

Practical Tools and Guidelines for Young Oncologists From Resource-Limited Settings to Publish Excellence and Advance Their Career

Khalid El Bairy, MD^{1,2}; Ouissam Al Jarroudi, MD^{1,2}; and Said Afqir, MD^{1,2}

Cancer research is evolving worldwide. However, publishing high-quality academic literature in oncology remains challenging for authors in the developing world. Young oncologists in low- and middle-income countries experience several barriers including lack of funding and research facilities, as well as inadequate training. Publication best practices, science integrity, and ethics are required to improve oncology research quality and therefore, improve patients' care in these countries. To achieve this goal, we propose some basic principles and tools that may help young oncologists especially in developing countries overcome these issues and boost their academic careers.

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INTRODUCTION

Research in oncology is a highly active field with more than 1 million papers published in the past 5 years alone, as clearly shown by the US National Library of Medicine Pubmed/Medline database.¹ Notably, the largest part of this progress has been achieved in high-income countries. By 2030, it is expected that cancer will be the primary cause of death in low- and middle-income countries (LMICs).² Promisingly, there is an enthusiastic movement among these developing countries to enhance scientific production in this field, but it is still facing big challenges, particularly regarding the shortage of the oncology workforce. Moreover, health researchers in these settings are markedly under-represented and there is a significant inequity regarding publications in leading medical journals compared with authors from high-income countries.³⁻⁵ Several well-documented factors have an influential impact on the poor production of oncology research papers in developing countries, including barriers to accessing oncology literature, inadequate training in research, lack of or poor mentorship, and rare international partnerships.^{5,6} Moreover, these authors are under-represented because of the competition of well-trained researchers from high-income countries and low financial support allowed for research in their affiliations. There is also a growing attitude among these authors to publish their cancer research with predatory publishers instead of reputed journals.^{7,8} Therefore, young oncologists in these countries should have access to optimal guidance as they might have a significant contribution to

the global knowledge pool in oncology. Improving publication quality requires ethical standards and basic principles, as well as research integrity good practices. In this perspective, we discuss these critical emerging issues together and provide some practical principles that early-career cancer researchers from developing countries have to follow to improve the quality of their research. This is anticipated to potentially advance their academic expertise. We believe that this paper will provide useful guidance for curricular development in these settings with limited resources, and therefore, improve cancer control.

PRACTICAL TOOLS AND GUIDELINES

Always Get Approval From an Ethics Committee Before Conducting a Study Involving Human Participants

Lack of ethics committee approval is one of the main limitations for cancer research of authors in LMICs. Researchers should get prior approval for their studies to get more chances of acceptance in reputed oncology journals. Clinical and biomedical researches that include animal models and human participants require an earlier ethics committee approval before starting the study enrollment. According to the Declaration of Helsinki of the World Medical Association, research on human subjects should be clearly formulated in experimental protocols and these should be submitted to independent ethical review boards (ethics committees and institutional review boards) for approval before the study starts. Notably, every participant has to be clearly informed about the different

ASSOCIATED CONTENT

Appendix

Data Supplement

Author affiliations and support information (if applicable) appear at the end of this article.

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CONTEXT

Key Objective

To provide a useful research toolkit to young oncologists in under-resourced settings.

Knowledge Generated

Curricular development in countries with limited resources needs guidance for a better cancer research that affects patients' outcomes. A number of rules and principles can be followed to improve research reporting in low-income settings.

Relevance

The tools and guidelines discussed in this paper will certainly help young cancer researchers developing skills for a better career in oncology.

aims, funding sources, and potential conflicts of interest, and also the significant anticipated benefits for advancing the related scientific field before giving their written consents to participate.⁹ Moreover, a detailed description of the potential risks related to interventions should be explained to participants to limit the possibility of causing any harm and to avoid any future legal actions. In countries with unavailable ethics committees, participant's written consents should be provided and the manuscript cover letter to handling editors should mention the difficulty of achieving a prior ethics committee approval. Importantly, cancer researchers should store these signed consents in print and electronically for future requests from journal editors. In exceptional situations where consents would be difficult to obtain, data collection from participating subjects may be conducted only after approval of a research ethics committee. If an author had no ethical committee available for consultation in their setting, they can request other country-based ethical review boards to review their protocol. Moreover, if the authors have no formal approval, the reason why should be explained in the methods section and also in the cover letter for the journal editor. For transparency, during manuscript writing, the name and the location of the ethical committee that approved the research protocol and the related approval number should be provided in the methods section. Infringement of these rules may cause serious damages to researchers, including retraction of publications after peer review. A useful non-exhaustive list of ethical committees can be found in the WHO portal.¹⁰ For more reading, see [Refs. 11,12](#).

Register Your Study Protocol

Study protocols have a cornerstone place in published reports and are decisive components of research. Their design occupies a central role in providing accurate data when testing hypotheses. Prospective registration of study protocols is becoming essential to enhance credibility, reproducibility, and transparency for both observational and interventional studies.^{13,14} In addition, meta-research studies, including systematic reviews with or without meta-analyses, are potential article types that require prior registration on online databases such as International

Prospective Register of Systematic Reviews, which have a significant positive impact on research results by increasing review quality.¹⁵ Several initiatives that support this transparency movement have been developed and have created various databases for this purpose, encompassing free and paid services ([Table 1](#)). Web-based sources such as the American ClinicalTrials.gov database, which is maintained by the National Library of Medicine at the National Institutes of Health, are a good example of a successful free service that provides updated data on human studies for researchers, clinicians, and also for patients and their family. Information related to clinical trial designs and result dissemination are updated during the study progress. The Pan African Clinical Trials Registry,¹⁶ which is the first WHO-recognized registry of clinical trials in Africa, is a comprehensive database to freely register and search clinical trials for all researchers of the African continent as recommended by the requirements of the International Committee of Medical Journal Editors. This initiative assists researchers understanding African research features and allows researchers to identify research gaps for future clinical investigations.¹⁷ These databases adhere to local policies, legal obligations, and ethical obligations of findings disclosure globally. Therefore, their use is recommended for all cancer researchers before the beginning of enrollment and data collection.

Follow Consensus Reporting Guidelines When Conducting and Publishing Research

Cancer research (particularly systematic reviews and observational and interventional clinical trials) has a remarkable influence on clinical practice guidelines. The relevance and quality of cancer research is widely judged by its final published reports. In the era of publish or perish, the usability and actionability of oncology research findings can be damaged by their poor reporting. It is commonly noticed that reports of health research may omit crucial information that should be provided to support the authors' hypotheses and limit reporting biases.^{18,19} This may dramatically mislead clinicians and researchers as well as decision makers when managing patients with cancer. These misleading research results are avoidable by a

TABLE 1. Recommended Databases Registering Clinical Studies

Databases	Web Site	Aims
ClinicalTrials.gov ^a	https://www.clinicaltrials.gov/	Registration of interventional and observational studies
PACTR ^a	https://pactr.samrc.ac.za/	Registration of interventional and observational studies
PROSPERO ^a	https://www.crd.york.ac.uk/prosperto/	Registration of protocols for systematic reviews and meta-analyses
The research Registry ^b	https://www.researchregistry.com/	Registration of all types of research studies
ISRCTN ^b	https://www.isrctn.com/page/why-register	Registration of clinical trials
AsPredicted platform	https://aspredicted.org/	Preregistration of studies with various research designs
OSF initiative ^a	https://osf.io/	Data repository and hosting of research projects
Trialrove service ^b	https://pharmaintelligence.informa.com/products-and-services/data-and-analysis/trialrove	Registration and monitoring of clinical trials
EU Clinical Trials Register	https://www.clinicaltrialsregister.eu/	Registration of interventional studies
INPLASY ^b	https://inplasy.com	Registration of protocols for systematic reviews and meta-analyses

Abbreviations: EU, European Union; INPLASY, International Platform of Registered Systematic Review and Meta-Analysis Protocols; ISRCTN, International Standard Randomised Controlled Trial Number Register; OSF, Open Science Framework; PACTR, Pan African Clinical Trials Registry; PROSPERO, International Prospective Register of Systematic Reviews.

^aFree.

^bRequires a registration processing fee.

proper use of reporting guidelines. In this perspective, authors should provide accurate and complete reporting of their rationale, methodology, results, their significance for practice, and limitations to maximize objectivity and extrapolation for daily management of patients with cancer. Several reporting guidelines have been developed according to the design of the studies to enhance the completeness and transparency as well as clarity of health research. Enhancing the QUALity and Transparency of health Research (EQUATOR) network²⁰ is a valuable resource for researchers that was developed by several editorial working groups and provides a large and robust database of more than 400 reporting guidelines.²¹ This freely available and comprehensive searchable library provides explanations, online training, and guidance for use in several languages to help authors report their findings responsibly. Moreover, the database site contains toolkits for writing and peer-reviewing research for anyone involved in scholarly publishing. Recently, the EQUATOR has developed EQUATOR Oncology that aims to support cancer researchers for high-quality reporting of their research and is recommended for all young oncologists working in clinical investigation.²² An illustrative example of these guidelines is the Reporting Recommendations for Tumor Marker Prognostic Studies (REMARK) that was developed to address the common issues in studies reporting findings on cancer biomarkers for predicting prognosis.²³ The REMARK checklist consists of 20 items that should be considered when designing, conducting, and writing manuscripts that describe tumor markers. However,

despite the implementation of EQUATOR guidelines widely by cancer researchers and journals, they are frequently used inappropriately by authors.²⁴⁻²⁶ Therefore, young oncologists are invited to properly accomplish training on how to use them in their research on the basis of EQUATOR tools before writing their manuscripts for publication. [Table 2](#) provides a nonexhaustive list of reporting guidelines to be used when writing research.

Learn the Basics of Evidence-Based Medicine and Biostatistics

The recent development seen in all areas of health care is associated with the rapidly growing field of medical publishing. Clinicians are therefore faced with a huge number of published articles in their field, which makes their use in health care decisions difficult. The so-called evidence-based medicine (EBM) was developed to systematically appraise and apply the current evidence in the context of patients' condition. EBM is a cornerstone of our daily practice, and this area of clinical research methodology is highly active in oncology. The use of EBM principles in daily oncology care is expected to improve outcomes of patients with cancer. EBM is founded on the critical evaluation of the findings of randomized and controlled clinical trials, their meta-analyses, as well as other study types. Translating the findings of EBM in oncology into our real life is challenging. During residency in medical oncology and related specialties, courses on developing skills in EBM are rarely included in the regular training, particularly in the context of countries with limited resources. Thus,

TABLE 2. Examples of Reporting Guidelines From the Enhancing the Quality and Transparency of Health Research Network

Guidelines	Research Design	Suggested Reading
ARRIVE	Animal preclinical studies	Kilkenny et al. 2010: https://doi.org/10.1371/journal.pbio.1000412
STROBE	Observational studies	Von Elm et al. 2007: https://doi.org/10.7326/0003-4819-147-8-200710160-00010
STARD	Diagnostic studies	Cohen et al. 2016: http://dx.doi.org/10.1136/bmjopen-2016-012799
PRISMA or MOOSE	Systematic reviews and meta-analyses	Moher et al. 2009: https://doi.org/10.1136/bmj.b2535 (PRISMA) Stroup et al. 2000: http://doi.org/10.1001/jama.283.15.2008 (MOOSE)
CONSORT	Randomized clinical trials	Schulz et al. 2010: https://doi.org/10.1371/journal.pmed.1000251
SAMPL	Statistical reporting	Lang and Altman, 2013: https://www.equator-network.org/wp-content/uploads/2013/03/SAMPL-Guidelines-3-13-13.pdf
CARE	Case reports	Gagnier et al. 2013: https://doi.org/10.1186/1752-1947-7-223
REMARK	Tumor marker prognostic studies	Altman et al. 2012: https://doi.org/10.1186/1741-7015-10-51
STREGA	Genetic association studies	Little et al. 2009: https://doi.org/10.1111/j.1365-2362.2009.02125.x
CHEERS	Health economic evaluation studies	Husereau et al. 2010: https://doi.org/10.1186/1741-7015-11-80

NOTE. Additional guidelines and their extensions can be found at <https://www.equator-network.org/> or at the Equator Oncology web site at <https://www.equator-network.org/library/equator-oncology/>.

Abbreviations: ARRIVE, Animal Research: Reporting of In Vivo Experiments; CARE, CAse REports; CHEERS, Consolidated Health Economic Evaluation Reporting Standards; MOOSE, Meta-analysis of Observational Studies in Epidemiology; PRISMA, Preferred Reporting Items for Systematic Reviews and Meta-Analyses; REMARK, REporting recommendations for tumour MARKer prognostic studies; SAMPL, Statistical Analyses and Methods in the Published Literature; STARD, Standards for the Reporting of Diagnostic Accuracy Studies; STREGA, STrengthening the REporting of Genetic Association Studies; STROBE, Strengthening the Reporting of Observational Studies in Epidemiology.

enhancing EBM skills in the training of young oncologists is highly recommended. Several strategies can be adopted, particularly, online-based courses and support. The use of the online COCHRANE training resources is highly recommended to master this area by young oncologists. COCHRANE offers various online courses, a rich documentation on EBM, as well as other tools that can be used for this purpose (see Appendix Table A1 and Table 3). Other essential guides such as the Journal Club of the European Society for Medical Oncology (ESMO) young oncologists' corner²⁷ and the ESMO Handbook of Interpreting Oncological Study Publications²⁸ are good examples of successful tools for young oncologists that desire to be involved in evaluating evidence and learning the basics of evidence-based oncology. The ASCO training resources and its e-learning platform²⁹ are also beneficial for developing capacities when doing EBM. In addition, the BMJ Best Practice tools and checklists^{30,31} can also be useful when reviewing the evidence on particular topics.

In several oncology publications, statistical reporting is incomplete and important interpretable and actionable data are not provided. Therefore, young researchers should support their manuscripts by a detailed description of statistical approaches used to test their hypotheses as recommended by international EQUATOR-related guidelines. The Statistical Analyses and Methods in the Published Literature guidelines were developed to help scientists report all the required statistical methods for publication in academic journals.³²

Young oncologists should also learn how to perform basic statistical testing such as associations,

correlations, logistic regression, Kaplan-Meier estimation, and especially the Cox hazard proportional model, as this statistic is widely used in cancer research to study time to event data. This will allow them to perform good oncologic studies in their setting with a focus on survival analysis and its associated predictors. They are also encouraged to consult statisticians when writing the design of their studies and also before data collection. This is crucial for testing hypotheses as the expected findings are associated with the initial sample size considerations and the design used. Useful publications and guides on how to understand clinical biostatistics with a particular focus on oncology can be found in Table 4.

Do Not Publish in Predatory Journals

An impressive number of open-access predatory journals and publishers are launched every year as money-collecting machines. They are now well known by their features such as the absence of peer-review, plagiarism tolerance, misleading US-based addresses, confusing indexing and fake high-impact factors, spam invitations, the nearly 100% acceptability rates, fake and unqualified editors, and so on.^{33,34} They basically accept everything without any verification of the contents of the submissions. With their typical e-mails, predatory journals and fake conferences will invite authors to submit their research. In addition, they use attractive names for their fake journals including the terms Canadian, British, American, European, International, etc, to attract the attention of potential authors. These authors, particularly from developing countries with limited training in publishing ethics and

TABLE 3. Freely Available Sources on EBM

Tools	Web Site Links
COCHRANE Training	https://training.cochrane.org/handbooks ; https://training.cochrane.org/handbook/current
ASCO Learning Tool	https://elearning.asco.org/homepage
ASCO Education Portal	https://www.asco.org/training-education/education-career-resources
ASCO Professional Development Portal	https://www.asco.org/training-education/professional-development
BMJ Best Practice/EBM Tools	https://bestpractice.bmj.com/info/toolkit/ebm-toolbox
BMJ Toolkit of Appraisal Checklists	https://bestpractice.bmj.com/info/toolkit/ebm-toolbox/critical-appraisal-checklists
CASP Checklists	https://casp-uk.net/casp-tools-checklists
Illinois EBM Library	https://guides.library.illinois.edu/ebm/appraise
EBM Toolbox	https://ebm-tools.knowledgetranslation.net/self-evaluation

Abbreviations: CASP, Critical Appraisal Skills Programme; EBM, evidence-based medicine.

under pressure to publish faster, submit their findings intentionally or unintentionally to predatory journals to boost academic promotion, grant applications, and jobs. This issue has become a bullying crisis that threatens the scientific integrity of research findings. This causes severe damages for young authors in these settings as these for-profit journals publish without proper peer review and therefore their articles are questionable, not credible,

and have little scientific impact.³⁵ It is mandatory that oncologists avoid these predatory journals and not accept to be part of their editorial boards. Unfortunately, it has been recently noticed that predatory journals can infiltrate respectable indexing/abstracting databases.⁸ Therefore, authors should be vigilant when selecting journals for publication. They must always take the needed time to verify the quality of academic journals before submitting

TABLE 4. Recommended Reading on Biostatistics Methods in Oncology

References	DOI
Barracough, et al: Biostatistics primer: What a clinician ought to know: hazard ratios. <i>J Thorac Oncol</i> 6:978-982, 2011	10.1097/JTO.0b013e31821b10ab
Simms, et al: Biostatistics primer: what a clinician ought to know—Prognostic and predictive factors. <i>J Thorac Oncol</i> 8:808-813, 2013	10.1097/JTO.0b013e318292bdcd
Barracough and Govindan: Biostatistics primer: What a clinician ought to know: subgroup analyses. <i>J Thorac Oncol</i> 5:741-746, 2010	10.1097/JTO.0b013e3181d9009e
Dudley, et al: An introduction to survival statistics: Kaplan-Meier analysis. <i>J Adv Pract Oncol</i> 7:91-100, 2016	10.6004/jadpro.2016.7.1.8
Emmerson and Brown: Understanding survival analysis in clinical trials. <i>Clin Oncol (R Coll Radiol)</i> 33:12-14, 2021	10.1016/j.clon.2020.07.014
Abd ElHafeez, et al: An overview on standard statistical methods for assessing exposure-outcome link in survival analysis (Part II): The Kaplan-Meier analysis and the Cox regression method. <i>Aging Clin Exp Res</i> 24:203-206, 2012	10.1007/BF03325249
Tripepi, et al: An overview of standard statistical methods for assessing exposure-outcome link in survival analysis (Part I): Basic concepts. <i>Aging Clin Exp Res</i> 24:109-112, 2012	10.1007/BF03325157
Veen, et al: A clinician's guide for developing a prediction model: A case study using real-world data of patients with castration-resistant prostate cancer. <i>J Cancer Res Clin Oncol</i> 146:2067-2075, 2020	10.1007/s00432-020-03286-8
Dey, et al: Practical overview and reporting strategies for statistical analysis of survival studies. <i>Chest</i> 158:S39-S48, 2020 (suppl 1)	10.1016/j.chest.2020.03.015
Rich, et al: A practical guide to understanding Kaplan-Meier curves. <i>Otolaryngol Head Neck Surg</i> 143:331-336, 2010	10.1016/j.otohns.2010.05.007
Wang and Ji: Sample size estimation in clinical research: From randomized controlled trials to observational studies. <i>Chest</i> 158:S12-S20, 2020 (suppl 1)	10.1016/j.chest.2020.03.010
Dey, et al: A practical overview of case-control studies in clinical practice. <i>Chest</i> 158:S57-S64, 2020 (suppl 1)	10.1016/j.chest.2020.03.009
Bullen: Studies of medical tests: Design and analytical considerations. <i>Chest</i> 158:S103-S112, 2020 (suppl 1)	10.1016/j.chest.2020.03.006
Wang and Kattan: Cohort studies: Design, analysis, and reporting. <i>Chest</i> 158:S72-S78, 2020 (suppl 1)	10.1016/j.chest.2020.03.014
Wang and Cheng: Cross-sectional studies: Strengths, weaknesses, and recommendations. <i>Chest</i> 158:S65-S71, 2020 (suppl 1)	10.1016/j.chest.2020.03.012
Zabor, et al: Randomized controlled trials. <i>Chest</i> 158:S79-S87, 2020 (suppl 1)	10.1016/j.chest.2020.03.013
Hernandez, et al: Meta-analysis. <i>Chest</i> 158:S97-S102, 2020 (suppl 1)	10.1016/j.chest.2020.03.003

their research. Several criteria can be used to find the most suitable journal for a manuscript. This includes multiple indexing on the three recognized databases—Medline, Scopus, and Web of Science—as this may limit the presence of infiltrating predatory journals. The use of the Beall's list can also be useful, but it is not regularly updated as dozens of new predatory journals are launched every month.³⁶ The prestige and the experience of trusted publishers should also be considered as it is rare to have a predatory journal published by a standard academic publisher. Appendix Table A2 shows trusted publishers that place nonfraudulent information regarding indexing/abstracting, impact factor and other metrics, and data on their official web site.

Some measures can be considered by authors to better repair this emerging issue. When their research findings are published accidentally in a predatory journal, they should deposit their article for evaluation by PubMed Central. This database has an initiative to index articles after an internal peer review and therefore, this is highly recommended.³⁷ For more transparency and credibility, articles published in predatory journals can be deposited into social networks such as ResearchGate to enhance postpublication open peer review with the scientific community. At an individual level, authors are compassionately invited to explain why they published their research in predatory journals in their curriculum vitae to enhance the reliability of their academic achievements.³⁸ Their research institutions should also publicly discuss this matter to prevent any other predatory publications in the future (for recommended reading on this topic, refer Appendix Table A3).

Participate in the Open Science Movement

Open access refers to making publication contents freely and openly accessible for readers and authors for reuse under the CC BY 4.0 license.³⁹ The broader term open science is used for a more general movement to disseminate knowledge and improve collaboration between researchers and the public. This framework has been developed worldwide by funders, policymakers, and research institutions to enhance access to research findings. From this perspective, cancer researchers with limited resources may benefit from the *Research4Life* partnership initiative that enables access to peer-reviewed content via a unique public-private partnership between United Nations Agencies, Yale and Cornell Universities, and academic publishers. Participating journals may provide partial or full waivers of article-processing charges according to the World Bank classification. Thus, authors should check the web sites of open-access journals when desiring to publish this way. However, the classification criteria to benefit from this advantage may be deceptive in some cases. As Moroccan young cancer scientists, we can benefit from a 50% waiver but we cannot afford it. Open science has a financial toxicity for oncologists from developing countries as their publications are rarely funded. Therefore, green

open access⁴⁰ should be supported and offered to these authors. Some other national projects such as the publication subsidy (*Programme de Subvention des Publications*) by the *Institut de Recherche sur le Cancer* in Morocco that supports its research associates to pay the charges of open access is a good program that should be developed to progress open science in similar settings. When choosing a subscription-based journal, submitting the draft to preprint servers such as Research Square and medRxiv is recommended for data sharing widely to enhance prepublication and postpublication peer review as well as the open science initiative. However, authors must check the policy of target journals for submission as some of them do not accept such deposition in preprint servers. Recommended preprint servers to be used to enhance transparency and publishing ethics can be found in Table 5. Importantly, there is a disparity related to the access to medical literature between LMICs and developed countries.⁴¹⁻⁴⁴ In keeping with this, several initiatives were developed to provide access to hidden content behind paywalls, including the questionable Sci-Hub project. This service offers free access to a great pirated proportion of articles.⁴⁵⁻⁴⁷ At the same time, licensed and authorized services also exist and can be used by authors from LMICs and those with limited resources to sustainably access research publications. For instance, EndNote Click (formerly Kopernio) is an online tool that can be used by researchers worldwide to search for free articles—related portable document format.⁴⁸ This full-text finder service can be integrated into web browsers to identify freely available article text.^{49,50} Other new tools such as Open Access Button⁵¹ and Unpaywall⁵² with their advantages and disadvantages were nicely discussed elsewhere.⁵⁰

Get Involved in Working Groups and Scientific Social Networking

The use of scientific social networking has recently emerged as a potential approach for professional development and collaboration.⁵³ Integrating social media in modern oncology practice and research is a recent trend that enabled the expansion of working groups to improve patients' care and foster research between oncologists from low-income countries and others from prestigious institutions from the developed world.⁵⁴ This opportunity provides an extremely promising frontier for cancer research without physical barriers. Moreover, this allows easy interaction and communication between oncologists worldwide to enhance second opinions on difficult patients' cases. In this perspective, *The ONCOLLEGE* working group⁵⁵ is a good example of ideas sharing and collective contribution of young oncologists to improve cancer patients' care via the use of social media to discuss cases that need second opinions. This initiative developed by youth working in different fields of oncology has also facilitated the development of several research projects that resulted in publications gathering

TABLE 5. Recommended Preprint Servers and Repositories

Repositories	Website Links
Research Square	https://www.researchsquare.com
medRxiv	https://www.medrxiv.org
bioRxiv	https://www.biorxiv.org
Authorea	https://www.authorea.com/browse-open-science-articles
Engage	https://www.cambridge.org/engage/coe/submission-information
OpenDOAR	https://v2.sherpa.ac.uk/opensoar
SSRN	https://www.ssrn.com/index.cfm/en
OSF Preprints	https://osf.io/preprints
AfricArXiv	https://info.africarxiv.org/fr
AMRC Open Research	https://amrcopenresearch.org
Sage Advance	https://advance.sagepub.com
SciELO Preprints	https://preprints.scielo.org/index.php/scielo
HRB Open Research	https://hrbopenresearch.org

Abbreviations: AMRC, Association of Medical Research Charities; HRB, Health Research Board; OSF, Open Science Framework; SSRN, Social Science Research Network.

international authors together.⁵⁶⁻⁶⁰ Notably, The International Immuno-Oncology Biomarker Working Group on Breast Cancer played a pivotal role in bringing clinicians and scientists to work together and improve cancer care through cooperation.⁶¹ This working group has published several impactful papers on the implementation of tumor-infiltrating lymphocytes in settings with limited resources as a surrogate for programmed death-ligand 1 testing in breast cancer.⁶²⁻⁶⁶ Other similar works and initiatives were also successful in providing practice changes through networking.⁶⁷ These conceptual models are valuable for integrated care delivery and interorganizational collaboration.⁶⁸ Despite these ideas being in early proof-of-concept stages, young oncologists are encouraged to enthusiastically participate in this movement to boost their career. Oncology is an active and a rapidly evolving field that requires collaboration and taking an active role in shaping its future. Moreover, peer networking and regional collaboration between oncologists in LMICs should also be considered to develop research affecting outcomes as they share similar issues related to cancer control. This will certainly help establishing durable long-term research initiatives.

Memberships in international oncologic societies such as ESMO and ASCO is highly recommended as they offer various travel grants, training programs, and support for oncologists to better manage patients with cancer and advance research on cancer. Interested oncologists can benefit from free or low fees of membership and enjoy various benefits to make their career in oncology better. A recommended list of working groups, international and recognized cancer organizations, and societies can be found in Appendix Table A4. They can be consulted regularly to explore education and training opportunities for young oncologists.

Apply for Funding Opportunities, Fellowships, and Grants

Cancer research in countries with a high income is predominantly sponsored by the pharmaceutical industry that addresses financial interests. Moreover, funding agencies play an important role in the performance of research institutes in these settings. The development of these human and funding capacities in high-income countries has generated outstanding improved outcomes that we have seen in the past few years. In LMICs, as mentioned above, lack of skilled researchers and motivation to conduct research as well awareness of the impact of the real-world studies are the significant factors affecting cancer research.^{5,6} Financial barriers for conducting clinical trials and other types of oncology research are additional factors that are negatively associated with the poor productivity of scientific publications that affect patients' outcomes in under-resourced settings.^{5,6} Promisingly, various initiatives are available to authors in LMICs to fund their research and boost their career. This encompasses fellowships, grants, and other funding opportunities from international organizations and scientific oncology societies. A good and illustrative example is the Conquer Cancer, an ASCO foundation, which offers several funding opportunities and awards to cancer researchers that cover various cancer settings for oncologists from all over the world. To benefit from these funding projects, oncologists from LMICs should apply for memberships as this is a requirement for submitting their proposals. A useful list of web site links to these opportunities can be found in Table 6. Importantly, most of these funding agencies require a prior writing of grant research proposals. Therefore, young oncologists should have the skills and guidance for successful research grant and fellowship applications. In this regard, various papers addressing recommendations for grant and research proposal writing were published to guide these scientists.⁶⁹⁻⁷⁷ Notably, this also usually needs English language skills when writing proposals. English has long been the dominant language in scientific writing and publishing. Nearly all oncology journals publish in English, and those with other languages such as French are currently switching to it. Learning English and scientific writing earlier in the career of oncologists is anticipated to create the environment for fostering international collaboration and publishing excellence. Native languages should be reserved for the popularization of science and are needed for communication with the public as well as patients with cancer. Useful links for developing scientific writing skills can be found in the Equator Network initiative.⁷⁸

Learn Peer Review

The peer-review system plays a central role in maintaining the high standards of scientific research and academic publishing. This process evaluates research and literature-based findings for originality, significance, quality, and impact on clinical practice.^{79,80} The duration of peer review varies significantly between publishers and academic

TABLE 6. Useful Links for Finding Funding Opportunities and Fellowships

Opportunities	Website Links
ASCO Conquer Cancer Foundation and Career Development	https://www.asco.org/career-development/grants-awards/funding-opportunities https://www.asco.org/career-development/grants-awards https://www.asco.org/career-development/trainee-fellow-resources https://careercenter.asco.org/
Funding opportunities from the AACR	https://www.aacr.org/professionals/research-funding/current-funding-opportunities/
ESMO training and funding opportunities	https://www.esmo.org/research/research-funding-opportunities https://www.esmo.org/career-development
UICC fellowships and grants	https://www.uicc.org/what-we-do/capacity-building/fellowships https://www.uicc.org/news/apply-research-grant
Grants of the ACS	https://www.cancer.org/research/we-fund-cancer-research/apply-research-grant.html
AORTIC training opportunities	https://aortic-africa.org/education-training-committee/
NCI fellowships and grants	https://cancercontrol.cancer.gov/about-dccps/fellowship-opportunities https://www.cancer.gov/grants-training/training/at-nci https://ccr.cancer.gov/training/trainee-resources/funding-opps
Fellowships and training programs at Dana-Farber Cancer Institute	https://www.dana-farber.org/for-physicians/education-and-training/fellowships-and-training-programs/
EACR fellowships	https://www.eacr.org/travel-fellowships
Memorial Sloan Kettering Cancer Center	https://www.mskcc.org/hcp-education-training/fellowships/search
Other opportunities	https://meyercancer.weill.cornell.edu/research/funding-opportunities https://euraxess.ec.europa.eu/worldwide/south-korea/find-your-phd-opportunity-europe https://www.findapostdoc.com/ https://www.findaphd.com/ https://www.postgraduatefunding.com/ https://www.nature.com/naturecareers/jobs/science-jobs https://www.research-in-germany.org/en/research-funding.html https://www.cancerresearchuk.org/funding-for-researchers https://jobs.sciencecareers.org/

Abbreviations: AACR, American Association for Cancer Research; ACS, American Cancer Society; AORTIC, African Organisation for Research and Training in Cancer; EACR, European Association for Cancer Research; ESMO, European Society for Medical Oncology; NCI, National Cancer Institute; UICC, International Union Against Cancer.

journals and may be lengthy. This very long process is because of the voluntary aspect of peer reviewers and associate editors. Access of early-career oncologists to peer review is challenging as training to develop this expertise is not included in their residency and research programs. Moreover, reviewing requires mentorship, specific instructions, experience in publishing, biostatistics, and clinical research methods. Currently, several web-based initiatives and resources were developed to help young investigators and are accessible worldwide for free (Appendix Table A5). A good example of these opportunities is the Publons Academy certified training program.⁸¹ This platform aimed to train young scientists the essential skills required for peer review by 10 modules and active mentorship by a qualified reviewer and scientific experts in the field of the participants. This is expected to foster the career of young oncologists to build proficient talents in their research field. Skilled peer reviewers may be invited by journals to be associate editors. This is a required competency for those desiring to develop academic journals for their local settings.

Do Not Be the Last to Know About the Latest News in Cancer Research

Oncology research is evidently a greatly active field with remarkable interventional and observational clinical trials

that release on-fire findings every week. This outstanding cancer research has a powerful and direct impact on patients' survival and outcomes. Summary and expert discussion on practice-changing clinical research is provided by various trusted educational platforms and companion web sites of international societies and organizations that were created to deliver the latest news in oncology. A number of these services can be found in Appendix Table A6. Educational portals for oncologists, such as The ASCO Post, the ESMO News/OncologyPRO, the *ecancer*, and also the ASCO Communications, which provide oncology news allow readers to be up to date with the latest developments that influence daily practice by newsletters and interacts with their authors. An illustrative example of these good free online initiatives is *ecancer*.⁸² This resource presents updated and free-of-charge knowledge on all areas of cancer research to meet global oncology needs. *Ecancer* publishes open research and research news, shares video resources and insights from covered conferences, provides continuing medical education–accredited e-learning in multiple languages, and provides free or low-cost in-person educational training across the globe. This initiative also offers education for patients with cancer through its program *ecancerpatient.org* intended to simplify oncology news and information in a friendly format.

Be Involved in Blogging, Volunteering, and Simplifying the Oncologic Sciences for the Public and Undergraduate Students

Blogging in oncology is a relatively recent extracurricular activity. It permitted to several oncologists and patients' advocates individual sharing of authors' perspectives and opinions on emerging concerns in oncology such as access to treatments, financial toxicities of novel drugs, governmental policies, supportive care, and issues in clinical trials that are not covered by traditional peer-reviewed academic journals. Blogging has a potent impact on improving patients' care by attracting a general audience that may increase awareness of current issues in oncology globally. Various platforms for blogging are available for all oncologists worldwide to share their ideas and interact with the oncology community. The ASCO Connection is a good example of a free successful blogging platform that can be used by early-career oncologists to issue their thoughts.⁸³

Volunteering in offering care, patients' education, preventive consultations, and popularization of cancer sciences provide an opportunity for young oncologists to build leadership and soft skills. Therefore, these future leaders will expectedly be competent at accurately speaking to the public and attracting decision makers and policymakers to respond to the needs of their oncology settings. Importantly, a shortage of cancer specialists is an emerging issue that needs to be addressed in developing countries. Involving undergraduate medical students in cancer research projects earlier during their career is a good initiative to attract them to this stunning specialty. Furthermore, attracting

more students to oncologic sciences to prepare the future workforce can be achieved by early exposure to these specialties during their graduate training.⁸⁴ Notably, organizing courses on the basics of oncology for medical students to enhance the scientific interaction with senior oncologists seems to be promising.⁸⁵ Oncology is a rapidly evolving field in which they can practice EBM and research compared with other medical specialties. Also, national societies should engage these students in internships and courses to make a career in oncology to boost the number of oncologists and respond to the increasing need for skilled care physicians.

CONCLUSION

Authors in countries with limited resources doing research on this pivotal medical field still need training and support to advance cancer research in their settings. To date, little is known about the capacity of cancer researchers, including oncologists in conducting accurate research to meet the needs for appropriate studies and actionable data for cancer burden control. Further bibliometric investigations on research outputs of oncologists from LMICs are required and awaited. This will hopefully bridge the gap of clinical research that affects patients' outcomes in these settings. Moreover, this will address the current challenges that health care professionals face in these countries by implementing better evidence-based programs and recommendations for best practices. We hope that this paper will provide useful information and guidance for cancer researchers from developing countries to boost their career.

AFFILIATIONS

¹Department of Medical Oncology, Mohammed VI University Hospital, Oujda, Morocco

²Faculty of Medicine and Pharmacy, Mohammed Ist University, Oujda, Morocco

CORRESPONDING AUTHOR

Khalid El Bairi, MD, Department of Medical Oncology, Mohammed VI University Hospital, BP 4806 Oujda Universite 60049, Oujda, Morocco; e-mail: k.elbairi@ump.ac.ma.

DISCLAIMER

The contents of this paper reflect the authors' perspectives and not of their institutions of affiliation. For transparency and research ethics, the plagiarism report using Turnitin service can be found in the Data Supplement.

AUTHOR CONTRIBUTIONS

Conception and design: Khalid El Bairi, Said Afqir

Collection and assembly of data: Khalid El Bairi, Ouissam Al Jarroudi

Manuscript writing: All authors

Final approval of manuscript: All authors

Accountable for all aspects of the work: All authors

AUTHORS' DISCLOSURES OF POTENTIAL CONFLICTS OF INTEREST

The following represents disclosure information provided by authors of this manuscript. All relationships are considered compensated unless otherwise noted. Relationships are self-held unless noted. I = Immediate Family Member, Inst = My Institution. Relationships may not relate to the subject matter of this manuscript. For more information about ASCO's conflict of interest policy, please refer to www.asco.org/rwc or ascopubs.org/go/authors/author-center.

Open Payments is a public database containing information reported by companies about payments made to US-licensed physicians ([Open Payments](http://OpenPayments)).

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APPENDIX

TABLE A1. Recommended Reading

References	DOI
Govindarajan R, Narayanaswami P: Evidence-based medicine for every day, everyone, and every therapeutic study. <i>Muscle Nerve</i> 58:486-496, 2018	10.1002/mus.26142
Djulgovic B, Guyatt GH: Progress in evidence-based medicine: a quarter century on. <i>Lancet</i> 390:415-423, 2017	10.1016/S0140-6736(16)31592-6
Chow N, Gallo L, Busse JW: Evidence-based medicine and precision medicine: Complementary approaches to clinical decision-making. <i>Prec Clin Med</i> 1:60-4, 2018	10.1093/pccmedi/pby009
Gyawali B, de Vries EGE, Dafni U, Amaral T, et al: Biases in study design, implementation, and data analysis that distort the appraisal of clinical benefit and ESMO-Magnitude of Clinical Benefit Scale (ESMO-MCBS) scoring. <i>ESMO Open</i> 6:100117, 2021	10.1016/j.esmoop.2021.100117
Janiaud P, Serghiou S, Ioannidis JPA: New clinical trial designs in the era of precision medicine: An overview of definitions, strengths, weaknesses, and current use in oncology. <i>Cancer Treat Rev</i> 73:20-30, 2019	10.1016/j.ctrv.2018.12.003
Tao JJ, Schram AM, Hyman DM: Basket studies: Redefining clinical trials in the era of genome-driven oncology. <i>Annu Rev Med</i> 69:319-331, 2018	10.1146/annurev-med-062016-050343

TABLE A2. Nonexhaustive List of Trusted Academic Publishers of Oncology Journals

Publisher	Web Site/Bibliographic Database
Springer Nature	https://www.springernature.com/gp https://link.springer.com/ https://www.nature.com/ https://www.biomedcentral.com/
Elsevier	https://www.sciencedirect.com/ https://www.elsevier.com/en-xm https://www.cell.com/ https://www.em-consulte.com/ https://www.scopus.com
AACR Journals	http://aacrjournals.org/
PLoS	https://www.plos.org/
Taylor and Francis	https://www.tandfonline.com/
Wiley	https://onlinelibrary.wiley.com/
Oxford University Press	https://academic.oup.com/journals
Hindawi	https://www.hindawi.com/
BMJ	https://www.bmj.com/
Wolters Kluwer	https://journals.lww.com/pages/default.aspx
Karger	https://www.karger.com/
SAGE Publishing	https://uk.sagepub.com/en-gb/afr/journals
Frontiers Media	https://www.frontiersin.org/
Future Medicine	https://www.futuremedicine.com/

Abbreviation: AACR, American Association for Cancer Research.

TABLE A3. Recommended Reading on Predatory Journals

References	DOI
For English-speaking readers	
Memon AR: Predatory journals spamming for publications: What should researchers do? <i>Sci Eng Ethics</i> 24:1617-1639, 2018	https://dx.doi.org/10.1007/s11948-017-9955-6
Beall J: Best practices for scholarly authors in the age of predatory journals. <i>Ann R Coll Surg Engl</i> 98:77-79, 2016	https://dx.doi.org/10.1308%2Frcsann.2016.0056
For French-speaking readers	
Laccourreye O, et al: Les revues prédatrices à l'assaut de la presse médicale scientifique. <i>Ann Fr Otorhinolaryngol Path Cervicofac</i> 135:40-42, 2018	https://doi.org/10.1016/j.aforl.2017.07.001
Tulandi T, Balayla J: Revues prédatrices et réunions bidon. <i>J Obstet Gynaecol Can</i> 41:581-583, 2019	https://doi.org/10.1016/j.jogc.2019.03.009
For Spanish-speaking readers	
Bertoglia AMP, Águila AA: Revistas depredadoras: una nueva amenaza a las publicaciones científicas. <i>Rev Med Chil</i> 146:206-212, 2018	http://dx.doi.org/10.4067/s0034-98872018000200206
Dal-Ré R: Publicaciones en revistas potencialmente depredadoras. <i>An Pediatr (Barc)</i> pii: S1695-4033(19)30027-X, 2019	https://doi.org/10.1016/j.anpedi.2019.01.010

TABLE A4. List of Working Groups, International and Recognized Cancer Organizations, and Societies

Organization or Center	Website Links
ESMO	https://www.esmo.org
ASCO	https://www.asco.org
AACR	https://www.aacr.org
UICC	https://www.uicc.org
EACR	https://www.eacr.org
European Organisation for Research and Treatment of Cancer	https://www.eortc.org
International Immuno-Oncology Biomarker Working Group on Breast Cancer	https://www.tilsinbreastcancer.org
American Institute for Cancer Research	https://www.aicr.org
Cancer Research UK	https://www.cancerresearchuk.org
Memorial Sloan Kettering Cancer Center	https://www.mskcc.org
MD Anderson Cancer Center	https://www.mdanderson.org
NIH National Cancer Institute	https://www.cancer.gov
The British Association for Cancer Research	https://www.bacr.org.uk
Cancer research working groups by cancer type	https://www.esmo.org/research/research-groups-tools-and-database/Cancer-research-groups-by-type
Other links of national and international organizations	http://www.cancerindex.org/clinks7.htm

Abbreviations: AACR, American Association for Cancer Research; EACR, European Association for Cancer Research; ESMO, European Society for Medical Oncology; NIH, National Institutes of Health; UICC, Union for International Cancer Control.

TABLE A5. Currently Available Free Peer-Review Training Courses, Resources, and Webinars

Resource	Website Links
Publons Academy ^a	https://publons.com/academy/
Wiley Author Learning and Training Channel	https://authorservices.wiley.com/author-resources/Journal-Authors/Prepare/webinars/index.html
The EASE Training	http://www.ease.org.uk/publications/peer-reviewer-toolkit/training/
Nature MasterClasses Training	https://masterclasses.nature.com/users/4925-claire-hodge/posts/20006-free-online-course-on-peer-review
ACS Reviewer Lab ^a	https://www.acsreviewerlab.org/
BMJ Training Material	https://www.bmj.com/about-bmj/resources-reviewers/training-materials
Elsevier Researcher Academy	https://researcheracademy.elsevier.com/navigating-peer-review/fundamentals-peer-review
Equator-Network Peer-review Toolkit ^a	http://www.equator-network.org/toolkits/peer-reviewing-research/peer-review-training-and-resources/

NOTE. For more information on peer-review, see <https://www.elsevier.com/reviewers/what-is-peer-review>.

Abbreviations: ACS, American Cancer Society; EASE, European Association of Science Editors.

^aHighly recommended.

TABLE A6. Trusted Web Sites and Online Resources of Cancer Research News

Resource	Website Links
ASCO Post	http://ascopost.com
Medscape	https://www.medscape.com/oncology
Prime Oncology	https://www.primeoncology.org
E-Cancer	https://ecancer.org
OncLive	https://www.onclive.com
OncNet	https://www.oncnet.com
ESMO Oncology News	https://www.esmo.org/Oncology-News
EurekAlert	https://www.eurekalert.org/cancer/news/
Cancer.org	https://www.cancer.org/latest-news.html
CancerResearchUK	https://www.cancerresearchuk.org/about-us/cancer-news
GenomeWeb	https://www.genomeweb.com/
PracticeUpdate	https://www.practiceupdate.com/explore/
CancerNetwork	https://www.cancernetwork.com/
2MinuteMedicine	https://www.2minutemedicine.com/category/all/cancer/
TargetedOnc	https://www.targetedonc.com/
Oncology Central	https://www.oncology-central.com/
The Scientist	https://www.the-scientist.com

Abbreviation: ESMO, European Society for Medical Oncology.