Ernesta Meintjes is a professor of biomedical engineering at the University of Cape Town (UCT). From 2007 to 2021, she held the prestigious South African Research Chair in Brain Imaging. She completed her Bachelor's Honors and M.Sc. degrees in physics at the University of KwaZulu-Natal (UKZN), Pietermaritzburg campus, in South Africa. Meintjes earned her Ph.D. in physics at Oregon State University in Corvallis, OR, USA. Upon her return to South Africa in 1998, she joined the Biomedical Engineering Department at UCT as a postdoctoral fellow. In this role, she contributed to developing a stereophotogrammetric image-guided neurosurgical navigator. Following the commissioning of the first MRI scanner at Groote Schuur Hospital in November 2001, she embarked on establishing an MRI research stream. In 2004, she implemented the first functional MRI studies in South Africa. These studies led to the establishment of the Cape Universities Brain Imaging Centre (CUBIC), with subsequent expansion to the Cape Universities Body Imaging Centre, of which she has been director since its inception in 2015. Meintjes' research focuses on developing technology to track and correct motion during MRI scanning, and on applying advanced imaging methods to study conditions particularly relevant to South Africa. These include studies on the effects of prenatal insults and diseases — such as HIV, maternal alcohol or drug use during pregnancy, and antiretroviral drugs taken by HIV-infected pregnant women — on brain development. She has authored and coauthored more than 140 peer-reviewed journal papers and more than 250 international conference papers. She has supervised to completion 26 Ph.D. and 31 M.Sc. students, and mentored 22 postdoctoral fellows. She is a fellow of both the University of Cape Town and the American Institute for Medical and Biological Engineering (AIMBE).

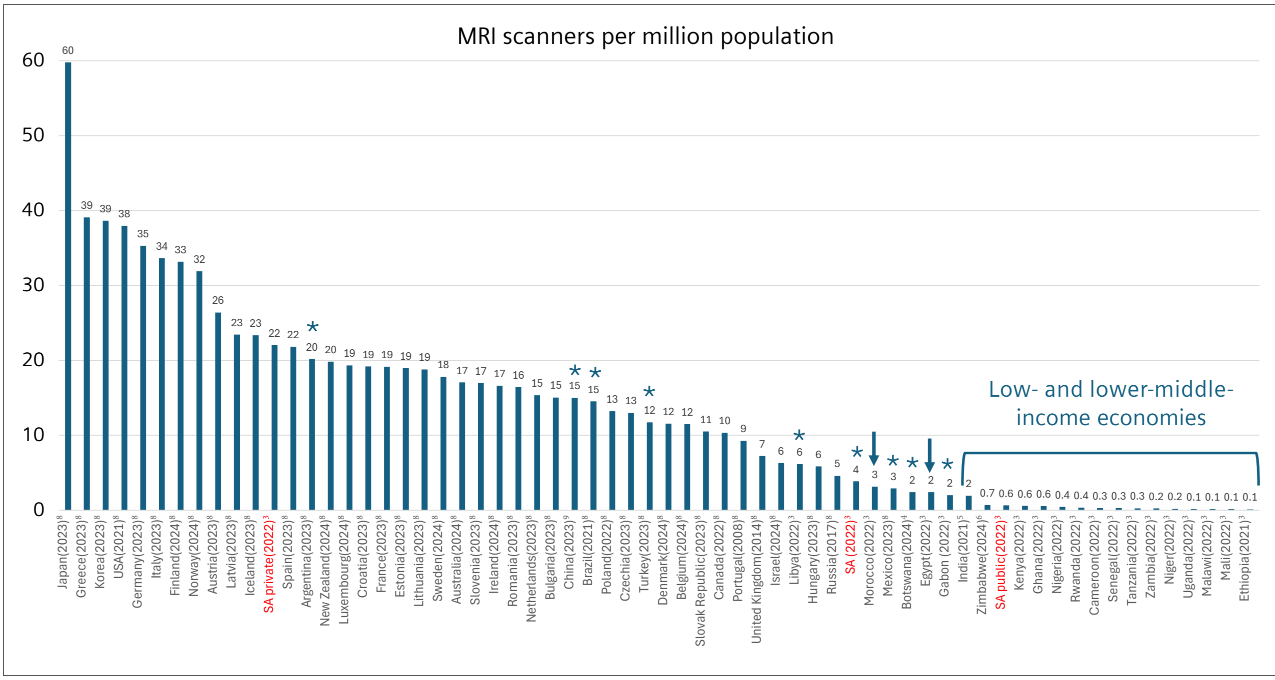
"Ubuntu" in the global conversation around MRI access

In the last 50 years, the superior soft tissue contrast of magnetic resonance imaging (MRI) has enabled early, non-invasive detection and characterization of tumors, inflammation, degenerative disease, and congenital abnormalities. As such, it has transformed healthcare across diagnosis, treatment planning, research, and patient safety.

Although I have worked in the MRI field for more than two decades, it wasn't until I attended the 2nd ISMRM Workshop on Accessible MRI in India in 2024 that I became aware of the degree of inequality in access to MRI across the globe. It is estimated that 66% of the world's 8 billion people do not have access to MRI [1–9]. As shown in Figure 1, the scanner density in low- and middle-income countries (LMICs) is significantly lower than in high-income countries (HICs). Further, disparities exist even within countries, with a higher density of scanners located in urbanized regions. Wealthier sectors of the population who can afford private healthcare also enjoy wider access than those relying on public healthcare. This is especially evident in Africa, which has a history of inequality, poverty, and political instability (Fig. 2) [3]. Limited access to MRI causes delays in diagnosis and management of diseases such as stroke, cancer, spinal/joint disease, and congenital heart disease, worsening outcomes and increasing downstream costs.

The need for innovation in the cost of MRI systems

Rapid innovation has been a constant and characteristic feature of the MRI community, but this has not extended to reducing the overall costs of MRI scanners. As such, clinical and research access to MRI remains available primarily to the privileged. I believe this is in part due to most members of our community not being aware of the magnitude of the problem, and to limited resources having been devoted to solving it. To put this in perspective, consider a country like South Africa. South Africa would need to purchase around 355 1.5T MRI scanners to increase the number of MRI scanners in the public sector from currently 0.6 per million population (pmp) to 7 pmp. This would put it on a par with the UK, but would still only be one third of the 22 pmp scanners available in South Africa's private sector. For the 85% of South Africans who rely on public healthcare, such an increase would shorten outpatient wait times for an MRI scan from the current 10–48 months to 1–4 months. Assuming a purchase price of $1 million per Tesla, purchasing these scanners would require the government to invest around $533 million — roughly 3% of South Africa's annual national health budget. Clearly, this is an insurmountable ask for an already stretched economy that struggles to deliver basic healthcare services. The situation in many other African countries is even more dire.



1 MRI scanners per million population by country. The blue bracket and arrows indicate low- and lower-middle-income economies, as defined by the World Bank for the 2026 fiscal year (datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups); asterisks indicate upper-middle income economies. The disparity between the number of MRI scanners in South Africa's (SA) public and private sectors is highlighted. Notably, the public health system serves 85% of South Africans.

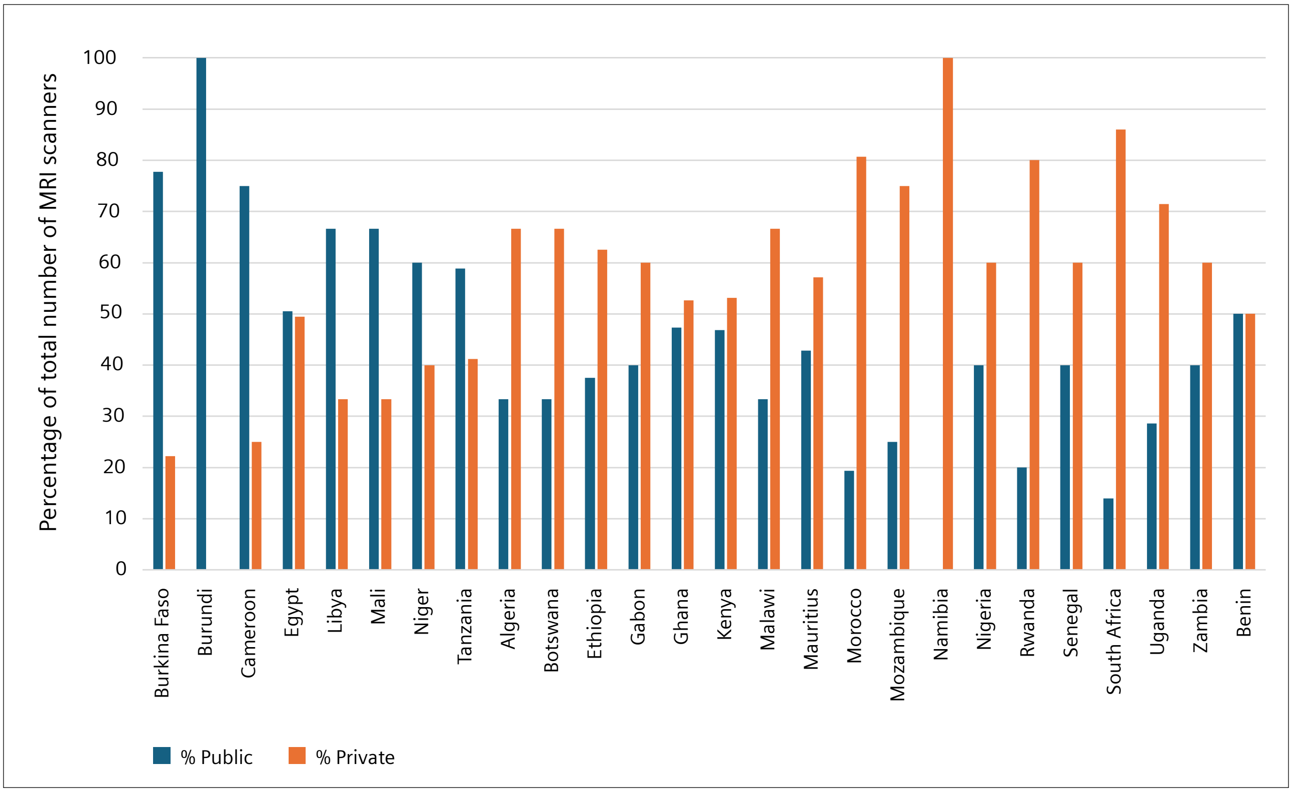
Mid-field MRI: Diagnostic images at lower cost

Recently, Synaptive Medical and Siemens Healthineers re-introduced commercial MRI scanners with 0.5–0.6T magnets [2, 10], which fall into the mid-field range (0.3T–1T) as defined by Arnold et al. [11]. These systems exploit increases in magnetic field gradient amplitude and slew rates, parallel imaging, compressed sensing, and improved image reconstruction algorithms that incorporate artificial intelligence (AI) to acquire diagnostic-quality images within acceptable scan times [12–16]. The scanners from Siemens Healthineers also feature DryCool technology, which means they need just 0.7 liters of liquid helium and no quench pipe. The helium-free magnet and the system's smaller footprint reduce siting and maintenance costs, respectively. However, even at an estimated $300,000 to $700,000 [2], the purchase price of these mid-field systems is still a significant barrier to LMICs, which would need to purchase hundreds of these systems to solve their MRI access crisis.

Very-low-field MRI: Promising, but price issues and concerns remain

To bring costs down by an order of magnitude, attention has turned to very-low-field MRI (0.01T–0.1T) [1, 11, 17, 18]. Currently, the only commercially available very-low-field MRI system that has FDA approval for clinical use is the 64 mT Hyperfine Swoop [19–22]. Despite initial optimism for a truly affordable, clinically viable brain MRI scanner that could be rolled out as a screening tool in remote settings, prices quickly soared from an initial $50,000 [21], still well within the $1 million per Tesla heuristic, to somewhere between $250,000 and $600,000 [23, 24]. Additionally, concerns remain regarding the extensive use of black-box AI algorithms by these systems, and the ethics around data sharing and ownership.

It is fortunate that awareness of accessibility-related issues is growing in the MRI community. This has led to tremendous progress in research on very-low-field MRI over a short period of time [25–31]. Additionally, researchers have made the technical details of their developments public through an open-source approach, thereby reducing barriers to entry for new researchers. And although the idea of manufacturing and donating very-low-field MRI scanners to resource-constrained settings is well intentioned, as a researcher based in Africa, I must caution



2 Percentage of the total number of MRI scanners in various African countries located in public and private healthcare facilities, respectively. Source: [3].

against donation models that are tied to data extraction or that are not grounded in locally defined needs. Approaches that bypass meaningful engagement with local stakeholders do little to strengthen local capacity building and do not assist under-resourced countries in becoming the architects of their own future. Rather, it makes them dependent on ongoing support or the need to purchase technology manufactured in the Global North [32]. That said, genuinely mutually beneficial donation models — those co-designed with local partners, aligned with local priorities, and coupled with sustained investment in training, maintenance infrastructure, and institutional capacity — can be highly valuable.

A different approach in India

The significant investment by the Indian government in capacity building and local manufacturing of MRI systems that operate at the current standard of performance presents a perfect counterexample. By facilitating in-house serviceability and maintenance [33, 34], India aims to substantially reduce the cost of ownership and address the country's challenges regarding MRI access. India's approach highlights a characteristic that I believe wealthier countries often overlook in under-resourced countries — namely the desire for self-sufficiency rather than dependency. This resonates with the well-known proverb, "Give a man a fish and you feed him for a day; teach a man to fish and you feed him for a lifetime."

Unanswered questions around very-low-field MRI

It remains to be established whether very-low-field MRI is sufficiently robust and reliable for routine clinical use, whether the reliance on AI is too high, and whether the applications are too specific. Another question is whether the reduction in manufacturing and ownership costs justifies the limited usability. It may be that the sweet spot for a system that is widely clinically useful lies somewhere between 0.05T and 0.5T. And even if very-low-field MRI is deemed to have a role, will it be considered adequate by clinicians and patients, or will it be rejected as a cheap surrogate? These and many other questions remain to be answered before very-low-field portable MRI systems can truly be considered as a clinically feasible solution for rural and under-resourced settings.

Moreover, in addition to solving the numerous technical challenges that arise from operating in the noise-dominated regime, AI pipelines will need to be developed and implemented to simplify workflows and patient positioning to compensate for skills shortages; telemedicine solutions will need to be tailored to settings with fluctuating bandwidth to facilitate remote reporting; and systems that run on alternative energy sources or batteries will need to be employed to combat unstable power supplies. Regulatory processes will also differ in each country and will need to be considered.

The bigger picture

Notably, while this piece focuses on the overall costs of MRI, the principles highlighted also apply to all technical advancements in the field. It is vital for researchers to contemplate the true costs of the solutions they are developing and whether these will be broadly accessible or limited to a privileged few.

Given this context and landscape, it is an exciting time to be working in MRI in Africa. Further, the bold move by the ISMRM to host its annual meeting on the African continent for the first time provides a unique opportunity for scientists from the Global North to be exposed to a less privileged setting and, to some degree, the challenges this presents. The theme of the meeting is "Ubuntu," which loosely translates to "I am what I am because of who we all are." This reminds and compels each of us to consider our responsibility toward and dependence on each other.

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Ernesta Meintjes

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