

POINT/COUNTERPOINT

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The open access financial model hinders the growth of medical physics research in low- and middle-income countries

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OVERVIEW

Publishing papers in journals has long been an important way to exchange ideas and propagate knowledge. Recently, open access (OA) journals have gained growing attention as they provide greater accessibility to a wider guidance. However, the difference in the financial model between the OA journals and conventional subscription journals has brought many controversies. Some think that the OA financial model can facilitate the growth of medical physics in low- and middle-income countries (LMICs), while others have significant concerns about financial burdens that OA can bring to potential authors will hinder medical physics research in LMICs. This is the premise debated in this month's Point/Counterpoint.

Arguing for the proposition is Biplab Sarkar, Ph.D. Dr. Sarkar is presently working as Chief Medical Physicist in Apollo Gleneagles Hospitals, Kolkata, India. He has completed his training in Radiological Physics from Bhabha Atomic Research Centre, Mumbai in 2004. Dr. Sarkar has served several premier institutions in India as a Clinical Medical Physicist/Assistant Professor. He served as visiting faculty and Post M.Sc Medical

Physics Program coordinator in Jadavpur University, Kolkata, India between 2008 and 2012. He received his Ph.D. from GLA University, Mathura, India in Physics and is currently perusing the D.Sc. from the same university. He is also an Adjunct Faculty and Ph.D supervisor in the same university. Dr. Sarkar has authored more than 100

manuscripts and presently confines his interest to rotational positional error, artificial intelligence, and patient toxicity (radiotherapy related and financial). He is an international affiliated member of AAPM since 2010.



Arguing against the proposition is Yi-Xiang Wang, M.Med., Ph.D. Dr. Wang studied medicine and was trained in diagnostic and interventional radiology in China. He did post-doctoral fellowships in Sheffield Medical School, UK, and Rotterdam School of Medicine (Erasmus MC), the Netherlands. Dr. Wang worked at AstraZeneca Pharmaceuticals R&D (UK) as a senior scientist during

2001–2006. He joined the Faculty of Medicine of the Chinese University of Hong Kong in late 2006, where he is currently a tenured Associate Professor. He is also an Adjunct Professor and graduate student supervisor of Jinan University, Guangzhou, China. Dr Wang is the Editor-in-Chief of *Quant Imaging Med Surg* journal. He has published >250 papers, and his works have been cited for >8000 times according to Web of Sciences, with H-index >46.



FOR THE PROPOSITION: BIPLAB SARKAR, PH.D

Opening Statement

In the recent times there is a many fold increase in the number of OA journals in the field of medical physics and

radiation oncology. While societies like ASTRO and ESTRO have introduced new OA journals like *Advances in Radiation Oncology*, *ctRO*, *phiRO*, *tipsRO* (Table 1), societies like the AAPM and Balkan Union of Oncology have started levying article processing charges (APC). Nearly all OA journals having an impact factor (IF) ≥ 1 have started charging authors. For authors having research grants, institutional support, or who are earning well, APCs may be insignificant,¹ but impossible to afford for researchers who are working without any financial support. APC acts as a financial glass ceiling for such researchers, students especially those who are from LMICs.²

The financial burden to potential authors from these developing economies can be estimated from the fact that the gross national income per capita for LMICs (\$1026–\$3995) is just 20% that in the developed economy ($> \$12\,376$).² AAPM's also depicts similar difference in medical physicist salary.³ Even the *Journal of Clinical Applied Medical Physics* (JACMP) APC, which is the minimum among all OA journals, is $\approx 30\%$ of an assistant professor's gross monthly salary in India. Table I shows APC of 15 OA journals as a function of monthly income for an assistant professor, averaged over median salary in India, Russia, and Brazil. Undoubtedly, APC for journals like *Radiation Oncology* is prohibitive for people from LMICs even when shared among all authors.

In Table I, 40% OA journals have no IF, yet have exorbitant APC which raises a pertinent question: Why should researchers pay high for publishing in a no/low IF journal?

Is this proposition just a conjecture or does APC really affect research from LMICs? The answer lies in the loss in number of publications in JACMP from LMICs. Publications from India showed a 6-fold decrease post-APC (2017–2019: 3 articles) compared to the same three years period in pre-APC era (2014–2016: 18 articles). This is a clear indication to how OA policy is hindering the growth of medical physics research in LMICs. Our group had a publication in JACMP in pre-APC era, but now can only afford APC-free correspondence.^{3,4}

OA journals do have a fees waiver policy which is not exclusively for LMICs. JACMP offers a 100% and 50% fee waiver for 82 low-income countries and 41 lower-middle-income countries respectively. Excluding Iran, there are 3 and 15 publications, respectively, from countries with 100% and 50% fees waivers, which is 0.4% and 2.0% of the total number of publications (732) in 2017–2019; with other OA journals faring even worse.^{5,6} The APC-waived countries meagerly contribute to the scientific yield of a journal and therefore utilization of fee-waiver policy is doubtful.

TABLE I. Open access journals, SJR, IF values, and their APC as a function of average salary of assistant professor.

	Journal name	Publishing year	SJR (2018) ^a	IF (2018) ^b	Publisher	APC (\$) (VAT additional)	% APC/Monthly income of Assistant Professor ^c
1	Journal of the Balkan Union of Oncology	1995	0.42	1.379	Balkan Union of Oncology	509	31.3
2	Journal of Applied Clinical Medical Physics	2000	0.726	1.544	Wiley/AAPM	600	36.9
3	Cancer Research and Treatment	1968	1.47	3.363	Korean Cancer Association	600	36.9
4	In Vivo	2004	0.419	1.116 (2019)	Intern Institute of Anticancer Research	700	43.1
5	BJR Open	2018	Nil	Nil	British Institute of Radiology	783	48.2
6	Physics in Medicine	2016	0.195	Nil	Elsevier	1100	67.7
7	Clinical and Translational Radiation Oncology (ctRO)	2016	Nil	Nil	ESTRO/Elsevier	1355	83.4
8	Journal of Radiation Research	1960	0.653	2.014	Jap Soc for Rad Onc/ Oxford	1355	83.4
9	Technical Innovation & Patient Support in Radiation Oncology (tipsRO)	2016	Nil	Nil	ESTRO/Elsevier	1396	86.0
10	PLOS ONE	2006	1.1	2.776	Public Library of Science	1595	98.2
11	Physics and Imaging in Radiation Oncology (PhiRO)	2016	Nil	Nil	ESTRO/Elsevier	1619	99.7
12	Medicine (baltimore)*	1948	0.784	1.87	Lippincott Williams & Wilkins Ltd.	1950	120.1
13	Technology in Cancer Research & Treatment	2002	0.512	1.481	SAGE Journals	2000	123.2
14	Advances in Radiation Oncology	2016	0.719	Nil	ASTRO/Elsevier	2000	123.2
15	Radiation Oncology	2005	1.139	3.098	Springer Nature	2680	165.0

^aSCImago journal rank.

^bImpact factor (The Clarivate Analytics Impact Factor).

^cBased on average monthly salary in Brazil, India, Russia (\$3200, \$1120, \$550: Average= \$1624).

In conclusion, APCs and the increasing number of OA journals have emerged as challenges for the economically weaker researchers/groups. The waiver policies do not reach the deserving people. Publishers, researcher, and societies should find an alternate solution⁷ to prevent the resultant financial toxicity to deserving researchers and allow them to publish seamlessly.

AGAINST THE PROPOSITION: YI-XIANG WANG, M.MED., PH.D

Opening Statement

I disagree with proposition that “The open access financial model hinders the growth of medical physics research in low and middle income countries”. I believe the opposite is true.

The majority of scientists and researchers are firstly readers and users of newly generated knowledge, this would be particularly so for those in LMICs. OA is a set of principles and practices through which research outputs are distributed, mostly online, free-of-charge to readers. Barriers to copying or reuse are also reduced or removed by an open license for copyright. Non-OA journals cover publishing costs through subscriptions, site licenses or pay-per-view charges. While research institutes and universities in high-income countries are more likely to subscribe to various non-OA journals, it is less so in LMICs. Thus, scientists and health care professionals in LMICs often do not have the financial resources to access newly published non-OA articles. The frustration of LMIC scientists is understandable when they want to read some particular articles but could not access them as the pay-per-view charge may be prohibitively high.

Evidentially, OA articles are generally downloaded more often than pay-walled articles, and the readership continues for longer. OA articles are also typically cited more often than equivalent articles requiring subscriptions.^{8–10} Readership is especially higher in groups that typically lack access to subscription journals (besides the general population, this includes many medical practitioners, patient groups, industry scientists and independent researchers).¹¹ Even those who do not read scholarly articles can benefit indirectly from OA, such as patients can benefit when their doctors and other health care professionals have access to the latest research. Davis¹² once noted that the real beneficiaries of OA publishing may not be the research community but the communities of practice that consume literature. For these reasons, universities, research institutions and research funders are increasingly adopting mandates requiring their researchers to make their publications openly accessible.

The biggest problem of OA mode is that, at least a small portion of publishers have the motivation to over-publish, if publishing more papers means financial gain for them, with the peer review standards falling. *Predatory journals* have negative effect on the reputation of the OA publishing model as a whole.^{13,14} Certainly, more measures are required to control excessive publishing of low-quality materials. However, the problems of conventional subscription journals are also apparent. These journals usually have long histories and are associated with various academic societies. The organizational structure is often complex which may lead to low

efficiency in publishing and even bureaucracy and unfairness. OA journals, which are most newly emerged, largely mitigate this important limitation of subscription journals.

REBUTTAL: BIPLAB SARKAR, PH.D

I agree with Dr. Wang when he says articles from OA journals are downloaded, cited and read more and can even be of benefit to patients indirectly by helping their caregivers. OA journals allow financially weak authors to read but not allow them to publish; which results in financially weak authors having their clinical and scientific practice guided by what financially well-off authors publish, but aren't be in position themselves to influence practice, as they cannot afford “pay to publish”. Hence preference of OA journals in the name of free-knowledge is not an acceptable model, especially for LMICs.¹⁵

The other concern is the trend prevailing among the societies and the publishing houses in launching OA journals. More than 50% of the journals in Table I were either launched or got converted to the OA business model since 2016. This tendency, especially seen among English language journals, is very alarming for researchers who have no funding, irrespective of which category of country they belong to. If only a fraction of the journals ($\approx 20\%$) were OA, nobody would have any concern. But too many OA journals in the field have significantly reduced publication opportunities for researchers, especially those from LMICs.¹⁶ For example, as stated previously, the conversion of JACMP to an OA journal diminished the number of publications from one LMIC (India) by six fold.

Publishing has become a profitable business in recent times, with Elsevier alone making a profit of \$1.17 billion in 2017.¹⁷ And as Dr. Wang has mentioned, profit-oriented publishers may rush to publish more “predatory journals” accommodating low-quality articles because their authors can “pay”. Financially well-off researchers publish easily and stand to get more research grants whereas the financially weak ones will struggle for publication and recognition. Researchers from LMICs are the biggest victims.

Getting articles from subscription-based journals is difficult but not impossible, especially since Google Scholar can identify the “free” articles. However, with ineffective fee-waiver policies, it is impossible to publish an article in OA journals. Personally, once I had to struggle for six months to get an APC waiver in *Radiation Oncology*.¹⁸

We cannot overlook the fact that a majority of LMIC researchers are active in research/publication driven only by their interest in understanding science: neither their promotion/remuneration depends on their publishing record nor do they receive research grants. Societies and publishers should be more sensitive to preserve such groups of underprivileged researchers through a sustainable solution.

REBUTTAL: YI-XIANG WANG, M.MED., PH.D

My respected colleague, Dr. Sarkar, is concerned that OA financial model hinders the publication of works conducted in LMICs. Firstly, there is no evidence that subscription journals

decreased in overall number due to the emerging of OA journals. A 2015 study by the Max Planck Society stated that, while numerous publishers adopted OA model, the share of openly available scientific articles was still only about 13%.¹⁹ The current problem is not that we do not have enough journals to accommodate good research outcomes, it is more that we have too many journals publishing more or less similar results.

OA journals generally cover their running-cost by charging authors publication fees (ie APC, article processing cost). The money may come from the author but more often come from the author's research grant or employer. APC is typically \$1000–2000/full article. For researchers who cannot afford to pay APC, there are various other ways. The first is to submit their good research works to journals which do not charge APC, or have very APCs (some journals charge APC as low as \$100–300/article). In the near future, subscription journals will still dominate. The second is to negotiate with the OA publisher for a partial or total waiver of APC. Another apparent way is that researchers disseminate their research results in through charge-free pre-print servers such as: ArXiv, BioRxiv or MedRxiv. Many physics disciplines are known to make use of these pre-print services. For medical physics papers, having the title not included in PubMed is a disadvantage. Then authors can further communicate their results in pre-print server by various means, such as directly e-mailing the documents to colleagues working in this field, writing review or commentary articles to promote their results.

While OA mode has its pros and cons, I believe OA publishing benefits even more for scientists in LMICs. A reasonable mixture of subscription journals and OA journals is likely to make the world of scientific publishing even better.

CONFLICTS OF INTEREST

Dr. Wang is the editor-in-Chief of *Quantitative Imaging in Medicine and Surgery* (QIMS) journal, which runs in Open Access mode. Regardless of where the submission is from, QIMS usually grant applications for partial or total waiver of APC (article processing charge) as long as the reasons are clearly presented by the authors. Dr. Sarkar has no relevant conflict of interest.

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