Sudan: current conflict, cancer care, and ripple effects on the region

The collapse of cancer services in Khartoum and many parts of Sudan since the eruption of the war in April, 2023, left thousands of Sudanese patients and those who come from neighbouring countries without care. Sudan, despite challenges, had achieved considerable strides in delivering cancer services, boasting one of the oldest cancer centres in Africa with most oncologists practising in Sudan having trained locally. Progress has been made in the decentralisation of cancer services with the establishment of several provincial cancer centres outside Khartoum.[1] Two centres, in Wad Medani and Merowe, provide radiotherapy although at a much more limited capacity than that of Khartoum. Other centres provide chemotherapy and a mostly partial array of cancer surgeries and diagnostics, such as those located in Shendi, El Obeid, El-Gadarif, Nyala, and El-Fasher. Decentralisation has enabled the sharing of services during the ongoing conflict, with patients being sent to provincial centres and attempts made to upscale these centres to meet the demand. Many internally displaced oncology professionals are engaged in providing services to help with the increasing pressure on the provincial centres. Sudanese oncologists have worked hard in the past few weeks to coordinate the delivery of services in the absence of central command from the Ministry of Health. Although provincial cancer centres have substantial capacity challenges, they have provided crucial options for cancer patients, especially those needing immediate care. The model attests to the importance of the decentralisation of services in low-income and middle-income countries and the importance of local training.

Sudan is also a major destination for cancer treatment for surrounding African countries. Sudan shares borders with seven countries, six of which have conflicts and fragile health systems. The disruption of cancer services in Sudan is a major blow to cancer services in the entire region.

Challenges cited by Sudanese oncologists include: a dwindling supply of cancer medicines and pain medications because of disruption to the supply chain; the difficulty of travel for cancer patients because of skyrocketing transportation costs and unsafe routes; a looming shortage of health-care workers because of security concerns, unpaid salaries, and leaving Sudan to flee conflict; and a substantial reduction in radiotherapy capacity given the collapse of services in Khartoum.

The current war in Sudan is intimately linked to the international, global power struggle, with competition for Red Sea ports, especially since the Ukraine war; competition for minerals and gold; and the destabilisation of whole regions in low-income and middle-income countries due to a climate change that these countries had little share in causing. The international community should respond swiftly to this crisis because it affects not only Sudan, but also neighbouring countries that are traditionally, for geopolitical reasons, excluded from attention. Sudanese patients with cancer should be afforded the same degree of mobilisation as seen in the programmes initiated for Ukrainian and Syrian patients with cancer.[2–4] Concerted efforts are needed.

We declare no competing interests.

Nazik Hammad, Rehab Ahmed
nazik.hammad@utoronto.ca

St Michael's Hospital, University of Toronto, Toronto, ON M5B 1W8, Canada (NH); Khartoum Oncology Hospital, Khartoum, Sudan (RA)

1 Maki HAH. General oncology care in Sudan. In: Al-Shamsi HO, Abu-Gheida IH, Iqbal F, Al-Awadhi A, eds. Cancer in the Arab world. Singapore: Springer, 2022: 251–64.

2 Union for International Cancer Control. UICC Solidarity Fund for Ukraine opens call for grants to qualifying organisations. April 25, 2022. https://www.uicc.org/news/uicc-solidarity-fund-ukraine-opens-call-grants-qualifying-organisations (accessed June 20, 2023).

3 American Society of Clinical Oncology Connection. ASCO stands with Ukraine's cancer community, demands safety for patients and healthcare workers throughout region. March 2, 2023. https://connection.asco.org/magazine/asco-member-news/asco-stands-ukraine-cancer-community-demands-safety-patients-and (accessed June 20, 2023).

4 European Society for Medical Oncology. Against any war. March 2, 2023. https://www.esmo.org/newsroom/esmo-society-updates/against-any-war (accessed June 20, 2023).

Published **Online**
June 30, 2023
https://doi.org/10.1016/S0140-6736(23)01303-X

How to avoid causing polio in the name of its eradication

WHO began immunising children against polio in low-income and middle-income countries (LMICs) in 1974, through the Expanded Programme on Immunisation, using a trivalent oral poliovirus vaccine (tOPV)—three doses during infancy. In 1984, a dose at birth was added.

Polio was not controlled in LMICs despite the four-dose tOPV schedule. Hence, in 1988, WHO proposed, and the World Health Assembly unanimously passed, a resolution to eradicate polio by 2000.[1] In our inequitable world, aiming for equity in polio prevention was altruism that inspired everyone, particularly financial donors.

Eradication meant reducing the incidence of polio to zero and interrupting poliovirus transmission, globally.[2] Reaching country-level zero polio and zero poliovirus transmission is defined as elimination.[2]

Before 1988, Sweden, Iceland, Finland, and Norway had eliminated polio using the inactivated poliovirus vaccine (IPV), with three doses during infancy and one or more boosters later.[3] Denmark achieved polio elimination using a sequential schedule of IPV followed by the oral poliovirus vaccine (OPV).[3] These experiences provided proof of principle and a one-stage, rapid, polio elimination model.

For achieving zero incidence of polio by 2000, the Global Polio Eradication Initiative (GPEI) should have transitioned to the IPV in LMICs and phased out the OPV, since it causes vaccine associated paralytic polio (VAPP) in an occasional vaccinated child or unvaccinated contact.[4] Indeed, OPV use is incompatible with polio eradication.

Several countries had achieved zero incidence of polio caused by wild polioviruses using tOPV but had to switch to IPV to avoid VAPP and reach polio elimination. This method was a slow, two-phase polio elimination model. France discontinued OPV in 1988, Germany in 1989, and the USA in 2000, all achieving elimination within 1 year of IPV switch.

Unfortunately, the GPEI could not manage to end wild poliovirus using tOPV because of its well documented suboptimal efficacy in tropical and subtropical LMICs.[5] Thus the two-phase model was inapplicable for polio eradication. Only one tactic could eradicate polio: to introduce IPV and when 80% coverage of three doses of IPV is reached, to phase out OPV, country by country. This method required a policy shift in the early 1990s so that the industry could ramp up IPV production.

Continuing use of the OPV beyond 1999, without ensuring protection from polio with IPV, has resulted in: between 8800 and 17 600 children being paralysed by VAPP;[6] sporadic polio, caused by vaccine-derived polioviruses types 1, 2, or 3, and polio outbreaks, caused by these circulating viruses, having paralysed nearly 5000 children; and wild poliovirus not yet being eliminated in Afghanistan and Pakistan where a section of society do not trust the OPV, particularly when given in repeated house-to-house campaigns.

Since the future polio-eradicated world can use only the IPV, transition to IPV is the sensible way forward. This policy shift must be announced without delay so that supply, especially of combination vaccines containing IPV, can be expedited. No child is recorded to have developed polio after receiving three doses of IPV during infancy. We appeal to the GPEI, donors, and global opinion leaders, to ensure that no more polio is caused in the name of its eradication. The promised equity must be delivered.

We declare no competing interests. TJJ is a retired employee of the Christian Medical College.

*T Jacob John, *Dhanya Dharmapalan, Norbert Hirschhorn, Robert Steinglass*
drdhanyaroshan@gmail.com

Christian Medical College, Vellore, India (TJJ); Apollo Hospitals, CBD Belapur, Mumbai 400094, India (DD); Immunization Center, John Snow, Marshall, NC, USA (RS); Minneapolis, MN, USA (NH)

1 WHO. Global eradication of poliomyelitis by the year 2000. May 13, 1988. https://apps.who.int/iris/bitstream/handle/10665/164531/WHA41_R28_eng.pdf?sequence=1&isAllowed=y (accessed March 26, 2023).
2 Dowdle WR. The principles of disease elimination and eradication. *MMWR Morb Mortal Wkly Rep* 1999; **48:** 23–27.
3 Böttiger M. The elimination of polio in the Scandinavian countries. *Public Health Rev* 1993; **21:** 27–33.
4 Nkowane BM, Wassilak SGM, Orenstein WA, et al. Vaccine-associated paralytic poliomyelitis. United States: 1973 through 1984. *JAMA* 1987; **257:** 1335–40.
5 Patriarca PA, Wright PF, John TJ. Factors affecting the immunogenicity of oral poliovirus vaccine in developing countries: review. *Rev Infect Dis* 1991; **13:** 926–39.
6 John TJ. A developing country perspective on vaccine-associated paralytic poliomyelitis. *Bull World Health Organ* 2004; **82:** 53–57.

Moravec's paradox and the fear of job automation in health care

The role of artificial intelligence in health care is becoming an increasingly topical and controversial discussion. There remains uncertainty about what is achievable regarding ongoing medical artificial intelligence research. Although there are some people who believe that artificial intelligence will be used, at best, as a tool to assist clinicians in their day-to-day activities, there are others who believe that job automation and replacement is a looming threat.[1]

Moravec's paradox is a phenomenon observed by robotics researcher Hans Moravec, in which tasks that are easy for humans to perform (eg, motor or social skills) are difficult for machines to replicate, whereas tasks that are difficult for humans (eg, performing mathematical calculations or large-scale data analysis) are relatively easy for machines to accomplish.[2] For example, a computer-aided diagnostic system might be able to analyse large volumes of images quickly and accurately but might struggle to recognise clinical context or technical limitations that a human radiologist would easily identify. Similarly, a machine learning algorithm might be able to predict a patient's risk of a specific condition on the basis of their medical history and laboratory results but might not be able to account for the nuances of the patient's individual case or consider the effect of social and environmental factors that a human physician would consider. In surgery, there has been great progress in the field of robotics in health care when robotic elements are controlled by humans, but artificial intelligence-driven robotic technology has been much slower to develop.[3]

Thus far, research into clinical artificial intelligence has focused on improving diagnosis and predictive medicine.[4] However, this is only a small component of the daily job of a doctor, at any level. Communicating to patients, performing practical procedures, and choosing investigations requires much more time and effort than the interpretation of results. This is not to say that the use of artificial intelligence to improve the interpretation of investigations is not important. Rather, this use of artificial intelligence augments the delivery of care provided by humans rather than replacing it.

Moravec's paradox highlights the importance of maintaining a human element in the health-care system,