information (examples beyond imaging here include liquid biopsies and digital pathology). With an AI-powered pathway companion, we will quantify the effect of digitalisation towards a personalised and affordable treatment that will provide clinical decision support to deliver the right treatment at the right time.

By holistically focusing on both advanced imaging techniques and modern radiation, we expect to better understand the biology of cancer to ensure that a treatment approach is appropriate. Moreover, we see the potential of automated systems for looking at images longitudinally over time, understanding effects of treatment interventions, and correlating with treatment and patient-reported outcomes to readjust treatment algorithms.

The future of cancer is personalised care based on all aspects of a patient's situation, including socioeconomic and demographic features, tumour molecular and genetic make-up, imaging, and a patient's sensitivity to treatment and ability to induce an immune response. Above all, quality of care everywhere is important: where you live should not determine if you live.

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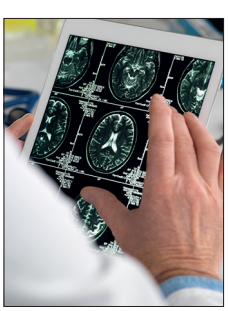
Imaging: towards a global solution to overcome the cancer pandemic



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See **The Lancet Oncology Commission** page e136

For the **IMAGINE database** see https://humanhealth.iaea.org/HHW/DBStatistics/IMAGINE.html

In *The Lancet Oncology*, Hedvig Hricak and colleagues present a wide and rich review of cancer imaging in low-income and middle-income countries (LMICs).[1] This *Lancet Oncology* Commission on medical imaging and nuclear medicine includes an inventory of resources, identification of needs, and a tightly argued call to action.

The UN has defined global health and access to care as a target for sustainable development.[2] In the meantime, the burden of cancer is increasing worldwide and is higher in LMICs than in high-income countries (HICs), with these countries experiencing a greater share of global cancer deaths (57·3% for Asia and 7·3% for Africa) than the share of global cancer incidence (48·4% and 5·8%, respectively).[3,4] However, the proportional level of care for cancer remains low in LMICs.

To provide insights on access to imaging, the IMAGINE (the International Atomic Energy Agency Medical imAGIng and Nuclear mEdicine) global resources database was developed. It has allowed demonstration of high disparities between countries and a paucity of imaging resources in LMICs with, for example, one CT scanner for 1 694 000 people in LMICs versus one for 25 000 people in HICs.

Because insufficient or no access to imaging causes delays in diagnosis, cancer survival in LMICs is still worse than in wealthier countries: more people are diagnosed in LMICs when their cancer has already spread and more people receive less intensive or effective treatment than in HICs. Hence, imaging is an essential step towards staging and better cancer care. Surgical, chemotherapy, and radiotherapy management cannot be optimised without an appropriate imaging plan. Like previous studies,[5,6] the present analysis reveals the potential benefits of scaling up imaging modalities in cancer management by improving 5-year survival.

Hricak and colleagues show the synergy between imaging, treatment, and quality of care for cancer management, and the individual effects are not additive.[3,7] Their microsimulation model demonstrated that simultaneous expansion of imaging, treatment, and quality of care would avert 9 549 500 deaths worldwide between 2020 and 2030, but four times fewer deaths (2 463 500) would be averted with the scale-up of imaging alone. Earlier diagnosis and optimal staging of cancer are efficient[8] because treatment for earlier cancer stages is more effective and less costly than treatment for advanced or metastatic disease.

Hricak and colleagues advocate for an integrated cancer care management approach to avoid fragmented or incomplete delivery of care. The provision of affordable and comprehensive cancer care, including imaging, in LMICs will be most effectively and efficiently accomplished with a coordinated and global coalition (involving governments, civil society, patients, health-care professionals, professional associations, researchers, funders, international agencies, private sector, and innovators) to scale up targeted and strategic investments.

Now is the right time for LMICs to increase their use of medical imaging and nuclear medicine. HICs have taken the preliminary steps in applying the technological advances in computing, information technology, and engineering in the use of medical imaging. The availability of digital infrastructures, wireless technologies, and mobile teleradiology in HICs has meant that LMICs can also swiftly develop and apply these technologies. Indeed, the costs of such technologies will continue to substantially decrease, like the costs of medical ultrasound, which is now used for the diagnosis and monitoring of many cancers in LMICs. Using these technologies, ultrasound manufacturers have created a new class of low-cost mobile health (mHealth) portable devices for LMICs. A concomitant step to scaling up imaging could be to increase data collection, enabling clinical research evaluation and regional or national health technology assessment.

In the future, a balance needs to be found between an increase in the production of images and more complex analysis. Progress in medicine involves the creation and use of large databases. Technological progress in HICs, such as artificial intelligence (AI) for defined tasks, might be one solution to optimise image productivity.[9] Nevertheless, complexity of multimodality imaging might not be solved by AI, and must be determined by expert radiologists.

A holistic approach is needed, including clinical, biological, and imaging data, using all AI technologies as machine learning or deep learning without prior knowledge; such an approach was used in a recent study for establishing the prognosis of patients with COVID-19.[10] Finally, Hricak and colleagues stress that although ultrasound is widely used in many countries, including LMICs, it lacks robustness. AI and in particular deep learning seem very promising for strengthening the use of ultrasound in LMICs.

Since 2020, the COVID-19 pandemic has demonstrated the adaptability of radiologists during a health crisis. CT has been the most widely used imaging technique and allows a precise analysis of the pulmonary lesions in the prediction of the severity of COVID-19. Nevertheless, due to severe delays in staging and follow-up during the pandemic, efforts are needed to ensure that during future infectious disease pandemics CT scanners are also available for patients with cancer to avoid a negative impact on their care.

Ultimately, scaling up cancer imaging, following a stepped pathway that is adapted to health-care complexity in LMICs, ensuring equitable access for all patients, and scaling up genomics, treatment, and quality of care will lead to improved health globally.

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