

Africa

Public health demands might drive advances in research, but scientists, working against the odds, must also strive to publish in global journals.

ARTICLE COUNT (AC): 651
 FRACTIONAL COUNT (FC): 172
 WEIGHTED FRACTIONAL COUNT (WFC): 128

In scientific publishing, Africa trails far behind the rest of the world, and economic factors explain some of its shortcomings. Although Africa is home to nearly 15% of the world's population, this region only produced 0.25% of the 2014 weighted fractional count (WFC) in the Nature Index. South Africa, which accounted for 64% of the region's 2014 WFC, spent only US\$2.8 billion on R&D (0.76% of its GDP). By comparison, the United States spent US\$466 billion (2.70% of GDP), and generated a WFC of 17,937. Africa's poor publishing record in the Index is down to more than economics.

In many cases, African scientists publish in journals that are not counted by the Index. "Many of the scientists we work with in Africa are publishing quite often, but most often their work is being published in much more local, regional or continental journals or ones with very specific topic areas," says Nina Dudnik, founder of the US-based nonprofit, Seeding Labs, which provides used equipment and training to scientists in developing countries in Africa and elsewhere. She cites one colleague in Ghana with 73 publications — virtually all of them in narrowly focused or regional publications that are not in the Index, such as *Food Research International* and the *Journal of the Ghana Science Association*. "Often scientists do not know the right way to pitch their research to a major journal," says Dudnik.

Most of Africa barely registers on the Index. Behind South Africa, Egypt contributes 11% of the region's 2014 WFC. Kenya, Algeria and Tunisia provide another 4%, 3.5% and 2%. Nine out of ten of Africa's top institutions by WFC are in South Africa, with the only exception being the Mpala Research Centre in Kenya.

"SOMETIMES IT'S NOT JUST LACKING CUTTING-EDGE EQUIPMENT, BUT ANY EQUIPMENT AT ALL."

PUBLIC HEALTH'S IMPACT

While Africa gets most of its WFC from physical sciences, efforts are under way to broaden the region's research scope. In particular, recent public-health challenges might drive more research in life sciences. For example, the Ebola epidemic — the worst ever recorded — has taken more than 10,000 lives, according to the US Centers for Disease Control and Prevention (CDC). This outbreak spurred the One Health research programme at the Southern African Centre for Surveillance of Infectious Diseases to assemble a multi-national team of

African researchers in Johannesburg to study strategies for controlling the virus, with funding from the Wellcome Trust. In Tanzania, The Zanzibar Research Agenda 2015–2020 calls for a range of health initiatives that will require research, such as exploring the potential to apply nanomedicine — nanometer-scale technology used in medical applications — to early detection of diseases, as well as diagnosis and follow-up on the impact of treatments.

Africa makes some effort to publish articles in the life sciences, which receives the second highest emphasis based on its percentage of the region's total WFC. In Index data for 2014, only two regions — North America and Australasia & Pacific Islands — placed more emphasis on life sciences.

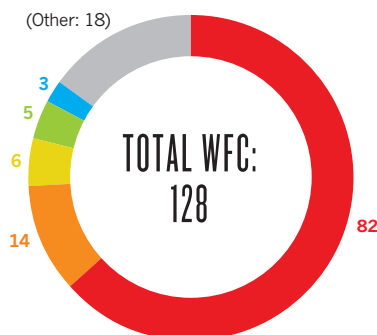
Like other developing regions, Africa could drive more life sciences research through clinical trials. According to Judy Coates, scientific and regulatory affairs manager at the Innovative Pharmaceutical Association South Africa in Johannesburg, her country has experienced a stable annual investment in clinical trials of about US\$200–250 million in recent years. A study by her organization, however, shows that this figure could grow to about US\$400 million if South Africa's pharmaceutical regulator, the Medicines Control Council, could improve the ability for companies to run trials with fewer delays.

Even with a relatively consistent investment

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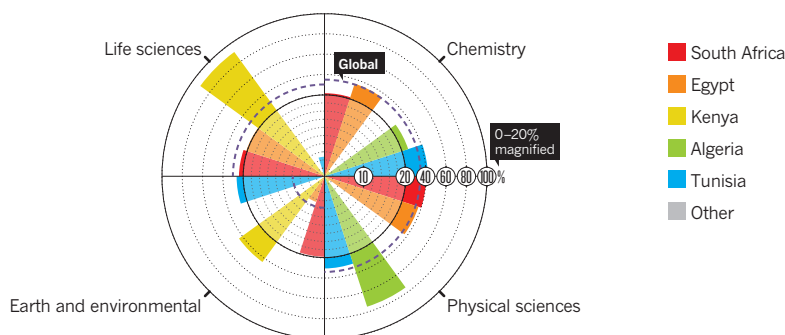
Countries' weighted fractional count (WFC)

South Africa and Egypt contributed 75% of the region's articles in the Index.



Relative subject area distribution

Although 91% of Kenya's Index articles explore life sciences, this came from a WFC of only 6.*



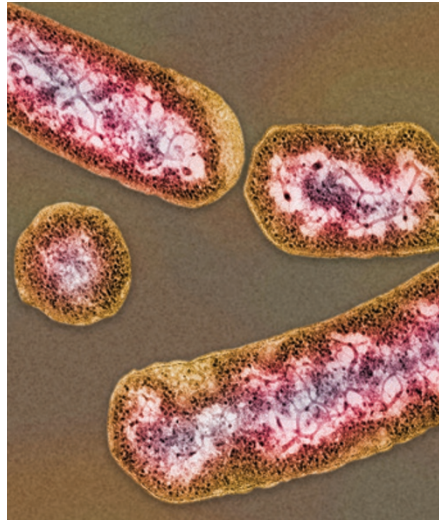
*Each slice represents the proportion each subject area contributes to a country's overall WFC. Subject areas can overlap, so the total percentage may exceed 100%.

in clinical trials in South Africa, the overall region's share of the global market is declining. A recent study by US-based Quintiles found, for example, a 9.1% decrease in sub-Saharan Africa's share of the global clinical-trial market from 2010 to 2012. In fact, most of that fall was in South Africa, where the share of the world market for clinical trials dropped by 7.9%. The experts at Quintiles speculated that sub-Saharan Africa could be losing some of the niche market in clinical trials, such as ones for malaria, which has been a driver in the past.

Still, scientists in the region study the local diseases. In 2014, for instance, a scientist from The Gambia was one of the dozen authors on a *Nature Communications* article about artemisinin combinations for treating malaria. Originally, this drug came from sweet wormwood (*Artemisia annua*), which is a herb used in traditional Chinese medicine, but now it can be mass-produced in genetically modified yeast. This study showed the value of doing research in Africa, because the authors concluded: "We find that a locally optimized treatment policy can be highly cost effective for reducing clinical malaria burden."

In addition, the healthcare industry can invest in Africa beyond clinical trials. For the pharmaceutical industry overall, "the companies are more involved in Africa since it is a growth market, and they are using numerous mechanisms, including investing in research infrastructure as well as initiating projects," says Dries Oelofse, business development manager at H3-D, a drug development centre at the University of Cape Town. For example, UK-based GSK funded a US\$6 million grant for African researchers to study non-communicable diseases in the region.

Despite Africa's small output compared to the rest of the world — or perhaps in some ways because of it — the region leads a significant metric in the Index. In the percentage of a region's WFC published in *Nature* or *Science*, Africa's 4.7% is the highest, surpassing second place North America (4.5%). Granted, that's



Prevotella bacteria in the gut of Hadza hunter-gatherers enhance the ability to digest plant material.

only about six publications for Africa (versus 870 for North America), but this is still an important metric.

COLLABORATION KING

Africa led the world in collaborations in 2014 articles in the Index. Overall, more than 70% of Africa's output comes from work done with scientists from other countries. This makes Africa the most internationally collaborative of all regions in the Index. On average, regions only collaborated internationally on 46% of their articles. Africa collaborated most in the earth and environmental sciences (85%) and the life sciences (80%). It collaborated less in the physical sciences (73%) and chemistry (69%). All but a few percent of those collaborators are with countries outside Africa. The region that African scientists most frequently work with is North & West Europe. This research bond arises in part from programmes that encourage collaborations between African scientists and those in the United Kingdom. For example, the Leverhulme Trust in

the United Kingdom offers funding up to about US\$750,000 over five years for some research projects.

Even when collaborating with scientists outside of the region, the research can make use of African resources. A 2014 *Nature Communications* article on the gut microbiome of Tanzania's Hadza hunter-gatherers included one author from the country, and the research explored how bacteria might have co-evolved with this human population. The results suggest that specific bacterial species and combinations impact how these people gain nutrition from even very fibrous plants.

To achieve more success in international publishing for Africa overall, though, the scientists need modern tools. A lack of advanced equipment limits high-profile publishing. As Dudnik explains, "Researchers using equipment that is not the Western gold standard have to work harder to demonstrate the validity of their results." That surely reduces Africa's impact.

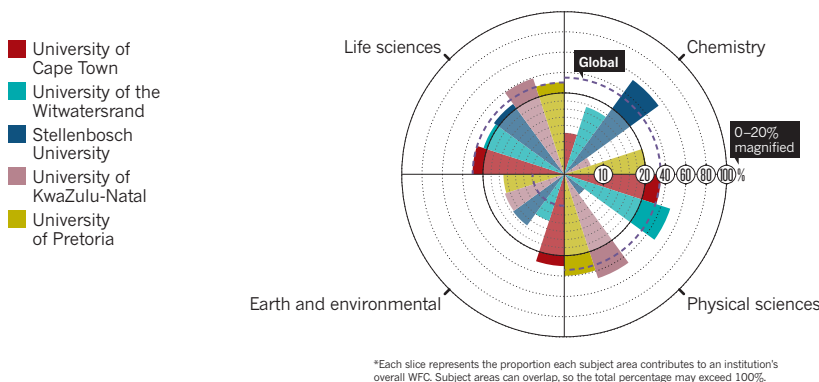
In 2014, for example, Dudnik wrote in *The Wall Street Journal* about the US Centers for Disease Control and Prevention establishing a laboratory in a hospital in Uganda to test blood samples for Ebola in 2000. "Yet 14 years later," Dudnik wrote, "that lab is gone and no institution in the region has the equipment required to test for Ebola or other prevalent diseases including yellow fever, hepatitis, Marburg virus or HIV." So sometimes it is not just lacking cutting-edge equipment, but lacking any useful equipment at all.

"Ultimately," says Dudnik, "the scientific output of African researchers receives less attention, reaches a smaller audience and is under-catalogued by global indices." By looking to international publications as potential outlets whenever possible, scientists in this region could start to work their way into the global world of science.

Spreading that trend across all of Africa, however, will take time, improved laboratory equipment and increased funding. ■

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Top 5 institutions' relative subject area distribution
All of the top five institutions in the region were in South Africa, and they published, on average, across the range of categories.*



Top 5 institutions' collaborativeness
African scientists collaborated more than any region in the world, and the top five institutions followed this trend.*

