The Journal of Academic Librarianship 44 (2018) 781–792

Contents lists available at ScienceDirect

The Journal of Academic Librarianship

journal homepage: www.elsevier.com/locate/jacalib

What Value Do Journal Whitelists and Blacklists Have in Academia?

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ARTICLE INFO

Keywords:
Banning
Blacklists
Discrimination
False positives and negatives
False discovery rate
Open access
Predatory publishing
Probability
Quality assessment
Uncertainty
Whitelists

ABSTRACT

This paper aims to address the issue of predatory publishing, sensu *lato*. To achieve this, we offer our perspectives, starting initially with some background surrounding the birth of the concept, even though the phenomenon may have already existed long before the popularization of the term "predatory publishing". The issue of predation or "predatory" behavior in academic publishing is no longer limited to open access (OA). Many of the mainstream publishers that were exclusively subscription-based are now evolving towards a state of complete OA. Academics seeking reliable sources of journals to publish their work tend to rely on a journal's metrics such as citations and indexing, and on whether it is blacklisted or whitelisted. Jeffrey Beall raised awareness of the risks of "predatory" OA publishing, and his blacklists of "predatory" OA journals and publishers began to be used for official purposes to distinguish valid from perceived invalid publishing venues. We initially reflect on why we believe the blacklists created by Beall were flawed, primarily due to the weak set of criteria confusing non-predatory with true predatory journals leading to false positives and missing out on blacklisting true predatory journals due to false negatives. Historically, most critiques of "predatory publishing" have relied excessively on Beall's blacklists to base their assumptions and conclusions but there is a need to look beyond these. There are currently a number of blacklists and whitelists circulating in academia, but they all have imperfections, such as the resurrected Beall blacklists, Crawford's OA gray list based on Beall's lists, Cabell's new blacklist with about 11,000 journals, the DOAJ with about 11,700 OA journals, and UGC, with over 32,600 journals prior to its recent (May 2018) purge of 4305 journals. The reader is led into a discussion about blacklists' lack of reliability, using the scientific framework of conducting research to assess whether a journal could be predatory at the pre- and post-study levels. We close our discussion by offering arguments why we believe blacklists are academically invalid.

The birth of "predatory"[1] publishing: how Beall's blacklists divided academia

For several years, Jeffrey Beall – a now-retired librarian at the University of Colorado Denver, Auraria Library – established a blog that documented cases of what he perceived to be "predatory" OA journals or publishers. Beall focused on these publishing entities because the OA publishing market was booming and because many new entities were relying on direct email campaigns, including spamming, to reach new potential author bases. Concerned that such entities represented an academic threat (Beall, 2017), and using a set of broad criteria, both academic and non-academic, Beall established two blacklists, one for OA journals and another for OA publishers. His blacklists grew rapidly in popularity, expanding annually, with his awareness campaign culminating in a call to ban such entities (Beall, 2016).

While gathering support from a sector of academia who related to his grievances, Beall also distanced many others, including authors who published in such venues. Beall's efforts occasionally spurred legal threats and led to the eventual demise of those blacklists and the sudden unilateral termination of his blog on 15 January 2017 (Beall, 2017). Beall retired from the University of Colorado Denver in March 2018. The foundation left by Beall has served an important learning curve for academics, publishers and policy-makers alike.

Beall's influence was profound and international. For example, Moher et al. advised academics to delist "predatory" papers such as those published in Beall-blacklisted OA journals or publishers from

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[1] We caution the reader that throughout this manuscript the term "predatory" is used *senso lato*, in the broadest possible sense to represent a rage from truly predatory (i.e., engaging in deceptive practices) to mistakenly giving the perception of being predatory. In the case where no "" are used around the term predatory, it means definitively predatory, i.e., deceptive practices.

https://doi.org/10.1016/j.acalib.2018.09.017
Received 10 July 2018; Received in revised form 15 August 2018; Accepted 29 September 2018
Available online 22 October 2018

their *curriculum vitae* (CV) and declare that their CV be free of "predatory publications" (Moher et al., 2017) while Cappell (2015) argued that such publications should be represented separately in a CV, referring to academics who had such papers as "pseudo-academics", two policy positions that we have argued are both unscholarly and potentially discriminatory (Teixeira da Silva & Tsigaris, 2018). Pyne (2017) used Beall's blacklists to target his work colleagues with false accusations of financial rewards for publishing in Beall-blacklisted OA journals or publishers, managing to convince others, including numerous scholars who cited the paper, and naïve media outlets, using spin, to misrepresent and distort his inconclusive and unsupported evidence.[2]

While we recognize that Beall's blog served to raise awareness and stimulate and expand the discussion about unscholarly OA journals and publishers, it is not in debate that his blacklists caused damage to an untold many. Therefore, one of our arguments in this paper is that academia needs to move away from Beall's blacklists and from blacklists in general due to significant weaknesses associated with such lists. While we are encouraging a movement away from such lists, for various reasons to be discussed later, due to the weak criteria that are used to detect and separate truly predatory from non-predatory journals, others, including official academic institutes, continue to use them as if they are valid, such as the Karolinska Institutet in Sweden.[3]

Is predatory publishing a myth or a tangible threat?

Predatory publishing is not only highly topical, it constitutes a real threat to academics. However, how that threat is defined and described, perceived, and dealt with varies widely, depending on the entity defining it. While Beall's criteria in general contained valid aspects worthy of criticism if they could be proved and quantified, such as via the "Predatory Score" (Teixeira da Silva, 2013), the failure to indicate clearly which aspects each blacklisted OA journal and publisher failed to comply with in order to merit its inclusion in Beall's blacklists was their biggest fault. Other errors include the existence of false positives (i.e., including in the lists non-predatory OA journals and publishers, also known as type I errors) and false negatives (i.e., predatory journals that escape from being listed, also known as type II errors); exclusive management by a single individual leading to list mismanagement; failure to list the precise criteria for each blacklisted OA journal and publisher; opaque appeals processes and apparent forceful blacklisting despite apparently valid appeals; and other weaknesses as described in the last section (Teixeira da Silva, 2017a, 2017b, 2018a). Collectively, these deficiencies with Beall's blog and blacklists made them unscholarly, and even their ethical basis was challenged (Teixeira da Silva, 2018b). These errors eventually began to distract academics from the actual threat, predatory publishing, because Beall's blog was influenced by excessive personal opinion (i.e., subjectivity), and mired in scandal and controversy. A publisher blacklisted by Beall, SCIRP (Scientific Research Publishing), clearly displeased with being blacklisted, published a critical analysis of several of those flaws.[4] Many academics not only stopped believing in the accuracy of Beall's blacklists, they ignored them, especially when he referred to them as "potential, possible or probable", as this string of adjectives basically implied that any OA journal or publisher could be predatory.

There is a faction of academics who see "predatory" publishers as a waste of money and other resources (Moher et al., 2017), while others seek their criminalization (Umlauf & Mochizuki, 2018). Despite this, the constant reliance on Beall's blacklists as the point of departure for defining what a "predatory" entity is, is erroneous, also because predatory is not only limited to OA, or to journals or publishers on Beall's blacklists, as we argue next.

Predatory publishing needs to look beyond Beall, blacklists and open access

Olivarez, Bales, Sare, and vanDuinkerken (2018) noted the need to apply the criteria that Jeffrey Beall had employed to classify whether OA journals are predatory or not, to non-OA journals and publishers, i.e., a journal or publisher need not be OA in order to display predatory qualities. Amaral (2018) went to a polar extreme by considering all publishers to be predatory, a notion that is erroneous. Thus, restricting Beall's blacklists to OA is one of the core weaknesses. SciELO, Scientific Electronic Library Online, which was categorized by Beall as a "publishing favela", considers blacklists to be "morally perilous".[5] Cameron Neylon categorized blacklists, including those by Beall, as "technically infeasible, practically unreliable and unethical. Period."[6] Despite this, many academics, librarians and their institutes made the mistake of employing those imperfect blacklists for official purposes, leaving many dazed when Beall shut his blog down. Olivares et al. suggested, after applying Beall's opaque 2012 criteria to 81 library and information science journals, that predatory publishing practices were detected in numerous non-OA journals. This is a good start to identify serious issues with the use of blacklists, but it does not go far enough. Academics, publishers, OA and non-OA, policy makers and funders need to establish alternative globally accepted methods to assess research output without relying on blacklists. Andy Nobes of INASP/AuthorAid recently issued a notice to academics: "Some researchers may be told to use journal 'blacklists', but you should exercise caution. We do not recommend using the 'Beall's List' blacklist to identify 'predatory' journals as it is not considered a reliable, unbiased, or transparent source of information, and has not been updated by Beall since January 2017."[7]

What can be done about predatory publishing?

If the answer to this question were simple, a solution would have been found a long time ago. Part of the difficulty in dealing with "predatory" publishing lies in the lack of understanding of the limits that define what this phenomenon is exactly, and distinguishing it from exploitation and deception. It is precisely for this reason that the "Predatory Score" was created (Teixeira da Silva, 2013), to use tangible parameters that can be assessed independently, and then tabulated and calculated to give a score that informs the end user whether a journal or publisher displays predatory qualities, and to what extent. The "Journal Evaluation Tool" by Rele, Kennedy, and Blas (2017) has also evolved as a simple online tool that the authors claim can "determine the credibility of a journal", providing information to scholars on the quality of a research outlet.

Shamseer et al. (2017) offer a set of features in their table 10 that academics could consider when searching a journal or publisher as a possible publication venue. Their study attempted to compare journals in Beall's OA blacklist with OA journals in the PubMed Central list and subscription-based journals listed in the Abridged Index Medicus. The comparison lead to the identification of 13 "salient" characteristics of what might be a predatory journal to help academics reduce the risk of submitting their work to predatory journals. One of the weaknesses of

[2] For various types of spin in research in the biomedical field, see Boutron and Ravaud (2018).

[3] https://kib.ki.se/en/publish-analyse/strategic-publishing#header-1.

[4] http://blog.scirp.org:80/scirp/response/jeffrey-beall-i-am-an-academic-crime-fighter/.

[5] https://blog.scielo.org/en/2015/08/04/jeffrey-beall-and-blacklists/; https://web.archive.org/web/20161108155910/https://scholarlyoa.com/2015/07/30/is-scielo-a-publication-favela/.

[6] https://cameronneylon.net/blog/blacklists-are-technically-infeasible-practically-unreliable-and-unethical-period/.

[7] https://www.linkedin.com/in/andynobes/; https://www.authoraid.info/en/news/details/1310/ A beginner's guide to avoiding 'predatory' journals (using your critical thinking skills).

these identification tools is that many of these characteristics can be associated with any quality journal and not necessarily a predatory one. For example, why is an APC less than $150 USD a "salient" characteristic of a predatory journal (i.e., item 11 of table 10)? Why is submitting a manuscript by email a salient characteristic of a predatory journal (i.e., item 7 of table 10)? It is no wonder that Shamseer et al. used the term "potential" predatory journals leaving the reader with doubt if it is indeed a true predatory journal.[8]

An important issue that the Shamseer et al. (2017) paper did highlight, however, is the risk that databases such as Scopus, or popular biomedical databases such as PubMed, may become populated by papers published in predatory journals. It is for this reason that a shift away from blacklists and a shift towards a more detailed and accurate characterization of a journals defects as well as their positive aspects, and the balance of both, is needed. Manca, Cugusi, Dvir, and Deriu (2017), recognizing this risk to the potential degradation of the integrity of the biomedical literature, via "infected" databases, also draw the attention of readers to this risk. The problem we like to bring to the attention of the reader is that attempting to identify "infection" of predators in whitelists is something that is important but using Beall's blacklist to "clean" whitelists is not a reliable way to achieve this, as it is based on opaque criteria. The risk that such researchers have taken is of classifying a journal as "predatory" when in fact it might not be "predatory", an issue which we expand upon in greater detail later on in this paper.

We argue that a solution to predatory publishing will depend on its definition. We offer some theoretical examples since the solution to deal with each of them will be distinct. A predatory publisher that claims to undergo peer review, but does not, needs to be shunned for claiming academic quality when in fact such quality or scrutiny is not provided. Similarly, a journal that includes individuals on its editor board that have not agreed to serve in this position, displays equally predatory behavior. One simple solution would be to delist such publishers from established indexing agencies, or to bar them from being listed until they meet minimum quality criteria. The difficulty is finding concrete evidence that indeed no peer review has taken place which can be difficult to prove since peer reports are often confidential, except for open peer review. A predatory publisher that uses excessive spamming in an attempt to harvest authors for its journals should have its IP address or server blocked or penalized if it fails to curb such a campaign after a request to stop sending emails from the academic or server. A "predatory" publisher (more in the sense of exploitative, rather than deceptive) that charges excessive article processing fees (APCs) or that charges APCs when none are stated on its website could be subjected to fines using anti-competitive laws such as the antitrust[9] law in the USA[10] or EU's competition law.[11] The solution, as well as the resulting fines for infractions of established norms, must be positively associated with the level of unscholarly, unethical and fraudulent behavior. In all cases, unless the level of infraction can be quantified, academics will continue to see paper after paper or editorial after editorial warning of unspecified threats but that tend to nostalgically refer to Beall's blacklists, or some resurrected lists that are based on those flawed lists. A new direction is needed and ignoring the threat by avoiding the use of the term predatory (Eriksson & Helgesson, 2018) is not useful, nor does it provide any concrete solutions because it simply changes the terminology in a bid to soften the negative stigma, but does not provide a solution.

All current options are deficient because they do not look at the issues holistically, and are skewed because they tend to focus on one issue more than others, depending on the focus group trying to deal with the issue. We exemplify with a few cases next. India's University Grants Commission (UGC) automatically considers journals listed by Clarivate Analytics' Web of Science or Elsevier/RELX Group's Scopus, among other criteria, as acceptable,[12] but does not consider that perhaps predatory journals (OA and non-OA) might exist in the latter two databases or among Elsevier's OA journals, as was suggested by Frandsen (2017). However, with evidence, the UGC claims that it will consider relisting entries from its whitelist that it may have delisted in error or because of incomplete information on the journal website following the removal of 4305 journals on 2 May 2018 from the original total of 32,659 in the first quarter of 2018, supposedly leaving it with 28,354 journals on its whitelist. The UGC has clarified that the delisted journals might not be of poor quality but that they did not provide basic information on their website.[13] The primary criterion for inclusion in the whitelist is a "dedicated" website for the journals with basic information. As of July 29, 2018, the UGC website states that it has "around 32,000",[14] weakening reliance on the UGC whitelist due to its lack of specificity. In recent days, the UGC and its ever-changing whitelist have come under increased scrutiny and critique in Indian media.[15] This is not surprising, given the superficiality of the eight criteria[16] with a simple binary "Yes"/"No" scoring system that the UGC uses to include or exclude journals in its whitelist. In extreme cases, journals such as the *Journal of Threatened Taxa* continue to force their authorship to exclude papers in the reference list of their papers that were published in journals or publishers blacklisted by Beall,[17] suppressing the ability of academics to independently assess the published literature and determine what is valid from what is not, even though these lists have now been defunct for a year and a half.

Can predatory publishing be quantified?

One way to quantify predatory publishing is to use the peer reviewed Predatory Score. However this now is outdated and has several weaknesses.[18] Patwardhan et al. (2018) also published a scoring system that can quantify predatory publishing. The criteria Patwardhan et al. used to label journals as questionable was a two-phase process in which journals had to first pass a set of basic information about the journal and a set of primary criteria (phase 1), and if they passed the first stage they were assessed with a set of secondary criteria and would need to score 6/10 (phase 2) to not be considered as questionable. Rather than

[8] Recognizing this weakness in the criteria to detect a true predatory journal Shamseer et al. state: "We recognize that these criteria are likely not sensitive enough to detect all potentially illegitimate, predatory journals. However, we feel they are a good starting point."

[9] We are of the opinion that such activity falls into the category of antitrust because when an author is finally billed an APC by a publisher that did not display such a payment, the author can still refuse to pay or, if payment is made in error or misjudgment, a complaint can be filed.

[10] https://www.ftc.gov/tips-advice/competition-guidance/guide-antitrust-laws.

[11] http://ec.europa.eu/competition/antitrust/overview_en.html.

[12] https://www.ugc.ac.in/journallist/ University Grants Commission. UGC Approved List of Journals.

[13] https://www.ugc.ac.in/journallist/An%20update%20on%20UGC%20-%20List%20of%20Journals.pdf ("The Standing Committee reiterates that removal/non-inclusion of a journal does not necessarily indicate that it is of poor quality, but it may also be due to non-availability of information such as details of editorial board, indexing information, year of its commencement, frequency and regularity of its publication schedule, etc.,").

[14] https://www.ugc.ac.in/journallist/methodology.pdf University Grants Commission. Scope, Coverage and Methodology Used for Preparing the UGC-approved List of Journals.

[15] https://indianexpress.com/article/india/sc-lakhotia-professor-emeritus-at-bhu-universities-ugc-responsible-for-relaxed-attitude-to-predatory-journals-5266866/.

[16] See page 2 of PDF file in footer #14.

[17] https://threatenedtaxa.org/index.php/JoTT/about/ JoTT policy against predatory journals.

[18] Cabell has devised a scoring system for deceptive practices but details are not available to the public to compare (Bisaccio, 2018).

outsourcing publishing-related decision-making, or relying on white, gray or blacklists that are established by individuals or groups with potential biases, conflicts of interest, and errors, there is value in establishing an updated version of the Predatory Score that would take into consideration, with suitable weighting, a host of new factors that have come to influence the quality of scholarly publishing in the past few years (Teixeira da Silva & Shaughnessy, 2017; Wicherts, 2017). This system should have clearly visible criteria and should be open to allow any member of the academic community or public to independently verify a journal or publisher's scholarly value or merit. However, we caution the reader that the Predatory Score should not be used to create blacklists as there are numerous caveats as explained throughout this paper and further discussed in the next section.[19]

Frustrated with the "threat" of predatory publishing whose goal-posts and characteristics are continuously shifting, as evidenced by Cabell's,[20] DOAJ and UGC whitelists, many in academia and the publishing industry made serious judgmental errors by relying exclusively on Beall, Beall's judgement and his blacklists to base their publishing decisions and choices, even 18 months after Beall closed his blog and the de facto "retraction" of his dysfunctional lists.

In the meantime, academics who may have published in a journal or publisher on any one of these whitelists or blacklists in constant flux may have discovered, much to their frustration, that the journal in which they published was either delisted, or considered as predatory at some time in the evolution of those lists, making authors the ultimate victims. Authors' rights are being frayed by the changing goal-posts of the publishing industry (Al-Khatib & Teixeira da Silva, 2017). In an extreme case, some are calling for the criminalization of predatory behavior as consumer fraud (Umlauf & Mochizuki, 2018), a prediction come true (Teixeira da Silva, 2016), but based on what and whose established criteria? To avoid frustration among academics, who may one day believe that their publishing venue (journal or publisher) was valid, only to find that it was delisted or invalidated, either because it was blacklisted, or judged to be predatory, a Predatory Score or any other measure that factors in quality and other positive factors is needed. Such a measure needs to be balanced by an assessment of unscholarly factors, and managed by a transparent panel of experts who can assess challenges, and adjust that measure accordingly. Current groups that carry policy weight in academic publishing, and that are related to the profit and non-profit publishing sectors, such as OASPA, COPE, WAME, the International Committee of Medical Journal Editors (ICMJE), and others, all have vested interests and thus strong biases as to what they might consider to be valid or invalid, scholarly or unscholarly, or predatory or not. For example, the ICMJE has a white-like list of members that self-enlist[21] without any quality control, and even the ICMJE does not, is unwilling to or is unable to, guarantee the veracity of those lists or the quality of the journals that claim to follow its guidelines, making the ICMJE lists unreliable as a source of scholarly conduct within medical publishing (Teixeira da Silva, 2017c), thereby invalidating them as a whitelist (i.e., as a reliable list of medical journals that follow acceptable publishing practices).

Lessons from the DOAJ experience

The Directory of Open Access Journals (DOAJ) released version 3 of its "best practices"[22] on 15 January 2018 in conjunction with the Committee on Publication Ethics (COPE), the Open Access Scholarly Publishers Association (OASPA) and the World Association of Medical Editors (WAME). These "best practices" form the basis of the "check" step of the "Think. Check. Submit." campaign,[23] which purportedly serves to guide authors into making wise decisions regarding publishing venue. The DOAJ prefers not to use the term predatory, suggesting that "questionable" be used instead,[24] as it encompasses OA and non-OA publishing, yet offers no criteria as to what might constitute a "questionable" OA journal or publisher. The DOAJ's whitelist has several weaknesses, reducing its reliability as a venue for the selection of OA publishing venues.

In 2014, the DOAJ removed journals based on Beall's lists and criteria as well as others that were stung by John Bohannon (Berger & Cirasella, 2015) in order to purge purported false positives (i.e., a false positive occurs when the DOAJ includes a predatory journal in its whitelist) from its whitelist, but by attempting to reduce the number of predatory publishing entities that it had whitelisted, it may have unfairly delisted some valid OA publishing venues simply because they had been blacklisted by Beall and stung by Bohannon.[25] Later in the paper we discuss serious issues with using blacklists to either "clean" whitelists or to conduct scientific research based on blacklists. Hence, the DOAJ also may have increased the number of false negatives (i.e., a false negative occurs when the DOAJ wrongly delists a non-predatory journal from its whitelist).[26] These two false cases and the two correct decisions the DOAJ may have made are explained in Table 1. What this illustrates is that an attempt to fix one problem (i.e., reduce false positives) can lead to another (i.e., increase false negatives) and hence solutions are not that easy and have side effects that also need to be considered.[27]

Another issue with solutions that the reader should be aware of is with classifying a journal as either white or black and nothing else as if a two-sided coin is on a two-dimensional flatland. Two-sided coins also have thickness, suggesting there are likely numerous shades of gray in between the coin's two sides, as was advocated by Walt Crawford.[28] Some journals might not even be on any list, either because they are not indexed, or are local, of low profile, or they are startups, so there are many exceptions to the "two sides of the coin" argument that limit the binary judgement of journals or publishers, as was also suggested by Hindawi's Head of Research Integrity, Matt Hodgkinson.[29]

Even within the DOAJ, journal quality also varies among journals,

[19] Also the name change from Predatory Score to something else is under consideration as "predatory" is not a correct term to use for deceptive and fraudulent practices.

[20] https://scholarlykitchen.sspnet.org/2017/07/25/cabells-new-predatory-journal-blacklist-review/.

[21] https://forbetterscience.com/2015/10/31/join-the-committee-ignore-publication-ethics/.

[22] https://doaj.org/bestpractice Principles of transparency and best practice in scholarly publishing.

[23] http://thinkchecksubmit.org/check/ Think. Check. Submit.

[24] https://doaj.org/faq#predatory.

[25] The ethically questionable aspects of the 2013 *Science* Bohannon sting also need to be considered (Teixeira da Silva & Al-Khatib, 2016).

[26] In accordance with the scientific method for research, including the creation of effective whitelists, the null hypothesis is that the journal is not white (i.e., predatory) and the alternative is that it is a non-predatory journal (i.e., it is a "white" journal). When using criteria for inclusion into the list, an assessor needs evidence that goes beyond a reasonable doubt that the journal is in fact non-predatory in order to be included, otherwise the list could be infested with predatory journals which may have been the case for the DOAJ. Hence their decision to remove Beall-listed journals, change their criteria and ask publishers and journals to re-apply for inclusion.

[27] Similar issues faced the UGC which issued a clarification that the delisted journals did not imply they are poor quality but missing some basic information on their websites.

[28] https://walt.lishost.org/2017/10/cites-insights-october-2017-available-gray-oa-2014-2017/; Crawford estimated around 18,900 OA journals in Beall's two lists. However, 10,000 of these were empty websites (nothing more than titles and template-generated websites as he put it) and excluded 12,070 journals which lead to a figure of around 6800 gray OA journals of which 2300 were questionable, most of which were based on Beall's evidence. This also shows how unreliable Beall's lists were since over 50% of the journals in Beall's two lists did not even exist as operational research outlets.

[29] https://about.hindawi.com/opinion/curbing-the-cargo-cults/; https://about.hindawi.com/team/matt-hodgkinson/.

Table 1
Summary of decision making of DOAJ to whitelist a journal.

Decision	True condition		
		H_o is true: Journal is predatory	H_o is false: Journal is not predatory
	Do not reject H_o: DOAJ decides journal is predatory	True negative/correct decision DOAJ rightly excludes from its whitelist predatory journals	False negative/type II error DOAJ excludes non-predatory journals from its whitelist
	Reject H_o: DOAJ decides journal is not predatory	False positive/type I error DOAJ includes predatory journal in its whitelist	True positive/correct decision DOAJ rightly lists non-predatory journal in its whitelist

Note: Even though the DOAJ prefers the word "questionable" to "predatory", we have maintained the word "predatory" to align with the mainstream literature on this topic.

some having a seal (11%) while most do not,[30] which signifies variation in quality within the DOAJ whitelist of OA publishing venues. A seal means outstanding best practices while no seal indicates best practices.[31] However, it is reasonable to assume that there is also variation within best practices from marginal to very good.[32] In summary, classifying a journal by placing it on only a two-sided flat coin is shortsighted and can lead to classification errors. Richard Poynder, an OA publishing analyst, classifies DOAJ whitelisted journals that are then delisted as the creation of a blacklist.[33]

Lessons from Cabell's white and blacklist

In 2014, Cabell also removed journals based on Beall's lists and criteria to reduce false positives from its whitelist, just like the DOAJ, and thus faces similar challenges as the DOAJ's experience such as increasing the rate of false negatives (i.e., at the expense of excluding journals that should be whitelisted).[34] However, Cabell went further and created a blacklist in June 2017 after Beall's blog of OA lists went blank. Cabell claims that it had 11,000 whitelisted journals that were added following an exclusive invitation, as well as over 6800 blacklisted journals (end of fall, 2017 statistics), but the discussion related to its blacklist provides few details (Bisaccio, 2018; Hoffecker, 2018). A recent piece in *The Economist* indicated that the blacklist ballooned to 8700 journals.[35]

Furthermore, unlike the DOAJ, which has publicly available information, Cabell's whitelist and blacklist are proprietary, i.e., access is only available via a paywall. Even though their criteria are available to the public, the link between specific criteria and individually listed journals (OA and non-OA) that are whitelisted cannot be independently verified, even after traversing the paywall, as these are not reported since inclusion in the whitelist is by invitation only (Bisaccio, 2018). What Bisaccio (2018) presented as "suitable" criteria for the inclusion of a journal on the Cabell whitelist were whether it had a Clarivate Analytics' journal impact factor (Journal Citations Reports), Cabell's classification Index© and median mentions per article from the Altmetric report, all of which are aspects with no intrinsic academic value.

Being refused by Cabell's staff for inclusion in the whitelist, or being removed from it, does not mean that a journal is exercising deceptive practices and is not placed on the other side of the coin, i.e., on the blacklist. These journals could be in a gray area.[36] It could be that the journal is run by a startup publisher or is of lower quality not able to meet the standards set by Cabell (p. 243; Bisaccio, 2018). How big is this gray space? If we consider the difference between the journals listed in UGC versus those in Cabell's whitelist, 21,600 journals (i.e., 66% of UGC's 32,659 journals) lie in Cabell's gray area. Cabell has an Excel sheet with numerous publishers under review, but it is curious that these are for blacklist evaluation with no reason provided as to why they are under review.[37]

Although whitelists have their set of problems, blacklists, including Cabell's, suffer from more serious issues as discussed throughout this paper and elaborated in the last section. One of the biggest weaknesses of Cabell's blacklist, and common to all blacklists, is their inability to separate low quality practices of journals and publishers from deceptive practices, which leads to numerous false positives in the list (see Table 2).[38] Cabell evaluates journals for inclusion in its blacklist based on Beall's OA lists, or because they have been excluded from the DOAJ and/or OASPA,[39] from community tips, and from other sources of information (Bisaccio, 2018). Also the ratio of OA relative to non-OA journals that are blacklisted is not known but if the evaluation is based

[30] https://doaj.org/faq#seal; https://doaj.org/faq#metadata (data accurate on July 29, 2018).

[31] https://blog.doaj.org/2015/11/03/indexed-in-doaj-versus-the-doaj-seal/.

[32] Why restrict it to only two classifications and not have a simple system that divides, based on the exact same criteria, a journal's scholarly conduct as outstanding (A), very good (B), good or satisfactory (C), and borderline (D), similar to student assessments? Even grades could be assigned for different percentiles, such as A (fulfills 90–100% of positive criteria), B (fulfills 80–89% of positive criteria), C (fulfills 70–79% of positive criteria), D (fulfills 60–69% of positive criteria), E (fulfills 50–59% of positive criteria), or F, for fail (fulfills less than 50% of positive criteria).

[33] https://twitter.com/RickyPo/status/908228615116132353.

[34] The UGC's recent delisting of 4305 journals was done to reduce the amount of false positives from its whitelist, but then UGC recognizing it may have increased the rate of false negatives as well with the delisting it decided to issue a clarification that delisted journals might not be of poor quality but instead lack a "dedicated" website.

[35] As of 6 July 2018, the number of blacklisted journals was 9039, increasing to 9051 by 29 July 2018.

[36] Quoting Bisaccio (2018; p. 246): "Of course, not all scholarly journals fall into either the 'good' or 'bad' category – many land somewhere in between. It should not be assumed that a journal absent from the Journal Whitelist is on the Journal Blacklist, and vice versa. As mentioned above, the Journal Blacklist is structured specifically to flag only those journals that have been identified as predatory operations meant to deceive and exploit, not low quality or new journals."

[37] Cabell has a link that states: "A list of journals under review for the blacklist is available here." The link allows an Excel sheet to be downloaded that has 955 publishers and 1128 journals listed (valid on 4 July 2018). There is also no explanation why these journals are under review. It would be interesting to see how much overlap this list has with Beall's lists of "predatory" OA journals and publishers.

[38] For a critique and review of Cabell's blacklist, also see: https://scholarlykitchen.sspnet.org/2017/07/25/cabells-new-predatory-journal-blacklist-review/

[39] It is curious that Cabell does not consider the position of COPE, WAME or the ICMJE.

mostly on Beall's blacklists, then Cabell's blacklist might also be biased against the OA movement. Other problems with Cabell's blacklist abound given that it is likely based heavily on Beall's lists. Some criteria for inclusion are opaque, and some violations are more serious than others but the public does not know the exact rubric that is used by Cabell to assess those journals.[40] For some violations, it is not possible to show proof beyond a reasonable doubt and hence cannot be independently validated. All these issues show some similarities to the weaknesses that enshrouded the Beall blacklists. Moreover, the requirement to pay for access to information that is important for the general public or for academia limits the wide and global use of Cabell's lists and is a concern, but understandable, since it is a private business that needs to pay for the resources it uses to deliver the services it provides. However, the quality of those services cannot be independently verified.

Given that whitelists and blacklists suffer from false positives and negatives, a scientific framework is needed to address how serious the problem really is. The framework should be capable of providing necessary and sufficient indicators for any list to be reliable. Can lists, especially blacklists, ever meet such conditions to be reliable? The next section models such a framework and attempts to shed light into the scientific issues associated with blacklists and the criteria used to list journals.

Modeling the false discovery rate for blacklists

Ioannidis (2005), a highly cited academic paper,[41] demonstrated why most research findings published in "legitimate" journals are more likely to be false than true. He showed that the likelihood a research finding is true depends on a number of variables such as the power to detect a false null hypothesis, the probability of a false positive, biases, number of studies on the same issue, but one of most important factors he considered is R, which he defined as "the ratio of true to no relationships among the relationships probed in each scientific field." This ratio is usually lower for studies where there are a few true relationships relative to thousands of hypotheses that may be postulated. It is then easy to show that $R/(R + 1)$ is the pre-study probability of a relationship being true, while $1/(R + 1)$ that it is false, even before the study is conducted. One practical example, which was introduced by Ioannidis, is exploratory discovery-oriented research that requires massive testing that would have an R ratio of 1:1000 and hence a pre-study probability that it is true equal to only 0.000999.[42] As a result, the post-study probability that the research finding is more likely to be true than false depends on this ratio as well as on the probability that the research finding is a false positive and the statistical power of the test to detect a false null hypothesis. In the following section, we apply the Ioannidis framework to blacklists[43] to show how unreliable, in general, they could be, even without biases.[44] First, we discuss the pre-study probability that a journal is predatory (i.e., assessing a new journal without any prior information) and secondly, its post-study probability (i.e., assessing a new journal with a set of criteria known also as screening tests).

The pre-study probability that a journal is predatory

In the same framework as Ioannidis, the most important factor, beyond prejudices, for significant errors to occur with blacklists is to consider that there are many levels of quality that can be postulated for a journal (for example, Beall changed Hindawi from being predatory to a borderline case for all of the publisher's journals[45]), but only one of these levels of quality is true (i.e., for example say that it is a low quality journal) which may also change over time.[46] Hence, the ratio of true quality of a journal to all possible levels of quality that may be postulated will result in a low pre-study probability of the quality being studied to be true than being false (e.g., the pre-study likelihood of claiming that a journal is predatory is in fact true is low even before an investigation is initiated).[47] For example, assume that a journal could be of any of the following two qualities: black or gray-black (borderline). In this case, the ratio of true quality to all other possible qualities is 1 and the pre-study probability that the journal quality being studied is true (i.e., that it is predatory) rather than false is 50%, which is like flipping a coin to decide inclusion and the maximum value the pre-study probability that can take, given that there is only one true quality, except if the assessor has predetermined the outcome because of biases and alternative motives. With three potential qualities, the ratio is 1/2 and the pre-study probability that quality being studied is true (predatory) is reduced to 33.3%. With four potential qualities, it is 25% and falls exponentially towards zero as the number of potential qualities increases. The pre-study probability that the null hypothesis (not predatory) is false and that the alternative (i.e., that it is predatory) is true is very low, only 25%, with four qualities postulated of which one is its true quality. As we add more layers of quality, the pre-study probability that a journal's quality being studied is true (predatory) and not false decreases further. It is thus more likely that rejection of the null hypothesis (H_o, i.e., accepting that a journal is predatory) is a false finding even before the study takes place if there are a large number of qualities that can be postulated for a journal before the study.[48]

The post-study probability that a journal is predatory

Let the null hypothesis be that a journal is not predatory versus the alternative that it is predatory.[49] The pre-study probability that the null is false and the alternative is true (predatory) is $\frac{R}{R+1}$, where R is the ratio of true quality of the journal to all other postulated qualities. On the other hand, the pre-study probability that the null (i.e., that a journal is not predatory) is true and the alternative (i.e., that a journal is predatory) is false is equal to $\frac{1}{R+1}$.[50] For example, if R is 0.25, then the pre-study probability that a journal is not predatory is 80%. The post-

[40] How much more weight is given to a serious violation such as false information on a website about indexation relative to spelling mistakes found on the journal site is not known. However, the scoring system and rubric used is briefly described in Bisaccio (2018), but cannot be independently assessed or verified.

[41] The PLOS page indicates (29 July 2018) that the paper has been cited 3446 times and viewed 2,562,981 times.

[42] Ioannidis applied this to the case of identifying genes from a huge pool of genes responsible for a disease: would testing 30,000 genes with only 30 of those genes reveal the true cause of the disease?

[43] The framework can be applied to whitelists, to blacklists and to academic research which uses Beall's blacklists as a resource.

[44] Adding biases would make matters worse. We leave this factor out of this framework but for future research.

[45] https://web.archive.org/web/20160412123120/https://scholarlyoa.com/?s=hindawi.

[46] One of the most controversial Beall listings was Swiss-based Frontiers Media SA, which triggered critical analysis by the science watchdog, Leonid Schneider: https://forbetterscience.com/?s=Frontiers.

[47] For example, Frontiers Media SA is whitelisted by DOAJ and is not blacklisted by Cabell indicating that even post study the quality of the journals of the publisher is unknown and can vary from high quality down to being predatory. This illustrates that the ratio of true quality to all other qualities that can be postulated, R, can be very low.

[48] The null hypothesis, for example, would be "not predatory" versus the alternative, which is predatory.

[49] In other words, the null is that a journal should be considered academic, scholarly and ethical, at base, unless proved otherwise. In accordance with scientific methods of research, including the creation of a blacklist, should be such that the null hypothesis is that the journal is not predatory versus the alternative that it is predatory. The evidence has to go beyond a reasonable doubt to claim the discovery of a predatory journal.

[50] The pre-study probability it is predatory and that it is not predatory should add up to 1.

Table 2
Summary of decision making to blacklist a journal.

		True condition	
		H_o is true: Journal is not predatory	H_o is false: Journal is predatory
Decision	Do not reject H_o: Assessor decides journal is not predatory	True negative/correct decision Assessor rightly excludes from blacklist non-predatory journals	False negative/type II error Assessor excludes predatory journals from blacklist
	Reject H_o: Assessor decides journal is predatory	False positive/type I error Assessor lists non-predatory journal in blacklist	True positive/correct decision Assessor rightly lists predatory journal in blacklist

study probability of a false positive is then α, the probability of making a decision which is a false positive (claiming that a journal is predatory when it is not), *multiplied* by the pre-study probability that it is not predatory. This is shown in the bottom row and second column of Table 3, as $\alpha\frac{1}{1+R}$. Scientists conducting research usually try and keep α low and mostly use 5%, although, due to the reproducibility crisis, many argue that a lower rate should be used, as low as 0.5% (Benjamin et al., 2018). Using $\alpha = 0.05$ and $R = 1/4$, then the post-study probability of a false positive is not 5% but lower, at 4%. On the other hand, the post-study probability that the assessor finds a true positive (i.e., a real predator) depends on the power of the criteria that are used to detect a true predator given as $1 - \beta$ where β is the probability of a false negative (deciding it is not predatory when it is) *multiplied* by the pre-study probability that it is predatory, namely $\frac{R}{R+1}$. This is shown in the bottom middle cell of Table 3. Adequate statistical power to detect a false null hypothesis is preferred to be around 80% (Ioannidis, Stanley, & Doucouliagos, 2017). For example, if $\beta = 0.2$ and $R = 1/4$, as above, then the post-study probability of a true positive is not 80% but only 16%. Why is that given that there is sufficient power to detect a false null hypothesis? It is because of the low pre-study probability of the journal being predatory, namely $\frac{R}{R+1}$ only 20%. The likelihood of a positive finding is then the sum of the likelihood of a false positive and true positive shown in the bottom right cell of Table 3. Hence, the post-study probability that the null hypothesis (i.e., that a journal is not predatory) is false and the alternative is true (i.e., that a journal is predatory), without biases, relative to a positive finding (i.e., which can be true or false) is known as the positive predictive value, *PPV* (Ioannidis, 2005). Hence, the PPV of finding a predatory journal is:

$$PPV = \frac{(1-\beta)R}{(1-\beta)R+\alpha} = \frac{1}{1+\frac{\alpha}{(1-\beta)R}}$$

The *PPV* is the fraction of the likelihood of true positives (i.e., rejecting the null given that the null is false) relative to the likelihood of a positive finding (i.e., both false and true positives). If this ratio is greater than 0.5 then it is more likely that the journal post-study is found to be predatory than not. For this to happen it must be that $(1-\beta)R > \alpha$ (i.e., the likelihood of a true positive should be greater than the likelihood of a false positive). Being greater than 0.5 is not a sufficient enough condition to yield a reliable list since the likelihood of a false positive could still be very high.

This post-study probability (after assessing a journal with established criteria) that a journal is in fact predatory, without biases, depends positively on this pre-study ratio. As this ratio becomes lower, so too does the post-study probability. Furthermore, the post-study probability is negatively related to the likelihood of making decisions and leads to false positives. The higher (or lower) the probability of including a non-predatory journal in a blacklist, for example due to weak criteria to detect predatory journals, the lower (or higher) the post-study probability that the journal is in fact predatory. Finally, the post-study probability is positively related to the power of the criteria that are used to detect a false null hypothesis. Better criteria to detect truly predatory journals lead to a higher *PPV* that the journal is in fact predatory. On the other hand, the false discovery rate (*FDR*) is the fraction of false positives relative to all true and false positives and given by: $FDR = 1 - PPV$.

If we keep $\alpha = 0.05$ and R at 1/4, then *PPV* is 80% while *FDR* is 20%, which is considered very high as 20% of the time journals will be declared predatory when they are not. If there are six other possible qualities in addition to predatory that can be postulated then R is 1/6 and the *PPV* is 72.7% and the *FDR*, assuming all else is held constant, is then 27.3%. A 27.3% *FDR* is senseless, and irresponsible or as Colquhoun (2014) states: "If you use p = 0.05 to suggest that you have made a discovery, you will be wrong at least 30% of the time. If, as is often the case, experiments are underpowered, you will be wrong most of the time." In other words, it is deceptive for an assessor to believe that they have discovered a finding, i.e., that a journal is predatory, when there is a 30% chance that they are wrong.

Even worse are creators of blacklists, such as Beall, who want to "catch" as many predatory entities as possible. To achieve their goal, they create criteria that are unclear, broad or unspecific, which results in a very high likelihood of a type I error. For example, Olivarez et al. (2018) asked three independent panelists to apply Beall's criteria and to assess 81 well-regarded library and information science journals. The panelists found that over 50% (i.e., 45 journals) would be classified as predatory. This suggests that the likelihood of false positives exceeds 50% when Beall's criteria are applied to a randomly selected journal. Hence, assuming an $\alpha = 0.5$ and $R = 1/4$, this would yield a *PPV* of 28.6% and an *FDR* of 71.4%. This would mean that the assessor would be wrong 71.4% of the time claiming that the journal is predatory. Assuming R is lower at 1/2 (so, predatory, borderline and satisfactory quality) and $\alpha = 0.5$, then *PPV* is 44.4% and *FDR* is 55.5%. In addition, if the criteria are underpowered to detect a false null hypothesis, then β is a high value and $1 - \beta$, the power of detecting predatory journals, would be low, thereby reducing *PPV* and increasing the *FDR*. For example, if $\beta = 0.8$, which is the norm in applied economic research according to Ioannidis et al. (2017),[51] then the power of the criteria to detect a false null hypothesis is only $1 - \beta$, so 0.2 or 20%, and if $R = 0.5$, then *FDR* increases from 55.5% to 83.3%. Creators of these lists would be embarrassing themselves by claiming that they had discovered a predatory journal when in fact all they may have discovered was a low quality or even a good quality journal. For readers to better appreciate other examples, we have set a range of examples in Tables 4 and 5 that offer specific *FDR*s of journal blacklisting.

Other consequences of blacklists with significant decision errors and high *FDR* are their usage for delisting journals from whitelists as the *FDR* is transferred from the blacklist to the whitelist. Also research on predatory publishing based on blacklists with high *FDR* will increase

[51] Ioannidis et al. (2017) studied 64,076 estimates of economic parameters in over 6700 empirical studies found the median statistical power at 18%, or less.

Table 3
An assessor's likelihood of quality findings and the true quality could be of varying degrees.

		True condition		
		H_o is true: Journal is not predatory	H_o is false: Journal is predatory	Total
Decision	Do not reject H_o: Assessor decides journal is not predatory	True negative $(1-\alpha)\frac{1}{1+R}$	False negative $\beta\frac{R}{1+R}$	$(1-\alpha+\beta R)\frac{1}{1+R}$
	Reject H_o: Assessor decides it is predatory	False positive $\alpha\frac{1}{1+R}$	True positive $(1-\beta)\frac{R}{1+R}$	$(\alpha+(1-\beta)R)\frac{1}{1+R}$

Notes: α is the probability of a false positive occurring, while β is the probability of a false negative, R is the ratio of the true quality of the journal to all other qualities that can be examined. $\frac{R}{1+R}$ as stated in the main text is the pre-study probability that H_o is false and the journal is predatory. *PPV* is the likelihood of a true positive to the likelihood of all positive outcomes. From the table *PPV* is $(1-\beta)\frac{R}{1+R}$ by $(\alpha+(1-\beta)R)\frac{1}{1+R}$ and *FDR* is 1 – *PPV*.

the likelihood that the research findings are more false than true. The framework that we advanced for the assessment of lists to identify predators, specifically predatory journals, points towards establishing evaluation criteria that have a low likelihood of false positives, a high power to detect a false null hypothesis and a high ratio of true to other postulated qualities of a journal. In Table 4, the first example provides a case where the FDR is the lowest but still relatively high at 5.9%. Unbiased assessors will be wrong in classifying a journal as predatory when it is not 5.9% of the time. As discussed and seen in Tables 4 and 5, many examples show that it is very difficult, if not impossible, to satisfy all of the above three conditions simultaneously and hence lists are not as reliable as one would hope them to be, even in the absence of biases. This framework leads to the next section as to why we believe blacklisting is a poor academic practice.

Why is blacklisting poor academic practice?

Non-academic blacklists are not novel and have been critiqued for violation of civil liberties, for example Bernstein (2013). Some have even claimed that blacklists can kill.[52] Despite this, blacklists, including Beall's and Cabell's, are entering the field of academia, as exemplified by China's new planned policy of establishing a "blacklist of 'poor quality' scientific journals, including domestic and international titles" in a bid to curb misconduct (Cyranoski, 2018). Do blacklists damage or aid academia? In science, "blacklisting" is a process of shunning, sometimes harassing, and excluding an individual (in this case, authors who published in OA publishers and standalone journals in Beall's blacklists), usually for perceived "misbehavior" (Kuhar, 2008). The psychology of the shaming factor cannot be ignored, as it can cause collateral damage and also spur an anti-science movement (Teixeira da Silva, 2018c). Science watchdog sites such as Retraction Watch and PubPeer are a form of personal and publishing entity-based blacklisting.[53]

We argue that blacklists have several caveats:

1) They are prone to having false positives. Just like whitelists are subject to false positives, so are blacklists. As stated previously, false positives would be to include in the blacklist non-"predatory" journals. This is the result of criteria being opaque to detect true "predatory" qualities, as is the case of Beall's blacklists where Beall failed to define the precise criteria for each OA journal or publisher that led to them being blacklisted. Having better criteria to reduce false positives makes sense but only to realize that this will increase false negatives (i.e., a higher number of truly "predatory" publishing entities not being blacklisted) which ultimately defeats the purpose of the blacklist to capture all "predatory" publishing entities. Hence, creators of blacklists prefer to have opaque criteria in order to capture as many predatory entities as possible, even if this is done at the expense of including non-"predatory" publishing entities. It is as if criteria are designed to minimize false negatives but in doing so they maximize the probability of the lists having false positives (i.e., capturing as many "predatory" journals or publishers as possible, but in doing so, capturing non-"predatory" publishing entities as well), which is contrary to the scientific method of discovery whose objective is to minimize false positives in order to claim a discovery. Signs of a high likelihood of false positives can also be seen by the speed at which journals are included in blacklists. Beall's lists had very few publishers in 2012 (23) but by 2016 it had reached 923.[54] Cabell's blacklists have also seen an explosive expansion in the number of journals from 3900 on 31 May 2017[55] to 6800 during the fall of 2017 (i.e., almost doubling over the summer of 2017) to 9051 on 29 July 2018. These rates of expansion cannot be free of errors and are most likely caused by having broad criteria for inclusion.[56]
2) Inclusion criteria are opaque resulting in not only a high number of false positives but a very high false discovery rate (FDR) (Colquhoun, 2014). Criteria that are used to identify predatory journals or publishers can be considered equivalent to a statistical or screening test. However, as in any statistical or screening test, the decision as seen previously in 1) could be associated with decision-based errors. Also as discussed previously, the FDR is the ratio of the likelihood of false positives, also known as type I errors, to the likelihood of true and false positives that can exist in blacklists. The

[52] https://twitter.com/eggersnsf/status/1004228630975799296; https://positivrat.ch/cms/en/views/389-black-lists-kill.html.

[53] Apart from these websites themselves, one distinct example is: https://retractionwatch.com/the-retraction-watch-leaderboard/.

[54] For changes in Beall's blacklists over time, see: http://asianeditor.blogspot.com/2016/06/bealls-list-of-predatory-publishers-2016.html.

[55] https://www.nature.com/news/pay-to-view-blacklist-of-predatory-journals-set-to-launch-1.22090 (this article by Silver claims that the list would be transparent, but this is not entirely true, as independent members of academia and the public cannot verify or independently test criteria or the validity of entries on those lists; the article also refers to the blacklist as a "list of predatory journals").

[56] Cabell's rapid expansion of blacklisting is similar in a way to Beall's expansion of publishers and journals but Cabell's is happening at a much faster rate.

Table 4
FDR of journal blacklisting for two cases of a likelihood of false positives, three cases of *R*, true quality to that of not true, and with adequate power to detect true predatory journals at: $(1-\beta)\times 100 = (1-0.2)\times 100$ or 80% power

Description of cases with adequate power to detect true predatory journals	α	*R*	FDR
A low likelihood to include non-predatory journals (false positives) and the highest possible *R* ratio	5%	1:1	5.9%
A low likelihood to include non-predatory journals and a moderate *R* ratio	5%	1:4	20.0%
A low likelihood to include non-predatory journals and a low *R* ratio	5%	1:6	27.3%
A high likelihood to include non-predatory journals and a high *R* ratio	50%	1:1	38.5%
A high likelihood to include non-predatory journals and a moderate *R* ratio	50%	1:4	71.4%
A high likelihood to include non-predatory journals and a low *R* ratio	50%	1:6	78.9%

Table 5
FDR of journal blacklisting for two cases of a likelihood of false positives, three cases of *R*, true quality to that of not true, and with underpowered criteria to detect true predatory journals set at: $(1-0.8)\times 100$ or 20% power

Description of cases with underpowered criteria to detect true predatory journals	α	*R*	FDR
A low likelihood to include non-predatory journals (false positives) and the highest possible *R* ratio	5%	1:1	20.0%
A low likelihood to include non-predatory journals and a moderate *R* ratio	5%	1:4	50.0%
A low likelihood to include non-predatory journals and a low *R* ratio	5%	1:6	60.0%
A high likelihood to include non-predatory journals and high *R* ratio	50%	1:1	71.4%
A high likelihood to include non-predatory journals and a moderate *R* ratio	50%	1:4	90.9%
A high likelihood to include non-predatory journals and a low *R* ratio	50%	1:6	93.8%

existence of a weak set of evaluation criteria would lead to a high FDR. Basically, there is a very high likelihood that a creator of blacklists will make a type I error given a positive finding.

3) Blacklists may violate article 11 of the declaration of human rights to be presumed innocent until found guilty in a public trial by the law.[57] Blacklisting is not conducted by a public trial governed by the law and it shifts the burden of proof to the accused who need to provide evidence that they are not predatory after which they will be removed from the list.[58] Also, those identified in such blacklists are automatically labeled as guilty by suspicion, a "guilt" that is automatically transferred to researchers that publish their work in such journals or publishers. We re-emphasize that blacklists have far more negative effects than the use of whitelists. First, as stated above, the burden of proof falls onto the accused. Also, in a blacklist "system", who is qualified to serve as a "judge", and who manages this "justice system"? Whitelists do not stigmatize, although they do give the impression of a "higher" or "superior" level relative to those that are not whitelisted, and they do not cause irreversible damage, only friction among academics (an exception maybe being the de-listing of entities from whitelists, e.g., the DOAJ or UGC). Blacklisting is a process of shunning and shaming, sometimes harassing, and excluding individuals (e.g., in Pakistan[59]) or entity usually for perceived "misbehavior." In contrast, whitelists do not cause harm, but have their own sets of problems such as potential "infection" by truly predatory journals or publishers.
4) Those that create blacklists can face legal and personal challenges.[60] Frontiers, which is whitelisted by the DOAJ, accused Beall of research misconduct on grounds that his research was unethical and flawed, and the University of Colorado Denver eventually launched an investigation. OMICS Publishing Group sought $1 billion in damages from of Beall (Mimouni, Braun, Mimouni, Mimouni, & Blumenthal, 2017).[61] Incidentally, OMICS Publishing Group is being monitored and sued by the FTC for anti-competitive behavior.[62]
5) Blacklists suffer from personal biases (e.g., Beall's own anti-OA views). Quoting Beall (2013): "The open-access movement is really about anti-corporatism. OA advocates want to make collective everything and eliminate private business, except for small businesses owned by the disadvantaged. They don't like the idea of profit, even though many have a large portfolio of mutual funds in their retirement accounts that invest in for-profit companies." Beall's erroneous views of OA were debunked by his direct supervisor just prior to his retirement (Swauger, 2017). In a recent interview with Indian Express Beall stated the following: "They also put an unqualified, mendacious supervisor over me, and he constantly attacked and harassed me. I decided I could no longer safely publish the list with my university threatening me in these ways" when he was asked why he shut down his blog.[63]
6) Blacklists can cause irreversible reputational damage to authors, editors and publishers (Kuhar, 2009; Teixeira da Silva, 2018a, 2018b, 2018c, 2018d). They can stigmatize researchers by being associated with them and can be used in a discriminatory manner, as was used by Pyne (2017) in continuous media campaigns,[64] to try and smear the reputation of colleagues in his department, by claiming that they have "predatory publications" (i.e., papers in OA journals and publishers that were blacklisted by Beall), and claiming

[57] http://www.claiminghumanrights.org/udhr_article_11.html.

[58] As one example, we point the reader towards the Beall experience. Not only was Beall biased against OA, based on tips from the community, he single-handedly decided if a journal (or publisher) was deceptive (i.e., the verdict was guilty). There was no public trial based on the law, the publisher was not presumed innocent until found guilty. Instead, it was a one-man operated court system in which the judge made the decision by himself. The accused was not provided a lawyer to defend themselves, nor were they presumed innocent until found guilty. Rather, they were guilty until they proved their innocence.

[59] https://www.thenews.com.pk/print/261617-hec-software-shows-its-director-s-paper-88pc-plagiarised.

[60] http://www.universityworldnews.com/article.php?story=20170920150122306.

[61] https://scholarlykitchen.sspnet.org/2013/05/20/high-noon-a-publisher-threatens-to-lunch-a-criminal-case-against-librarian-critic/

[62] https://www.ftc.gov/enforcement/cases-proceedings/152-3113/federal-trade-commission-v-omics-group-inc; https://www.ftc.gov/news-events/press-releases/2016/08/ftc-charges-academic-journal-publisher-omics-group-deceived; https://www.ftc.gov/system/files/documents/cases/omics_de_86_-_ftc_motion_for_summary_judgment.pdf.

[63] https://indianexpress.com/article/india/jeffrey-beall-american-librarian-predatory-publishers-threaten-scientific-integrity-are-embarrassment-to-india-5266858/.

[64] See article in *The Economist* in footnote 7; also: https://www.nytimes.com/2017/10/30/science/predatory-journals-academics.html

falsely that such academics were financially rewarded for such publications relative those that did not have such publications. Media spin, especially via social media platforms such as Twitter and Facebook, is becoming an increasingly wide phenomenon in the dissemination of scientific information, but can lead to misrepresentation of the facts by hyping facts, leading to overstatements or misinformation (Haber et al., 2018).

7) Blacklists can cause serious friction between colleagues, between librarians and scientists, and between scientists and other scientists as a result of their erroneous use and applications (Teixeira da Silva, 2018a, 2018b, 2018c, 2018d). A recent example is that of *Oncotarget,*[65] an OA journal published by Impact Journals, that was delisted from the Web of Science and PubMed's Medline,[66] with impassioned claims by the Editor-in-Chief, Mikhail V. Blagosklonny, that he and his journal were subject to harassment by Beall and by critics (Blagosklonny, 2018). *Oncotarget* is currently one of 1128 journals under scrutiny by Cabell for possible inclusion in its blacklist. Errors in this journal are being heavily profiled by Elizabeth Bik and others, at PubPeer.[67]
8) Blacklists can be used as a poor excuse by academic assessors and decision makers to save them valuable time by not having to read manuscripts to assess their individual quality (i.e., laziness). Reading manuscripts published in journals is not a waste of people's time and money. It is the responsibility of scholars to read research and evaluate if a paper expands knowledge and not simply assess it only on the exclusive basis of inclusion and/or exclusion on whitelists or blacklists.

For all of these reasons, we strongly argue against the use of blacklists to assess the value of research, publications, and publication venues.[68] Rather, decision makers should rely on experts' opinions, as they currently do, to support funding, merit pay, tenure and academic promotions and not on blacklisting. We further argue that governments and higher academic bodies should refrain from using blacklists to make decisions on academic matters. Assessors must read individual papers to assess their merit, and should not exclusively decide the value of research on the basis of its inclusion or exclusion on blacklists or whitelists, or on journal metrics such as the Clarivate Analytics' journal impact factor, or Elsevier's CiteScore, given the ease with which these metrics are gamed and abused (Teixeira da Silva, 2017d; Teixeira da Silva & Memon, 2017). However, blacklists may cause damage to the listed identities while the benefits are not that clear, if any, and may accrue to only a few identities.

Conclusions and future extensions of the study

In summary, we advise against the use of blacklists for decision-making on academic matters due to their severe shortcomings, as we have presented within this paper. Even as we advise against the use of blacklists, we are cognizant that there is a sector of academia, policy makers and the public that passionately praises and seeks to fortify the use of blacklists, especially select science watchdogs like Retraction Watch,[69] who are staunch supporters of Beall (Teixeira da Silva, 2018d). Unlike what Elizabeth Wager, the former COPE Chair (2009–2012), advised, namely to "worry less about predatory publishers" (Wager, 2017), which we consider to be poor academic advice, or unlike what Fanelli (2018) believes, namely that there is no reproducibility crisis in science, we believe that a wide and complex crisis is taking place in academic publishing, including in reproducibility, as well as the lax barriers to publishing introduced by potentially predatory journals or publishers who may not be conducting rigorous peer review or quality control prior to publication of research results. We thus believe that not only is there a crisis in publishing, but that predatory publishing is a real and tangible threat, but that is currently poorly understood, and lacking suitable signals, criteria and quantification. Our paper does not aim to, or claim to, provide a silver bullet to the issue of predatory publishing. However, by expanding the discussion, and by showing that all current modes of classification of whitelists and blacklists are infused with both false positives and negatives, our objectives are to make academics more aware and cautious, not unlike the objectives of Think.Check.Submit, when selecting a venue to publish their results or intellect. Entities that decide to create whitelists and blacklists must also be aware that there are probabilities of including false positives or negatives, and these must be seriously considered since the reputation of journals (by association, their publishers) and of authors who publish in them are at stake. Thus, a false finding/classification of a journal as predatory (i.e., a false positive), even if it is later delisted for not being predatory will already have caused reputational damage. Finally, a staunch alert to policy makers who may be too lazy, as per reason 8) above, to create their own set of decision criteria as to what constitutes predatory or non-predatory, there is risk in simply adopting whitelists and blacklists that have been created by third parties, as was shown by the reliance by the DOAJ or Cabell on Beall's flawed blacklists, or by the ever-changing UGC whitelist. Policy makers with poor decision-making skills or understanding of the issues underlying predatory publishing may be placing academics at risk rather than offering them purported protection. Nations such as China, who are rushing forward with sudden draconian measures are cautioned about the desire to try and curb predatory behavior based perhaps on a poor understanding of what delimits poor academic practice from what constitutes unethical behavior. When policy is suddenly implemented at a national scale, and with urgency as has been witnessed with China, academics must be wary of possible interference by potentially biased interest groups. Some of these groups are likely to share a different opinion to ours, including the active and passionate promoters of blacklists.

This crisis in academic publishing could be approached in the same way that policy makers attempt to reduce smoking and other bad health habits, consisting of measures that aim at producers and consumers. One long-term solution to reducing the number and impact of deceptive (in practical terms, equivalent to predatory) journals and publishers would be to invest in education to increased awareness about predatory publishing, with the objective of reducing the demand for such journals, but also from the supply side via measures discussed in this paper, including penalties and fines for deceptive practices. Whitelists carry value when they are properly curated, but current whitelists all have weaknesses. As for identifying predatory journals what is needed is common sense, caution, verification, and asking colleagues about their experience with potential predatory journals. Also, tools like an updated Predatory Score or the Journal Evaluation Tool can be of some value to identify possible journal outlets.

In closing, we wish to encourage the following extensions to our ideas that would accommodate for a wider range of opinions: 1) academics and policy-makers reading this paper are encouraged to envision new possibilities of how to deal with predatory publishing; 2) we have not discussed the costs to society of making decision-based errors such as false positives and negatives which is a limitation but an issue worth looking into in the future; 3) We encourage others to test and apply this framework more widely; 4) We further encourage perhaps more robust modeling to include biases, and all the other corollaries identified by Ioannidis (2005), including his corollary 6 which states that the hotter the topic in a scientific field the lower the likelihood the

[65] http://www.oncotarget.com/; http://retractionwatch.com/category/by-journal/oncotarget/.

[66] https://www.ncbi.nlm.nih.gov/nlmcatalog/?term=all%5Bfilter%5D+NOT+currentlyindexed%5Ball%5D+AND+oncotarget.

[67] https://www.pubpeer.com/journals (search for "*Oncotarget*"); https://twitter.com/MicrobiomDigest/status/1018190147907510273.

[68] This also is in line with DOAJ's statement that it does not "believe" in blacklists. See: https://doaj.org/faq#predatory.

[69] https://www.statnews.com/2017/01/27/journal-predatory-blacklist/.

research findings are true, because research findings in the area of predatory publishing are currently very "hot". Finally, an interesting extension of the framework discussed in this paper is to explore the problems criteria have in detecting predatory journals in the same way the problems screening devices have in the medical field for deciding if people in a given population have a particular disease (Maxim, Niebo, & Utell, 2014).

Funding

None.

Conflicts of interest

The first author has been critical of the Beall blacklists for several years. The first author has been profiled by Retraction Watch and by PubPeer. The authors declare no other conflicts of interest, financial or otherwise, of relevance to this topic.

Authorship

Both authors contributed equally to all aspects of the ideas, writing, development and editing of the paper, all drafts and take responsibility for its content. They are co-corresponding authors.

Acknowledgements

The authors thank the following for their input and ideas related to the final version of the paper: Raymond A. K. Cox (School of Business & Economics, Thompson Rivers University, Canada), and Andrea Manca and Franca Deriu (Dipartimento di Scienze Biomediche, Università degli Studi di Sassari, Italy).

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