arxiv.* 2011. 1101.5260.
Reference Source

24. Charbonneau DH, McGlone J: **Faculty experiences with the National Institutes of Health (NIH) public access policy, compliance issues, and copyright practices.** *J Med Libr Assoc.* 2013; **101**(1): 21–5.
PubMed Abstract | Publisher Full Text | Free Full Text

25. Neylon C: **Science publishing: Open access must enable open use.** *Nature.* 2012; **492**(7429): 348–9.
PubMed Abstract | Publisher Full Text

26. Shamseer L, Moher D, Maduekwe O, *et al.*: **Potential predatory and legitimate biomedical journals: can you tell the difference? A cross-sectional comparison.** *BMC Med.* 2017; **15**(1): 28.
PubMed Abstract | Publisher Full Text | Free Full Text

27. **Court Rules in FTC's Favor Against Predatory Academic Publisher OMICS Group; Imposes $50.1 Million Judgment against Defendants That Made False Claims and Hid Publishing Fees.** *Federal Trade Commission Press Releases.* 2019. [cited 2019 Jun 10].
Reference Source

28. Shen C, Björk BC: **'Predatory' open access: a longitudinal study of article volumes and market characteristics.** *BMC Med.* 2015; **13**(1): 230.
PubMed Abstract | Publisher Full Text | Free Full Text

29. Björk BC, Solomon D: **The publishing delay in scholarly peer-reviewed journals.** *J Inf.* 2013; **7**(4): 914–23.
Publisher Full Text

30. van Noorden R: **Gates Foundation research can't be published in top journals.** *Nature.* 2017; **541**(7637): 270–270.
PubMed Abstract | Publisher Full Text

31. van Noorden R: ***Science* journals permit open-access publishing for Gates Foundation scholars.** *Nature.* 2017.
Publisher Full Text

32. van Noorden R: ***Science* journals end open-access trial with Gates Foundation.** *Nature.* 2018; **559**(7714): 311–2.
PubMed Abstract | Publisher Full Text

33. Nasser M, Clarke M, Chalmers I, *et al.*: **What are funders doing to minimise waste in research?** *Lancet.* 2017; **389**(10073): 1006–7.
PubMed Abstract | Publisher Full Text

34. deVito NJ, French L, Goldacre B: **Noncommercial Funders' Policies on Trial Registration, Access to Summary Results, and Individual Patient Data Availability.** *JAMA.* 2018; **319**(16): 1721–1723.
PubMed Abstract | Publisher Full Text | Free Full Text

35. Viergever RF, Hendriks TCC: **The 10 largest public and philanthropic funders of health research in the world: what they fund and how they distribute their funds.** *Health Res Policy Syst.* 2016; **14**: 12.
PubMed Abstract | Publisher Full Text | Free Full Text

36. Whitlock EP, Dunham KM, DiGioia K, *et al.*: **Noncommercial US Funders' Policies on Trial Registration, Access to Summary Results, and Individual Patient Data Availability.** *JAMA Netw Open.* 2019; **2**(1): e187498.
PubMed Abstract | Publisher Full Text | Free Full Text

37. Xia J, Harmon JL, Connolly KG, *et al.*: **Who publishes in "predatory" journals?** *J Assoc Inf Sci Technol.* 2015; **66**(7): 1406–17.
Publisher Full Text

38. Goldacre B: **The WHO joint statement from funders on trials transparency.** *BMJ.* 2017; **357**: j2816.
PubMed Abstract | Publisher Full Text

39. Jackson JL, Kuriyama A, Anton A, *et al.*: **The Accuracy of Google Translate for Abstracting Data From Non-English-Language Trials for Systematic Reviews.** *Ann Intern Med.* 2019; **171**(9): 677–679.
PubMed Abstract | Publisher Full Text

40. Tenopir C, Dalton E, Fish A, *et al.*: **What Motivates Authors of Scholarly Articles? The Importance of Journal Attributes and Potential Audience on Publication Choice.** *Publications.* 2016; **4**(3): 22.
Publisher Full Text

41. National Institutes of Health: **Plan for Increasing Access to Scientific Publications and Digital Scientific Data from NIH Funded Scientific Research**. 2015.
Reference Source

42. Dwan K, Gamble C, Williamson PR, *et al.*: **Reporting of clinical trials: a review of research funders' guidelines.** *Trials.* 2008; **9**(1): 66.
PubMed Abstract | Publisher Full Text | Free Full Text

43. Adjei KOK, Owusu-Ansah CM: **Publishing preferences among academic researchers: Implications for academic quality and innovation**. 2016.
Reference Source

44. Wakeling S, Spezi V, Fry J, *et al.*: **Academic communities: The role of journals and open-access mega-journals in scholarly communication.** *J Doc.* 2019; **75**(1): 120–39.
Publisher Full Text

45. Topper L, Boehr D: **Publishing trends of journals with manuscripts in pubmed central: Changes from 2008-2009 to 2015-2016.** *J Med Libr Assoc.* 2018; **106**(4): 445–54.
PubMed Abstract | Publisher Full Text | Free Full Text

46. **Wellcome updates open access policy to align with cOAlition S | Wellcome.** [cited 2019 Oct 27].
Reference Source

47. Peterson AT, Johnson PE, Barve N, *et al.*: **The NIH public access policy did not harm biomedical journals.** *PLoS Biol.* 2019; **17**(10): e3000352.
PubMed Abstract | Publisher Full Text | Free Full Text

48. National Institutes of Health (NIH): **NOT-OD-18-011: Statement on Article**

Publication Resulting from NIH Funded Research. [cited 2018 Jan 15].
Reference Source

49. Lalu MM, Shamseer L, Cobey KD, *et al.*: **How stakeholders can respond to the rise of predatory journals.** *Nat Hum Behav.* 2017; **1**(12): 852–5.
PubMed Abstract | Publisher Full Text

50. Morris S: **The true costs of scholarly journal publishing.** *Learn Publ.* 2005; **18**(2): 115–26.
Publisher Full Text

51. Berger M, Cisarella J: **Beyond Beall's List: Better understanding predatory publishers.** *Coll Res Libr News.* 2015; **76**(3): 132–5.
Publisher Full Text

52. Tao T: **India's Fight Against Predatory Journals: An Interview with Professor Bhushan Patwardhan.** *The Scholarly Kitchen.* 2020. [cited 2020 May 1].
Reference Source

53. Patwardhan BK, Nagarkar S, Gadre SR, *et al.*: **A critical analysis of the 'UGC-approved list of journals'.** *Curr Sci.* 2018; **114**(6): 1299–303.

54. Patwardhan B: **Why India is striking back against predatory journals.** *Nature.* 2019; **571**(7763): 7.
PubMed Abstract | Publisher Full Text

55. Graham ID, Logan J, Harrison MB, *et al.*: **Lost in knowledge translation: time for a map?** *J Contin Educ Health Prof.* 2006; **26**(1): 13–24.
PubMed Abstract | Publisher Full Text

56. Michie S, Richardson M, Johnston M, *et al.*: **The Behavior Change Technique Taxonomy (v1) of 93 Hierarchically Clustered Techniques: Building an International Consensus for the Reporting of Behavior Change Interventions.** *Ann Behav Med.* 2013; **46**(1): 81–95.
PubMed Abstract | Publisher Full Text

57. Anderson K: **Lessons from the Demise of PubMed Central Canada.** Caldera Publishing Solutions. 2018.
Reference Source

58. Seethapathy GS, Santhosh JU, Hareesha AS: **India's scientific publication in predatory journals: need for regulating quality of Indian science and education.** *Curr Sci.* 2016; **111**(11): 1759–1764.

59. Kolata G: **Many Academics Are Eager to Publish in Worthless Journals.** The New York Times. 2017.
Reference Source

60. Bagues M, Sylos-Labini M, Zinovyeva N: **A walk on the wild side: 'Predatory' journals and information asymmetries in scientific evaluations.** *Res Policy.* 2019; **48**(2): 462–77.
Publisher Full Text

61. Cappell MS: **List predatory journal publications separately from genuine scholarly publications as standard for CVs.** *BMJ.* 2015; **350**: h2470.
PubMed Abstract | Publisher Full Text

62. Pond BB, Brown SD, Stewart DW, *et al.*: **Faculty applicants' attempt to inflate CVs using predatory journals.** *Am J Pharm Educ.* American Association of Colleges of Pharmacy; 2019; **83**(1): 7210.
PubMed Abstract | Publisher Full Text | Free Full Text

63. Shamseer L, Brehaut J, Stewart L, *et al.*: **Extracted Data**. 2020.
http://www.doi.org/10.17605/OSF.IO/YUDP4

64. Shamseer L, Cobey K, Page MJ, *et al.*: **Study Forms**. 2021.
http://www.doi.org/10.17605/OSF.IO/FSUQ2

65. Shamseer L, Cobey K, Page MJ, *et al.*: **Study Protocol**. 2021.
http://www.doi.org/10.17605/OSF.IO/J6CSK

66. Shamseer L, Cobey K, Page MJ, *et al.*: **Audit of health research funder policies and recommendations on journal publication of research**. 2021.
http://www.doi.org/10.17605/OSF.IO/Z59U6

Open Peer Review

Current Peer Review Status: ✔ ✔

Version 2

Reviewer Report 19 April 2021

https://doi.org/10.5256/f1000research.55848.r83430

✔ **Nicholas Devito**
The DataLab, Nuffield Department of Primary Care Health Sciences, University of Oxford, Oxford, UK

Many thanks to the authors for their consideration of my review and their revisions. While many of my comments were addressed, I do have some additional feedback based on the responses from the authors that I believe should be further considered. That said, these are all relatively minor enough that I recommend the manuscript move forward for indexing as the analysis and related discussion is overall fundamentally sound.

-As indicated, Dr. Holmes is the CEO of a health research funding organization (not included in our sample). Her expertise of the funding landscape and whether a listing of health research funders existed or whether the chosen list was the best source of this information, was an invaluable methodological contribution to our research. We prefer not to remove this acknowledgment.

I still believe this reads awkwardly in the text and is not how personal communication citations are typically used. If it is just an acknowledgement it is ultimately redundant to your thanks of Dr. Holmes in the “Acknowledgements” section at the end of the piece. However this is a minor point.

-Extraction criteria were devised de novo based on expertise within the author team. There is no reference standard for funder policies about publishing and as such we did not use any framework for extraction. We have added a clarification of this point in the methods section rather than in the discussion section.

The addition to the methods is appropriate although I do believe there is an argument to be made that using criteria developed in-house based on expertise, while an acceptable method, could be seen as a limitation as it is lacking further validation and consideration beyond the study team.

-We did not apply an analytical framework to the extracted text and doing so would be a post-hoc analysis. The table/text is provided for reference/transparency of extracted data

summarized in Tables 2-4. We do not feel that a summary is necessary.

I do not agree that a full analytic framework is required to condense multiple tables of raw verbatim text within the body of a manuscript into something more easily digestible to readers. I still strongly recommend that the authors reconsider the utility that 7 pages of Tables in the middle of the manuscript (including 4 pages just for Table 5) has for readers when Tables 2-4 summarize the extractions from this raw data as necessary for the endpoints considered and interested parties could examine the very well-curated, transparent, and clearly sign-posted raw data for themselves as necessary.

-To be clear, we did not make a post-hoc justification regarding the lack of outreach to funders. We specifically did not have the a priori intent of verifying our data with funders. We anticipated that the results of our previous work, https://www.nature.com/news/stop-this-waste-of-people-animals-and-money-1.22554, which identified a large number of funders supporting research in predatory journals, may impact/prompt changes in funder policies once published (Sept 2017). Due to the timing of the current study, (Aug – Sept 2017), we decided not to engage funders since we did not want to influence any potential changes to their policies as a result of the study process. We did not find this to be a limitation. As expected, and as noted in our discussion, we are aware of at least one funder (NIH) who, in Nov 2017, clarified their policies about publication as a result of the previous study. The specific impacts (i.e., number and type of clarifications) of engaging funders to clarify extracted data in Goldacre et al's previous work are unclear, however, we have added text to the limitations section outlining the additional potential benefit of engaging funders in the study process.

While it is true that outreach to sponsors was not specified in the protocol, it is also true that the justification for not doing so was also not provided in the protocol despite the fact that it was used in the study cited as informing your data collection/extraction methods. Therefore, while the decision not to conduct outreach was not post hoc there is no way to know if the provided justification was or not. In my original reading the provided information was not well-supported by even your own findings. Expanding on the context provided above in your revision is helpful however there is another aspect at play here. You relied on a single author for searches and only involved a second party for extractions. There is no acknowledgement of the potential that documents could have been missed by a single searcher. Outreach to the parties under investigation would allow them to confirm whether or not you have missed potentially relevant documentation on the topics of interest. It is a validation step for your methods rather than simply a way to potentially increase "uptake of our findings/ recommendations into practice."

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Metascience, health policy, publication ethics.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Version 1

Reviewer Report 08 March 2021

https://doi.org/10.5256/f1000research.30678.r79363

?

Nicholas Devito
The DataLab, Nuffield Department of Primary Care Health Sciences, University of Oxford, Oxford, UK

Many thanks for the opportunity to review this piece on health research funders' policies on journal selection for research outputs.

Overall, this piece investigates an interesting topic, has appropriate methods, appears well-executed, and follows open science best principles of pre-registration and open sharing of data for which it should be commended. I ultimately believe it should be recommended for indexing but a minor revision is in order. Specific points are provided below.

Can the authors please revisit the piece for a bit of editing? The informational content all appears very relevant and well-researched but the prose can carry on at times and structurally it jumps back and forth between topics and it is difficult to connect the threads. This is most applicable to the introduction (and perhaps the Discussion as well) but I think taking a critical eye towards developing a more direct, succinct, and straight-forward writing style throughout would enhance readability. A sharper consolidation and organisation of your ideas and arguments, while trying to be more concise overall, will aid readers considerably. A brief example: "Funders ought to be concerned that funded research may be published in journals that do not ensure discoverability of content ensuring it is available to contribute to future science" could surely be consolidated to something like "Funders should ensure published research is discoverable to the scientific community."

One area that doesn't really come through clearly in the Intro is what funders get out of publication of their funded work and how this influences this dynamic. Why are they moving towards Open Access? What about other dissemination routes?

The personal communication citation of Dr. Beverly Holmes feels a bit out of place. Is she merely stating an opinion? If so, why can the authors not just state this opinion directly themselves since I assume they share it? I'm sure Dr. Holmes is perfectly knowledgeable and her opinion is valuable, but is citing her necessary here? I'm most familiar with citations of personal communication to convey official information not published elsewhere, from a direct source, rather than simply used to state an opinion the authors agree with. The average reader won't have any insight as to why they should trust the word of Dr. Holmes on this issue.

The link to the protocol is upfront and clear and points readers to exactly where they can easily access more detailed information about the search/data extraction methods. Very well done by the authors.

How were the extraction criteria derived? Did the authors base them on anything or did they come up with them de novo? This should be stated and potentially explored in the Discussion.

One major area I was surprised that the authors did not include in their assessments is whether the funder offers to pay the open access/APCs of work they fund. This would be an important part of the dynamic of how, where, and why certain journals may be chosen and why funders should care even more about where the research they fund ends up.

In Figure 1, it is unclear when INSERM is mentioned as to whether that is the funder being removed or the reason another funder is being removed (later context shows it's the latter, but this is unclear). Also there is a type ("allocated") in the "Excluded Funders n=6" box. I think ideally you would list which exact funders are entering or exiting the sample in this figure for clarity as you don't get a good sense of what funders are actually being assessed until the results. It's also not necessary to restate in prose everything Figure 1 already conveys (something to be cognisant of throughout).

Table 5 is a bit overwhelming. Perhaps consider summarising each policy in Table 5 and make the full text extractions available as an appendix for interested readers.

I don't find the reason given for a lack of outreach to sponsors particularly compelling. The author's state they did not verify with sponsors (despite this being a feature of the work from Goldacre *et al*. they cite as a template for this research) because "data collection took place at a time when the publishing activities…was rapidly changing." That seems like a post hoc justification rather than an actual reason why it didn't actually occur. It also isn't supported by their own data as the median date of effect of policies reported was September 2014, 3 years prior to data collection and the higher IQR range is April 2016, over a year before the searches. Similarly, this article is cross-sectional, so I don't see that reason as relevant anyway. You could simply have discarded policies from before a cutoff date, etc. Can the authors please revisit their discussion of this limitation?

Table 8 may fit better in an appendix.

Is the work clearly and accurately presented and does it cite the current literature?
Partly

Is the study design appropriate and is the work technically sound?
Yes

Are sufficient details of methods and analysis provided to allow replication by others?
Yes

If applicable, is the statistical analysis and its interpretation appropriate?
Yes

Are all the source data underlying the results available to ensure full reproducibility?
Yes

Are the conclusions drawn adequately supported by the results?
Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Metascience, health policy, publication ethics.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Author Response 01 Apr 2021

Larissa Shamseer, University of Ottawa, Ottawa, Canada

Thank you for reviewing this work. Please see responses to your comments below.

- We have made some changes in the introduction and discussion sections to make the wording more concise.
- We have clarified that scholarly publishing is intended to facilitate the discoverability and uptake of funded research (into practice) and that predatory journals limit this by having unreliable discovery and questionable trustworthiness. We did not set out to investigate funders' open access (OA) policies or shifts towards OA since discoverability and other journal features compromised by predatory journals can be achieved independent of openness. We note that several sources (ROARMAP, SHERPA JULIET) list details of funders' open access policies. This research is instead concerned with hallmarks of journal validity which have been (mis)taken as signals of research quality.
- Regarding other dissemination routes, we have clarified that this research focuses on journal publications rather than other publications routes (end of introduction section).
- As indicated, Dr. Holmes is the CEO of a health research funding organization (not included in our sample). Her expertise of the funding landscape and whether a listing of health research funders existed or whether the chosen list was the best source of this information, was an invaluable methodological contribution to our research. We prefer not to remove this acknowledgment.
- Extraction criteria were devised de novo based on expertise within the author team. There is no reference standard for funder policies about publishing and as such we did not use any framework for extraction. We have added a clarification of this point in the methods section rather than in the discussion section.
- We have added text to the introduction (2nd para) outlining the waste of research funds & APCs due to predatory journals. While we did not extract specific data on funders' APC provisions, where funders provided information about journal APC support, this can be found in Table 5.
- We have updated the suggested information in the flow diagram and left the related descriptive text in results for additional reference.
- We did not apply an analytical framework to the extracted text and doing so would be a post-hoc analysis. The table/text is provided for reference/transparency of extracted data summarized in Tables 2-4. We do not feel that a summary is necessary.

- To be clear, we did not make a post-hoc justification regarding the lack of outreach to funders. We specifically did not have the *a priori* intent of verifying our data with funders. We anticipated that the results of our previous work, https://www.nature.com/news/stop-this-waste-of-people-animals-and-money-1.22554, which identified a large number of funders supporting research in predatory journals, may impact/prompt changes in funder policies once published (Sept 2017). Due to the timing of the current study, (Aug – Sept 2017), we decided not to engage funders since we did not want to influence any potential changes to their policies as a result of the study process. We did not find this to be a limitation. As expected, and as noted in our discussion, we are aware of at least one funder (NIH) who, in Nov 2017, clarified their policies about publication as a result of the previous study. The specific impacts (i.e., number and type of clarifications) of engaging funders to clarify extracted data in *Goldacre et al's* previous work are unclear, however, we have added text to the limitations section outlining the additional potential benefit of engaging funders in the study process.
- F1000 does not allow appendices and we have opted not to move this table to the Open Science Framework repository for this project as supplementary materials. We feel that the recommendations in this table are part of our discussion and are likely to receive little uptake if readers have to navigate away from the full text.

Competing Interests: No competing interests were disclosed.

Reviewer Report 01 March 2021

https://doi.org/10.5256/f1000research.30678.r79367

Shubhada Nagarkar
[1] Department of Library and Information Science, Savitribai Phule Pune University, Pune, India
[2] Centre for Publication Ethics, Savitribai Phule Pune University, Pune, Maharashtra, India

The purpose of this work is clear and the work is explicitly and precisely presented. Researchers would like to describe the policies of major health research funding agencies. The job is sound technically.

Authors selected policies from 44 funding agencies and assessed systematically to find information and recommendations on the dissemination of research output, recommendations on criteria for the selection of journals (quality, impact factor and other metrics).

Methodology for data collection and analysis is discussed very well and the protocol followed is described in detail.

Statistical data can be interpreted easily. Source data can be reproducible.

The results obtained through this exercise are well discussed and will be of interest to all funding agencies, especially those from developing countries. The findings of the study show that there is no specific guidance about how to select a journal for publication. The mention and cautionary notes on predatory publishers and their open-access nature should be made clear by these funding agencies. Authors warned policymakers about this. If the policy of these funding agencies advises researchers to current trends in publishing, researchers may not fall into pray with predatory publishers.

Overall, this work is recommended for indexing. Similar studies can be considered for the assessment of policies of funding agencies other than health research funders.

Is the work clearly and accurately presented and does it cite the current literature?
Yes

Is the study design appropriate and is the work technically sound?
Yes

Are sufficient details of methods and analysis provided to allow replication by others?
Yes

If applicable, is the statistical analysis and its interpretation appropriate?
Yes

Are all the source data underlying the results available to ensure full reproducibility?
Yes

Are the conclusions drawn adequately supported by the results?
Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Bibliometrics, publication ethics, institutional repositories.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Author Response 01 Apr 2021

Larissa Shamseer, University of Ottawa, Ottawa, Canada

Thank you for your thoughtful comments.

Competing Interests: No competing interests were disclosed.