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Nations can learn from Greece's use of AI to curb COVID-19

Governments are hungry to deploy big data in health emergencies. Scientists must help to lay the legal, ethical and logistical groundwork.

A few months into the COVID-19 pandemic, operations researcher Kimon Drakopoulos e-mailed both the Greek prime minister and the head of the country's COVID-19 scientific task force to ask if they needed any extra advice.

Drakopoulos works in data science at the University of Southern California in Los Angeles, and is originally from Greece. To his surprise, he received a reply from Prime Minister Kyriakos Mitsotakis within hours. The European Union was asking member states, many of which had implemented widespread lockdowns in March, to allow non-essential travel to recommence from July 2020, and the Greek government needed help in deciding when and how to reopen borders.

Greece, like many other countries, lacked the capacity to test all travellers, particularly those not displaying symptoms. One option was to test a sample of visitors, but Greece opted to trial an approach rooted in artificial intelligence (AI).

Between August and November 2020 — with input from Drakopoulos and his colleagues — the authorities launched a system that uses a machine-learning algorithm to determine which travellers entering the country should be tested for COVID-19. The authors found machine learning to be more effective at identifying asymptomatic people than was random testing or testing based on a traveller's country of origin. According to the researchers' analysis, during the peak tourist season, the system detected two to four times more infected travellers than did random testing.

The machine-learning system, which is among the first of its kind, is called Eva and is described in *Nature* this week (H. Bastani *et al*. *Nature* https://doi.org/10.1038/s41586-021-04014-z; 2021). It's an example of how data analysis can contribute to effective COVID-19 policies. But it also presents challenges, from ensuring that individuals' privacy is protected to the need to independently verify its accuracy. Moreover, Eva is a reminder of why proposals for a pandemic treaty (see *Nature* **594**, 8; 2021) must consider rules and protocols on the proper use of AI and big data. These need to be drawn up in advance so that such analyses can be used quickly and safely in an emergency.

In many countries, travellers are chosen for COVID-19 testing at random or according to risk categories. For example, a person coming from a region with a high rate of infections might be prioritized for testing over someone travelling from a region with a lower rate.

> **"Techniques such as machine learning are limited by the quality of the available data."**

By contrast, Eva collected not only travel history, but also demographic data such as age and sex from the passenger information forms required for entry to Greece. It then matched those characteristics with data from previously tested passengers and used the results to estimate an individual's risk of infection. COVID-19 tests were targeted to travellers calculated to be at highest risk. The algorithm also issued tests to allow it to fill data gaps, ensuring that it remained up to date as the situation unfolded.

During the pandemic, there has been no shortage of ideas on how to deploy big data and AI to improve public health or assess the pandemic's economic impact. However, relatively few of these ideas have made it into practice. This is partly because companies and governments that hold relevant data — such as mobile-phone records or details of financial transactions — need agreed systems to be in place before they can share the data with researchers. It's also not clear how consent can be obtained to use such personal data, or how to ensure that these data are stored safely and securely.

Eva was developed in consultation with lawyers, who ensured that the program abided by the privacy protections afforded by the EU's General Data Protection Regulation (GDPR). Under the GDPR, organizations, such as airlines, that collect personal data need to follow security standards and obtain consent to store and use the data — and to share them with a public authority. The information collected tends to be restricted to the minimum amount required for the stated purpose.

But this is not necessarily the case outside the EU. Moreover, techniques such as machine learning that use AI are limited by the quality of the available data. Researchers have revealed many instances in which algorithms that were intended to improve decision-making in areas such as medicine and criminal justice reflect and perpetuate biases that are common in society. The field needs to develop standards to indicate when data — and the algorithms that learn from them — are of sufficient quality to be used to make important decisions in an emergency. There must also be a focus on transparency about how algorithms are designed and what data are used to train them.

The hunger with which Drakopoulos's offer of help was accepted shows how eager policymakers are to improve their ability to respond in an emergency. As such algorithms become increasingly prominent and more widely accepted, it could be easy for them to slide, unnoticed, into day-to-day life, or be put to nefarious use. One example is that of facial-recognition technologies, which can be used to reduce criminal behaviour, but can also be abused to invade people's privacy (see *Nature* **587**, 354–358; 2020). Although Eva's creators succeeded in doing what they set out to do, it's important to remember the limitations of big data and machine learning, and to develop ways to govern such techniques so that they can be quickly — and safely — deployed.

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Despite a wealth of methods for collecting data, many policymakers have been unable to access and harness data during the pandemic. Researchers and funders should start laying the groundwork now for emergencies of the future, developing data-sharing agreements and privacy-protection protocols in advance to improve reaction times. And discussions should also begin about setting sensible limits on how much decision-making power an algorithm should be given in a crisis.

US president must keep funding pledge to HBCUs

Congress has eviscerated a White House proposal to upgrade research at historically Black colleges and universities.

It's a scandal: for decades, more than 400 colleges and universities in the United States that focus on educating students from under-represented communities, including Black, Hispanic and Indigenous Americans, have been underfunded – by both state and federal governments.

Efforts are now under way to address some of these historical injustices. Courts are awarding compensation to some of the more than 100 historically Black colleges and universities (HBCUs) that form part of a wider group known as minority-serving institutions (MSIs).

And in March this year, the White House proposed US$20 billion to upgrade research infrastructure across MSIs as a whole. If approved by Congress, this funding would be dedicated to upgrading laboratories and creating new centres for research excellence – including a new national climate laboratory affiliated with an HBCU.

Fast forward six months, and the US Congress – which must approve the government's spending plans – has eviscerated US President Joe Biden's original proposal.

On 8 September, Democrats in the House of Representatives introduced an education funding package that amounts to a fraction of the original $20-billion request. Democrats are instead proposing just $1.45 billion for MSIs from the federal government, to be distributed among the 400 institutions over 5 years between fiscal years 2022 and 2026.

It's a small increase from the roughly $1 billion that the federal government annually spends on grants and scholarships at these universities. But it's nothing like what the Biden team acknowledged is needed to make up for decades of discrimination and neglect – by scaling up research across hundreds more higher-education institutions.

The House Democrats' proposal does include $2 billion in federal grants earmarked for all US universities outside the R1 category (under the Carnegie Classification of Institutions of Higher Education), which indicates the highest levels of research activities. But more than 700 institutions will need to compete for this funding. "We are struck by the contrast between the vision laid out by the president and the actual application that we see in Congress," Lodriguez Murray, senior vice-president of public policy and government affairs at UNCF, an organization that raises funding for HBCUs, told *The Washington Post*.

> **"There is no substitute for steady, predictable, long-term funding."**

HBCUs in the United States trace their origins to the segregation era of the 1800s. They seek to provide a nurturing environment for their students in a way that is less common elsewhere in higher education. The university experience is like being part of a family, several HBCU staff members and students have told *Nature*. "It's not unusual for students who experience housing or food insecurity to be taken to an administrator's home and given care and support," said Ronald Smith, who runs mentoring programmes at Howard University in Washington DC.

The majority are teaching-focused institutions, although an increasing number have ambitions to excel at research, too. One-third of Black Americans with a PhD earned their first degree at an HBCU; 11 of these institutions are in the second-highest research classification, called R2, but none yet is among the 131 universities with the coveted R1 status.

For decades, HBCUs have suffered from underinvestment – especially when compared with the funding of predominantly white institutions. Now, in addition to long-standing fundraising from UNCF, technology corporations are also stepping in with donations. Google is providing $50 million to 10 HBCUs, and Apple $5 million to four institutions.

Some HBCUs are also seeing extra funding from legal settlements in which state governments are compensating universities for past inequities. In the United States, state governments fund public universities and the federal government provides grants for research. Four HBCUs in Maryland – including Morgan State University in Baltimore – will share $577 million from a settlement with the state of Maryland over the next decade, following a 15-year campaign by alumni highlighting that the state had treated its HBCUs less fairly than it did predominantly white institutions.

Such settlements are an overdue step, but the leaders of universities and colleges educating students from under-represented communities rightly say that there is no substitute for steady, predictable, long-term funding, as opposed to one-off grants – for which institutions that are intentionally collaborative and inclusive will have to start competing.

Institutions, agencies and governments around the world have made many pledges to increase inclusion in the past year in science, technology, engineering and mathematics. These pledges need to be fulfilled and words must now translate into action. That means congressional support for research at historically underfunded universities at a level that is much closer to the Biden administration's original $20-billion proposal.