Creative Approaches to Global Cancer Research and Control

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editorials

Introduction

Cancer is a significant source of morbidity and mortality globally, but the burden is greater in low- and middle-income countries (LMICs), which together account for > 70% of the nearly 20 million annual incident cancers. Increasing life expectancy, advancements in human development, and the adoption of a westernized lifestyle are contributing to a rapidly growing cancer epidemic in LMICs.[1-4] These trends highlight the urgency and importance of developing "Creative Approaches to Global Cancer Research and Control," the theme of the 8th Annual Symposium on Global Cancer Research (ASGCR). This meeting was scheduled to convene on April 17, 2020, in Washington, DC, but had to be postponed because of the SARS-CoV2 pandemic—a potent reminder of the need for and the value of a global approach to health and diseases, including cancer.

Creative approaches from individual researchers and collaborative and transdisciplinary teams, complemented by cancer societies and both governmental and nongovernmental organizations, are needed to move the global oncology field forward. Such approaches include innovative study designs, methods, and technologies plus improvements in training and curricula and expanded platforms for networking and virtual interactions that take into account the realities of high-, middle-, and low-resource settings.[5-7] Many of these approaches, which we planned to discuss at the ASGCR, have the potential to narrow the cancer disparities between high-income countries and LMICs by lowering costs and improving access or quality of screening, early detection, diagnosis, and treatment.

The 8th ASGCR steering committee, which comprises leaders from National Cancer Institute (NCI)–accredited cancers centers in the Baltimore-Washington area, ASCO, the American Association of Cancer Research, and NCI, along with researchers and practitioners who registered for the meeting are a paradigmatic example of multiple stakeholder engagement. Such engagement is required to brainstorm on the research, implementation and dissemination, and methods and technologies that either are available or need to be developed for successful global cancer control. Together, innovation and collaboration will be essential in pushing forward an agenda to recognize and combat the global burden of cancer.

Current Research on Creative Approaches

Technological approaches. Prevention, early detection, and treatment depend on a range of technologies, some of which are not currently used in LMICs because of cost, limited medical and public infrastructure, and trained personnel. Emerging point-of-care technologies (POCTs) promise to revolutionize care delivery in such settings. Attractive features of POCTs include lower cost, increased durability, and more streamlined approaches that are useful to providers who practice outside traditional clinical settings.[8] Advances in engineering and test chemistry have enabled the detection of sophisticated biomarkers on small, portable platforms that require minimal training to use. These advances have led to high-quality home-based testing or self-testing, which extends the impact from the clinic into the community.[9]

Because 95% of the global population is covered by mobile networks, mobile health (mhealth) continues to be one of the most promising avenues for providing access to health services.[10] In parallel, the emergence of mHealth 2.0, including connectivity to wearables and the Internet of things, has led to a glut of new health data in high-resource settings.[11] This creates unique research opportunities and challenges for LMICs, where gaps persist in availability of these technologies, their infrastructural requirements, and personnel needed to implement them. Looking forward, increased broadband Internet coverage will further enable telementoring, telemedicine, and telepathology, while 5G networks promise a reduction in latency that could enable real-time educational, research, and clinical interventions from halfway around the world.

The speed and capability of computers continue to grow, and this has driven innovative applications of machine learning and artificial intelligence (MLAI) for development of high-quality computer-assisted cancer detection and diagnosis that can be implemented with little training. Nevertheless, significant implementation barriers exist in LMICs, including a lack of reliable local data to train and validate AI systems, a limited trained workforce, and the lack of regulatory capacity to oversee and manage MLAI.[12] These barriers notwithstanding, progress has been made in the use of

MLAI in medical physics, where researchers are developing MLAI tools to automate dose planning for radiation treatment, and in cervical cancer, where deep learning shows some initial promise for revolutionizing screening in community settings.[13,14]

Methodological approaches. While much attention has been paid to novel technologies such as AI, nanotechnology, and omics, the development of creative approaches to their evaluation and integration into existing cancer prevention and research strategies is equally, if not more, important.[15-19] These methodologies include the collection of a broad range of lifestyle data, including comprehensive daily physical activities, dietary intakes, environmental exposures, and physiologic parameters, through wearable and mHealth technologies; deployment of novel clinical trial designs; and wider adoption of observational epidemiology methods that engage big data, bioinformatics, and biostatistics for integrative epidemiology, systems epidemiology, and phenome-wide association studies.[20-35] Innovations in the development and use of open source tools and rapidly growing social and economic infrastructure will support implementation of these innovative research and management programs that can inform local cancer prevention and management efforts.[36-41] Engagement of novel implementation and dissemination science toolkits and multidisciplinary collaborations that engage the best team science methods have great potential to rapidly translate new knowledge into cancer public health policies and practice.[42-48]

Training, infrastructure, and funding approaches. Formal changes to oncology curricula to include global oncology are needed to enable the development of necessary skills. Furthermore, there is need for new or expanded networks of physicians, scientists, and institutions that would foster development, research, implementation, and communication of successful creative approaches globally. In-person and virtual meetings to foster understanding of resources settings can enable the development and deployment of effective solutions regardless of the resource levels and the creation of global inventories of successful global cancer control and treatment strategies.[49,50]

Funding opportunities have increased worldwide for global oncology over the past few decades, and cancer societies have played an important role in garnering support for expanded funding. Several grant mechanisms now exist that are dedicated to this area of research. As stated in a recent National Institutes of Health study, there has been a substantial increase in global oncology research and training conducted by NCI-designated cancer centers, and much of this work is happening in LMICs.[51] This progress has created a structured funding pathway for global oncology specialists and will pave the way for the development of new and more-effective strategies to improve equitable access to cancer control and treatment in all resource settings. In contrast, there is limited funding to support LMICs to scale up successful cancer control and treatment interventions similar to the President's Emergency Program for AIDS Relief or the Global Fund to Fight AIDS, Tuberculosis and Malaria. Efforts to integrate HIV and noncommunicable disease treatment and prevention programs have met with limited success. Resolution of these challenges is bound to rise to the top of the global oncology agenda going forward.

In conclusion, these are exciting and challenging times for global oncology. Never before has such a range of tools—from enabling technologies to novel study designs and big data approaches—been available to bring to bear on the problems of cancer prevention and control. The SARS-CoV2 pandemic raises new challenges for the global oncology community to develop innovative approaches to collaboration, communication, and implementation virtually and effectively over long distances. Our past successes in global oncology have been recognized in previous conferences, whereas the present conference offered an opportunity to tell new and compelling stories that highlight progress in the global effort to reduce the burden of cervical cancer, the development and implementation of new educational curricula in LMICs, and innovative approaches to improve quality and access to radiotherapy in LMICs, to name but a few examples. It is our hope that the global oncology community will come together to resolutely face the post–COVID-19 world and continue to develop creative and innovative approaches to global cancer control, treatment, and research. Our field is poised to emerge stronger than ever and renewed in our resolve to foster increasing equity across the globe. Our future conferences will disseminate the progress we will make.

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REFERENCES

1. Bray F: The evolving scale and profile of cancer worldwide: Much ado about everything. Cancer Epidemiol Biomarkers Prev 25:3-5, 2016

2. Bray F, Jemal A, Grey N, et al: Global cancer transitions according to the Human Development Index (2008-2030): A population-based study. Lancet Oncol 13:790-801, 2012

3. Torre LA, Siegel RL, Ward EM, et al: Global cancer incidence and mortality rates and trends--An update. Cancer Epidemiol Biomarkers Prev 25:16-27, 2016

4. Bray F, Soerjomataram I: The changing global burden of cancer: Transitions in human development and implications for cancer prevention and control, in Gelband H, Jha P, Sankaranarayanan R, et al (eds): Cancer: Disease Control Priorities, Third Edition (Volume 3). Washington, DC, The International Bank for Reconstruction and Development/The World Bank, 2015, pp 23-44

5. Dittrich C, Kosty MP, Jezdic S, et al: Global curriculum edition 2016: European Society for Medical Oncology/American Society of Clinical Oncology recommendations for training in medical oncology. J Clin Oncol 35:254-255, 2017

6. Hortobagyi GN, Pyle D, Cazap EL, et al: American Society of Clinical Oncology's Global Oncology Leadership Task Force: Findings and actions. J Glob Oncol 10.1200/JGO.17.00060

7. Beaglehole R, Bonita R: What is global health? Glob Health Action 3, 2010

8. Haney K, Tandon P, Divi R, et al: The role of affordable, point-of-care technologies for cancer care in low- and middle-income countries: A review and commentary. IEEE J Transl Eng Health Med 5:2800514, 2017

9. Jani IV, Peter TF: How point-of-care testing could drive innovation in global health. N Engl J Med 368:2319-2324, 2013

10. International Telecommunications Union: mHealth for NCD - BeHe@lthy BeMobile, 2020. https://www.itu.int/en/ITU-D/ICT-Applications/Pages/mhealth-for-ncd-behealthy-bemobile.aspx

11. Istepanian RSH, Al-Anzi T: m-Health 2.0: New perspectives on mobile health, machine learning and big data analytics. Methods 151:34-40, 2018

12. Mehta MC, Katz IT, Jha AK: Transforming global health with AI. N Engl J Med 382:791-793, 2020

13. Kisling K, Zhang L, Simonds H, et al: Fully automatic treatment planning for external-beam radiation therapy of locally advanced cervical cancer: A tool for low-resource clinics. J Glob Oncol 10.1200/JGO.18.00107

14. Hu L, Bell D, Antani S, et al: An observational study of deep learning and automated evaluation of cervical images for cancer screening. J Natl Cancer Inst 111:923-932, 2019

15. Murillo R, Robles C: Research needs for implementing cancer prevention and early detection in developing countries: From scientists' to implementers' perspectives. BioMed Res Int 2019:9607803, 2019

16. Nipp RD, Hong K, Paskett ED: Overcoming barriers to clinical trial enrollment. Am Soc Clin Oncol Educ Book 39:105-114, 2019

17. Schmidt W-P: Randomised and non-randomised studies to estimate the effect of community-level public health interventions: Definitions and methodological considerations. Emerg Themes Epidemiol 14:9, 2017

18. Trimble EL, Rajaraman PL, Chao A, et al: Need for national commitments to cancer research to guide public health investment and practice, in Gelband H, Jha P, Sankaranarayanan R, et al (eds): Cancer: Disease Control Priorities, Third Edition (Volume 3). Washington, DC, The International Bank for Reconstruction and Development/The World Bank, 2015, pp 249-262

19. Lippman SM, Abate-Shen C, Colbert Maresso KL, et al: AACR white paper: Shaping the future of cancer prevention - a roadmap for advancing science and public health. Cancer Prev Res (Phila) 11:735-778, 2018

20. Spitz MR, Caporaso NE, Sellers TA: Integrative cancer epidemiology--The next generation. Cancer Discov 2:1087-1090, 2012

21. Meyer A-M, Olshan AF, Green L, et al: Big data for population-based cancer research: The integrated cancer information and surveillance system. N C Med J 75:265-269, 2014

22. Kantarjian H, Yu PP: Artificial intelligence, big data, and cancer. JAMA Oncol 1:573-574, 2015

23. Cannon C: Telehealth, mobile applications, and wearable devices are expanding cancer care beyond walls. Semin Oncol Nurs 34:118-125, 2018

24. Cox SM, Lane A, Volchenboum SL: Use of wearable, mobile, and sensor technology in cancer clinical trials. JCO Clin Cancer Inform 10.1200/CCI.17.00147

25. Harris J, Cheevers K, Armes J: The emerging role of digital health in monitoring and supporting people living with cancer and the consequences of its treatments. Curr Opin Support Palliat Care 12:268-275, 2018

26. Pelaz B, Alexiou C, Alvarez-Puebla RA, et al: Diverse applications of nanomedicine. ACS Nano 11:2313-2381, 2017

27. Welk GJ, Bai Y, Lee JM, et al: Standardizing analytic methods and reporting in activity monitor validation studies. Med Sci Sports Exerc 51:1767-1780, 2019

28. Lungu II, Grumezescu AM, Volceanov A, et al: Nanobiomaterials used in cancer therapy: An Up-To-Date overview. Molecules 24:E3547, 2019

29. Norouzi M, Amerian M, Amerian M, et al: Clinical applications of nanomedicine in cancer therapy. Drug Discov Today 25:107-125, 2020

30. Singh R: Nanotechnology based therapeutic application in cancer diagnosis and therapy. 3 Biotech 9:415, 2019

31. Zhang Y, Li M, Gao X, et al: Nanotechnology in cancer diagnosis: Progress, challenges and opportunities. J Hematol Oncol 12:137, 2019

32. Ildstad ST, Evans CH Jr: Small Clinical Trials: Issues and Challenges. Washington, DC, National Academies Press, 2001

33. Cornu C, Kassai B, Fisch R, et al: Experimental designs for small randomised clinical trials: An algorithm for choice. Orphanet J Rare Dis 8:48, 2013

34. Pendergrass SA, Brown-Gentry K, Dudek SM, et al: The use of phenome-wide association studies (PheWAS) for exploration of novel genotype-phenotype relationships and pleiotropy discovery. Genet Epidemiol 35:410-422, 2011

35. Khoury MJ, Lam TK, Ioannidis JP, et al: Transforming epidemiology for 21st century medicine and public health. Cancer Epidemiol Biomarkers Prev 22:508-516, 2013

36. Rance B, Canuel V, Countouris H, et al: Integrating heterogeneous biomedical data for cancer research: The CARPEM infrastructure. Appl Clin Inform 7:260-274, 2016

37. Lau JW, Lehnert E, Sethi A, et al: The Cancer Genomics Cloud: Collaborative, reproducible, and democratized—A new paradigm in large-scale computational research. Cancer Res 77:e3-e6, 2017 [Erratum: Cancer Res 78:5179, 2018]

38. Mendy M, Caboux E, Sylla BS, et al: Infrastructure and facilities for human biobanking in low- and middle-income countries: A situation analysis. Pathobiology 81:252-260, 2014

39. Özdemir V, Badr KF, Dove ES, et al: Crowd-funded micro-grants for genomics and "big data": An actionable idea connecting small (artisan) science, infrastructure science, and citizen philanthropy. OMICS 17:161-172, 2013

40. Pearlman PC, Divi R, Gwede M, et al: The National Institutes of Health Affordable Cancer Technologies program: Improving access to resource-appropriate technologies for cancer detection, diagnosis, monitoring, and treatment in low-and middle-income countries. IEEE J Transl Eng Health Med 4:2800708, 2016

41. Pesec M, Sherertz T: Global health from a cancer care perspective. Future Oncol 11:2235-2245, 2015

42. Gonzales R, Handley MA, Ackerman S, et al: A framework for training health professionals in implementation and dissemination science. Acad Med 87:271-278, 2012

43. Bennett LM, Gadlin H, Marchand C. Collaboration Team Science: Field Guide. Bethesda, MD, National Cancer Institute, 2018

44. Sullivan R: Putting public health back into the global cancer agenda. Ann Oncol 23:2995-2996, 2012

45. Abed J, Reilley B, Butler MO, et al: Developing a framework for comprehensive cancer prevention and control in the United States: An initiative of the Centers for Disease Control and Prevention. J Public Health Manag Pract 6:67-78, 2000

46. Brownson RC, Fielding JE, Maylahn CM: Evidence-based public health: A fundamental concept for public health practice. Annu Rev Public Health 30:175-201, 2009

47. Colditz GA: Disseminating research findings into public health practice. Cancer Causes Control 13:503-504, 2002

48. Rositch AF, Unger-Saldaña K, DeBoer RJ, et al: The role of dissemination and implementation science in global breast cancer control programs: Frameworks, methods, and examples. Cancer, 126 (Suppl 10):2394-2404, 2020

49. El Saghir NS, Farhat RA, Charara RN, et al: Enhancing cancer care in areas of limited resources: Our next steps. Future Oncol 10:1953-1965, 2014

50. The Lancet Oncology: COVID-19: Global consequences for oncology. Lancet Oncol 21:467, 2020

51. Abudu RM, Cira MK, Pyle DHM, et al: Landscape of global oncology research and training at National Cancer Institute-designated cancer centers: Results of the 2018 to 2019 Global Oncology Survey. J Glob Oncol 10.1200/JGO.19.00308

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