

the majority of health outcomes. “It is critical that we continue to deepen our understanding of the mechanisms by which these factors influence health, particularly for populations that have disproportionate burdens of disease,” she says. “There is growing evidence that chronic exposure to the toxic effects of discrimination and poverty can affect the biological systems that fight disease.”

Such research is taking place in an increasingly fraught political landscape. Since returning to office this year, President Donald Trump has taken a series of actions to roll back diversity, equity and inclusion (DEI) efforts across the federal government. These have included an executive order targeting DEI programmes, threats to withdraw medical research funding from institutions with diversity policies, and calls to revoke accreditation for universities promoting such initiatives. Several DEI-related research programmes funded by the National Institutes of Health (NIH) have already lost grants or seen reductions.

The VOICES study is solely supported by the ACS, a non-profit organization that receives almost all of its income from private donations and fundraising. This independence might become increasingly important support for studies that tackle racial disparities in medicine, such as VOICES. “There is so much work to be done – and that’s why the continuation

of funding of research on racial equity is important to the health of many Americans,” says Peek.

McCullough is focused on the long view. “Eventually, we will be able to look at associations with factors that are related to cancer, for example obesity or precancerous conditions, which can inform screening and public policy,” she says. “Long-term, my goal is that we actually are able to give insight to why Black women are getting more aggressive cancers and create new prevention messages.”

Although McCullough might not be at the helm for the next 30 years, she’s always planning for the future. “I don’t anticipate that I’ll be around to really see the full maturity of the study, but I know the study will be in good hands,” she says. “My goal is just to leave behind a resource that not only will improve health for this demographic”, but also help emerging scientists to “study this population in a robust way”.

Singapore’s rich diversity is ideal for Asian health study

Health for Life in Singapore

When John Chambers first shared his genetic studies on Asian populations in London two decades ago, they were scientifically

accepted but the international response was muted. “They weren’t always taken seriously,” Chambers, a cardiovascular epidemiologist recalls, “partly because they focused on a small migrant group in London. And that’s not where most Asians live.”

One of those early studies, published in 2014⁵, analysed the full genetic sequence of more than 300 South Asians and revealed millions of previously undocumented genetic variants. It helped show why South Asians are more vulnerable to conditions such as diabetes and heart disease. However, it had become clear to Chambers, who was based at Imperial College London at the time, that the research needed to be rooted in Asia, to fully capture the region’s cultural, behavioural and genetic diversity.

In 2015 he got a call from James Best, then the dean of the Lee Kong Chian School of Medicine at Nanyang Technological University (NTU) in Singapore, which was at the beginning of a collaboration with Imperial and Singapore’s National Healthcare Group to create a state-of-the-art cohort study. Best wanted Chambers involved as one of the six principal investigators.

It marked the start of an ambitious longitudinal population cohort study called Health for Life in Singapore (HELIOS). Since it began in 2018, HELIOS has recruited 10,004 people across Singapore’s three main ethnic groups

KEY FACTS: VOICES

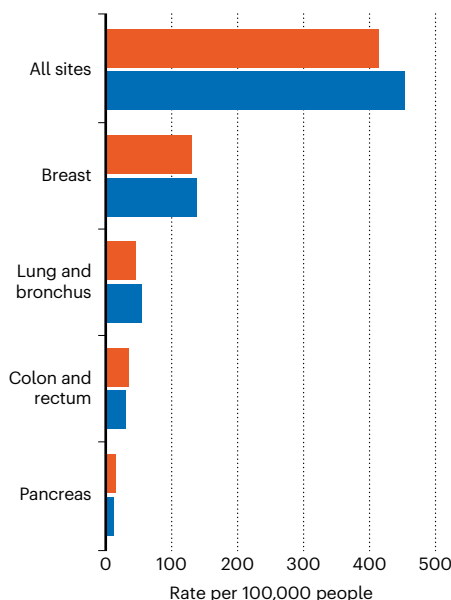
- **Study name:** VOICES of Black Women.
- **Lead institution:** American Cancer Society (ACS).
- **Principal investigators:** Lauren McCullough, visiting scientific director at the ACS, and Alpa Patel, senior vice-president of population science at the ACS.
- **Participant goal:** 100,000 Black women aged 25–55, cancer-free at enrolment.
- **Current participant numbers:** 4,850
- **Data collected:** Online surveys (60 minutes at baseline, two 30-minute follow-ups per year) covering health behaviours, discrimination, social support, economic stress and personal care product use; optional blood samples; anthropometric and biometric data (such as height, weight, blood pressure).
- **Launch year:** Pilot 2023, official launch 2024.
- **Duration:** At least 30 years.
- **Funding:** Solely funded by the American Cancer Society.

VARYING IMPACT

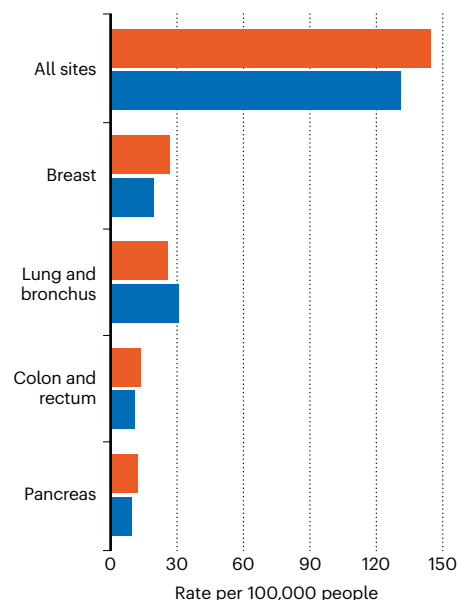
Cancer mortality rates in the United States are higher for Black women despite the incidence rate for the same group being lower than for white women. The disparity is particularly stark for breast cancer, a disease that Black women are around 40% more likely to die from compared with white women.

Black women White women

Cancer incidence rates per 100,000 people in the United States, 2017–21



Cancer death rates per 100,000 people in the United States, 2018–22



Note: Exclusive of Hispanic ethnicity. Rates are per 100,000 and age adjusted to the 2000 US standard population.

SOURCE: SAKA, A. H. ET AL. *CJ CANCER*, CLIN 75, 111–140 (2023).

— Chinese, Malay and Indian — and is collecting an unusually rich set of biological, clinical, behavioural and environmental data. The goal is to understand why Asian populations face such high rates of chronic disease, and how prevention, diagnosis and treatment can be improved.

“Cardiovascular mortality has dropped dramatically in the US and Europe over the past two decades,” says Chambers, who is now based at NTU. “But in Asia it’s gone the other way.”

There are around 296 million people in Asia with diabetes, more than half the estimated 589 million adults around the world with the condition. Cardiovascular disease deaths in Asia rose by 93% from 5.6 million in 1990 to 10.8 million in 2019, whereas the population only increased by 45%. Despite these trends, people of Asian ancestry remain under-represented in global biomedical studies.

“Long-term studies are some of the richest sources and it is critical that people of the south and southeast Asian regions be represented.”

As Singapore’s population grows older and chronic disease rates rise, the need for well-designed, long-term health studies has grown. By 2030, one in four Singaporean citizens will be aged 65 or older, and already around one in three adults has high blood pressure or high cholesterol.

Anurag Agrawal, dean of biosciences and health research at Ashoka University in Sonapat, India, says that large, long-term health studies that collect detailed biological and lifestyle data, such as HELIOS, are key to closing this gap. “They are some of the richest sources of information from which biological insights can be gleaned and it is critical that people of the south and southeast Asian regions be represented,” he says. It is particularly important as artificial intelligence becomes “the language of biology”, he adds, with growing use of machine learning to analyse biological data, detect patterns and guide health-care decisions.

The HELIOS participants, aged 30 to 84, undergo extensive baseline phenotyping, including bone-density scans, retinal imaging, electrocardiograms and testing for lung function and physical fitness. They provide blood, urine, saliva, stool and skin cell samples. They also complete detailed lifestyle, dietary and mental-health questionnaires, all validated in local languages. This is all taken over three to four hours, as participants move through 11

dedicated stations, each focused on a different aspect of health.

It sounds onerous but HELIOS has budding participants lining the block, keen to receive a comprehensive analysis of their health that dedicated doctors will assess. Participants will be contacted if previously unknown health issues surface in the results. “At one point the waiting list was 12 months,” Chambers laughs. “It’s been an amazing success.”

Data from the study are already revealing health disparities among ethnic groups⁶. Indian and Malay participants show higher rates of diabetes, high blood pressure, obesity and anxiety symptoms than Chinese participants, despite reporting higher physical activity and, in some cases, better diet quality. “A huge global conundrum is why South Asians have a higher risk of diabetes than Europeans,” Chambers says. “What’s often not appreciated is those same disparities exist even within Asian populations.”

The detail of the HELIOS study means that researchers can build an in-depth picture of participants. It combines whole-genome sequencing to identify genetic variation, RNA sequencing to capture gene activity, and metabolomic profiling to measure compounds in the blood related to diet and disease. These data are linked to national health records — including laboratory tests, prescriptions and clinical diagnoses — providing researchers with a long-term view of each participant’s health across multiple systems.

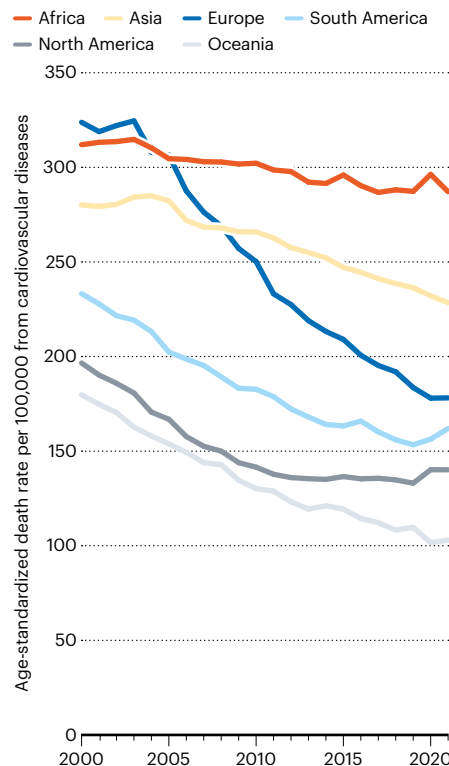
“This is a step change in how we assess diet and health,” Chambers says. Most studies rely on asking participants to recall how often, or what, they ate “but let’s be honest, most people can’t remember what they ate yesterday”. Instead, HELIOS uses what’s known as plasma phenotyping: analysing chemical markers in the blood to identify diet-related biological patterns without relying on self-reporting. It “lets us identify dietary phenotypes objectively, at scale, across hundreds of thousands of samples”, Chambers says.

A recent analysis⁷ used data from HELIOS to identify a genetic variant that alters the levels of a coenzyme involved in removing cholesterol from the blood stream, reducing the efficiency of cholesterol transport, and which is common in Asians but rare or absent in other populations, he says. “That’s why its effect is so much more visible in our cohort.” It’s exactly the kind of region-specific insight HELIOS was built to reveal, and a reminder of why diverse representation in biomedical research matters.

Jimmy Lee Chee Keong, one of the six principal investigators on HELIOS, and a psychiatrist in the National Healthcare Group, says that at the project’s conception both academic and health-care leaders were thinking about “how

REGIONAL SKEW

In general, the death rate from cardiovascular diseases has been falling during the twenty-first century but there are clear disparities among different regions. In Africa and Asia, for example, the mortality rate has dropped much more slowly than in Europe.



KEY FACTS: HELIOS

- **Study name:** Health for Life in Singapore (HELIOS).
- **Lead institutions:** Lee Kong Chian School of Medicine, Nanyang Technological University. Partner institutions: Imperial College London, Singapore’s National Healthcare Group.
- **Participant goal:** 10,000 adults aged 30–84 across Chinese, Malay and Indian groups.
- **Data collected:** Imaging, biosamples (blood, urine, saliva, stool, skin), physical tests and validated questionnaires on lifestyle, diet, mental health and cognition. Includes genomic and metabolomic profiling.
- **Launch year:** 2018
- **Duration:** Long term; now part of SG100K, Singapore’s national precision-medicine programme.
- **Funding:** Part of Singapore’s National Precision Medicine programme, which has committed S\$114 million so far.

index

to drive the health insights of the future”.

“We needed to understand the biological and molecular make-up of our population to meet our health needs, and to anticipate them,” he says. He adds that the team was inspired by the UK Biobank, which holds de-identified genetic and health data from 500,000 UK participants. They adopted design elements from that project, such as cognitive testing and physical-activity monitoring, aligning them with international standards so data could be comparable in the future.

The easiest and most cost-efficient approach in research is to take a single snapshot in time, whereas tracking a large group of people over many years, with intricate details about their health and what might influence that, is “actually very costly”, Chee Keong says. HELIOS is an investment that Singapore has committed to as a piece of long-term health infrastructure, he says.

Singapore’s commitment to HELIOS sits within a broader National Precision Medicine (NPM) strategy: a government-led, three-phase plan to improve health-care outcomes and grow the biomedical sector over 10 years. In 2017, the government committed S\$34 million (US\$ 26.5 million) to phase 1 of the NPM programme to establish infrastructure, including the development of national genomic databases and the set up of cohort studies, including HELIOS. In 2020, it followed with S\$80 million in funding for phase 2, which scales these efforts through PRECISE-SG100K, an even bigger study involving 100,000 participants across four national cohorts, of which HELIOS is one, looking at genetic, environmental and lifestyle factors linked to disease.

Lee adds that cultural and environmental context is just as important as biological elements. “We focused a lot on diet, lifestyle, even family make-up – the environmental risk factors that may affect our health-care trajectories.”

Community engagement has been essential to HELIOS, both in building trust and ensuring diverse participation. Focus groups were used early on to test how the study was understood, with questions such as: “Is the message coming across clearly? Are we saying anything that could be misunderstood?” says Chambers. Outreach has been tailored through language-specific recruitment at places of worship and community groups, and by working with employers across different sectors. Information is provided in English, Chinese, Malay and Tamil. “We closely monitor recruitment on an ongoing basis to make sure we’re reaching a broad mix of people,” he adds. “If we spot that something’s drifting off track, we refocus our outreach.”



A researcher checks biological samples at the HELIOS lab in Singapore.

With the initial target cohort of 10,000 complete, HELIOS is already on to its next phase, underpinning the SG100K initiative. And findings are informing public-health strategies, such as those seeking to identify undiagnosed diabetes and improving equity in screening and treatment among different ethnic groups.

“The final piece of the puzzle is then translating this into policy, practice, and better treatment, better prevention for Asian popu-

lations, in Singapore and outside Singapore,” Chambers says.

Anna McKie is a freelance journalist in London.

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