CERI & KRISP Newsletter

Volume 6, Number 4, April/May 2023

Introduction

A warm welcome to our growing scientific community. April was an incredibly busy and exciting month for CERI and KRISP, centered around the launch of the CLIMADE (Climate Amplified Diseases and Epidemics) consortium and the inauguration of the R1.2 billion Biomedical Research Institute (BMRI) at Stellenbosch University. This events brought together leading experts and stakeholders from all over the world to celebrate this momentous occasion and the state-of-the-art facilities that will enable us to lead the way in genomic research.

At the same time, 36 fellows from 18 different African countries joined us for an intensive two-week genomics and bioinformatics workshop we hosted at CERI, as part of our fellowship programme. This training initiative and our continued efforts in genomics surveillance and pandemic response helped to re-emphasise the importance of capacity building and knowledge transfer between scientists in the global south.

Highlights

News: **Search for Diseases Supercharged by Climate Change: The CLIMADE consortium**

News: **How Africa could protect the world from new pathogens**

News: **Scientists warn climate change will increase the spread of infectious diseases**

News: **This is the 'highest level of science' – inside the new Biomedical Research Institute**

News: **Africa's Most Sophisticated Biomedical Research Centre Opens in South Africa**

Feature: **Launch of the International Pathogen Surveillance Network, Geneva, 30 May**

Feature: **First annual report the WHO Hub for Pandemic and Epidemic Intelligence**

Training: **Genomics and Bioinformatics Training Workshop, CERI, 11 – 21 April**

NEWS: Virus Hunters Search for Diseases Supercharged by Climate Change: The CLIMADE consortium

By Riley Griffin, Bloomberg, 20th April 2023

As extreme weather events and warming temperatures threaten to create new and deadly pathogens, some of the biggest names in public health have joined forces to launch a new consortium, known as CLIMADE, aimed at thwarting climate-amplified diseases and epidemics.

Led by the South Africa-based Centre for Epidemic Response and Innovation (CERI), Brazil's Fundação Oswaldo and the University of Sydney, CLIMADE has drawn more than 100 scientists and secured nearly $10 million in funding from the World Bank, European Commission, Africa CDC, US National Institutes of Health, Abbott Laboratories, among others, to predict, track and mitigate the impact of diseases supercharged by climate change.

CLIMADE-backed scientists will analyze data on weather patterns, the environment and viral sequences to predict ripe conditions for a disease outbreak. Once a potential health threat is identified, the consortium will deploy surveillance tools and other resources to prevent the spread of that disease or track its evolution. CLIMADE will initially focus on places in Africa and Latin America disproportionately impacted by climate change, but intends to expand to other regions as it coalesces additional funding.

"If you have a big flood in California, you would want to know quickly whether that flood contaminated that river with a new bacteria—or if you have a fire that shifts the movement of wild animals, you want to know if they're carrying diseases," said Tulio de Oliveira, the director of CERI

As CLIMADE discovers new pathogens and learns about climate-related changes to existing ones, it will make that data public, thereby allowing governments around the world to act on those insights. De Oliveira said he's particularly concerned about how warmer temperatures are amplifying mosquito-borne diseases, such as West Nile virus, Zika virus and Chikungunya virus.

Link to full article:
https://www.bloomberg.com/news/articles/2023-04-20/climade-s-virus-hunters-search-for-deadly-diseases-amplified-by-climate-change

Link to CLIMADE website: **https://climade.health**

NEWS: How Africa could protect the world from new pathogens

By Ben Farmer, The Telegraph, 3 May 2023

Prof Tulio de Oliveira is clearly proud of the impression his gleaming new Cape Town laboratory makes on academic visitors from Europe, America and beyond. “To see the faces of the Americans, the Australians, the British, the Germans, the Swedes, when they arrive here,” he smiles. “They are just completely surprised. They don't expect that kind of lab,” he says.

Built inside a recently-opened Stellenbosch University research complex, the new Centre for Epidemic Response and Innovation (CERI) lab is a centrepiece in a rapidly growing network of genomic surveillance centres across Africa.

“It's awesome,” enthuses one visiting scientist from Berlin. “This building is so great. I have seen a lot of labs, but this is really, really nice. The entire atmosphere. And equipment-wise, you are so well-equipped.”

Genomic surveillance has been focused in the past three years on Covid-19, but as the pandemic fades, other pathogens are being studied. Scientists in South Africa have for example for years been sequencing and tracking HIV and tuberculosis variants so that they can tailor treatment effectively.

There are three benefits of genomic surveillance. Firstly, by tracking the changing genomes and genes of known pathogens, they can ensure that tests, treatments and vaccines remain effective. Secondly, the lab can help virus hunters quickly identify and track new emerging infections, such as the coronavirus, or ones that have re-emerged. For **example researchers from the lab have recently been studying cholera sequences from Malawi**, which has been hit by its worst outbreak of the disease in decades. **The lab has also tracked Zika and Chikungunya outbreaks in South America.**

CERI will play a leading role in an ambitious new consortium, known as CLIMADE, aiming to thwart climate-amplified diseases and epidemics.

Link to full article:
https://www.telegraph.co.uk/global-health/science-and-disease/genomic-surveillance-lab-science-research-pathogens/

Link to CLIMADE website: **https://climade.health**

NEWS: Scientists warn climate change will increase the spread of infectious diseases

Lucious Chabuka, a laboratory technologist at the Public Health Institute of Malawi, came to South Africa for training in Sars-CoV-2 sequencing. Picture: Brian Sokutu, The Citzen

Scientists work on surveillance system to catch outbreaks before they escalate. CLIMADE will start with disease surveillance in Africa and Latin America and expand to countries around the world that are often impacted by infectious disease outbreaks.

With the world still reeling from the Covid pandemic, leading scientists are warning that global warming will impact more than half of known infectious diseases which commonly spread via water or animals. These include Cholera and Malaria in Africa and chikungunya in Latin America, both of which are spread by mosquitoes.

According to Professor Tulio de Oliveira **"These epidemics will emerge often, affecting global travel. Climate change, coupled with the concentration of population in one area, such as on the Cape Flats, will lead to the outbreak of epidemics."**

"But this does not mean the next epidemic has to become a pandemic. That is why we have to act quickly – identify teams that collaborate all around the world, with governments and industry playing a role to protect the world for the next epidemic," said De Oliveira.

De Oliveira said a team of scientists was dispatched to flood-ravaged Malawi, which recently had the **"worst cholera outbreak in African history – 100 000 cases following an extreme climate event",**

"Two weeks ago, we responded to Paraguay, where the country experienced the worst outbreak of chikungunya, which is transmitted by mosquitoes. It's the worst epidemic in the history of Latin America. Warm and rainy weather led to a mosquito – driven epidemic – what climate change is going to lead to in the next few years," said De Oliveira.

Link to full article:
https://www.citizen.co.za/news/climate-change-increase-spread-of-infectious-diseases/

Link to CLIMADE website: **https://climade.health**

NEWS: Abbott And New Global Consortium Partnership Tackle Viral Outbreaks Caused By Climate Change

Abbott announced today that it's partnering with the Climate Amplified Disease and Epidemics (CLIMADE) consortium, a group of more than 300 global scientists in public health agencies, academia and industry focused on using data science technology and diagnostic testing to tackle the impact climate change has on disease outbreaks.

Climate change effects, such as warmer temperatures and a rise in droughts and floods, have accelerated the spread of disease, which could fuel a new era of pandemics. Research has found that climate change will impact more than half of known infectious diseases, which commonly spread via water or animals carrying diseases, such as Lyme disease, West Nile virus and malaria.

As part of the consortium, scientists trained in infectious diseases, bioinformatics and data science will develop technologies that can aggregate environmental, weather and viral sequencing data sets to predict if conditions could cause a disease outbreak. If a potential outbreak is identified, resources and rapid surveillance testing can be sent to that location to prevent further spread.

"Imagine being able to track weather patterns to determine if rising floods may lead to a water-borne disease outbreak," said Gavin Cloherty, Ph.D., head of infectious disease research and the Pandemic Defense Coalition in Abbott's diagnostics business.

The CLIMADE scientists is led by Tulio de Oliveira, Ph.D., a professor at CERI as well as Luiz Carlos Alcantara, Ph.D., a professor at the Fundação Osvaldo Cruz (FIOCRUZ) in Brazil and Prof Edward Holmes from University of Sydney. "We are bringing together the best minds in the medical, scientific and public health communities to help the world create a robust surveillance system that quickly identifies pathogens and tracks their evolution and spread," said Oliveira.

Link to full article:
https://www.prnewswire.com/news-releases/abbott-and-new-global-consortium-partnership-address-viral-outbreaks-caused-by-climate-change-301802831.html

Link to CLIMADE website: **https://climade.health**

PUBLICATION: Rapid epidemic expansion of chikungunya virus-ECSA lineage in Paraguay

The spread of vector-borne viruses, such as chikungunya (CHIKV), is a significant public health concern in the Americas, with over 120,000 cases and 51 deaths in 2023, of which 46 occurred in Paraguay. Using a suite of genomic, phylodynamic, and epidemiological techniques, we characterized the ongoing large CHIKV epidemic in Paraguay.

Manuscript by: Giovanetti et al. medRxiV, 2023, https://doi.org/10.1101/2023.04.16.23288635

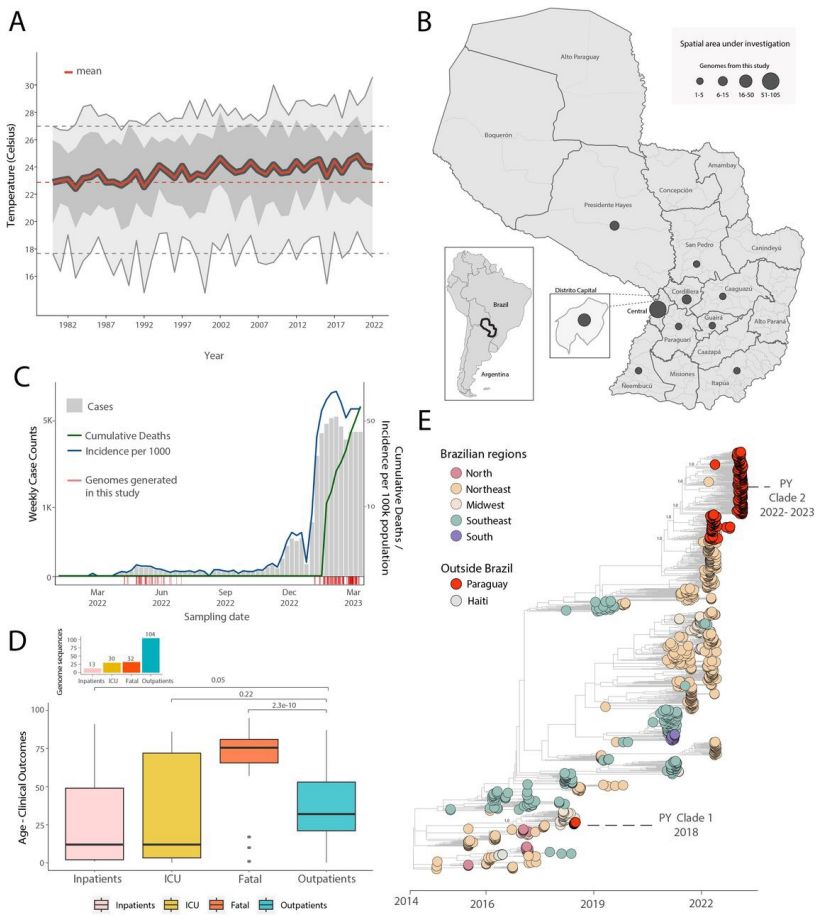


Fig 1: Spatial and temporal distribution of CHIKV cases in Paraguay.

The rapid and large resurgence of CHIKV in 2022 coinciding with the highest mean temperatures ever reported (Figure 1A). The samples had a good spatial representation of southern Paraguay (10 out of 17 districts) (Figure 1B) including several of the districts with highest historical counts of CHIKV infections and captured both the out- and in-season periods of transmission (autumn and early winter 2022 and summer 2023, Figure 1C). Time-resolved maximum likelihood tree including the newly complete genome sequence from Paraguay (n=179) generated in this study (Figure 1E)

Chikungunya is a mosquito-borne disease caused by the chikungunya virus (CHIKV), a single-stranded positive-sense RNA virus belonging to the Togaviridae family (1), which is transmitted to humans through the bite of infected Aedes mosquitoes.

The Study

CLIMADE scientists from FioCruz in Brazil and CERI in South Africa partnered with the Pan-American Health Organization (PAHO) to perform on-site genomic surveillance at the Laboratorio Central de Salud Pública in Asunción, Paraguay. From March 11 to 17, 2023, a team of molecular biologists from Brazil and Paraguay worked with a set of selected samples (based on cycle threshold - Ct ≤35 and availability of epidemiological metadata, generating 179 viral genomes.

Conclusions

This study highlights the resurgence of CHIKV-ECSA in Paraguay in 2022-2023. Our findings provide evidence of lineage persistence in the country over a period of 11 months preceding resurgence and present the notable coincidence of virus resurgence alongside the highest mean temperatures ever recorded in Paraguay.

Link to full paper:
https://climade.health/2023/04/24/rapid-epidemic-expansion-of-chikungunya-virus-ecsa-lineage-in-paraguay/

NEWS: This is the 'highest level of science' – inside the new Biomedical Research Institute: CERI's home

By Elsabé Brits, Daily Maverick, 19 April 2023

The new Biomedical Research Institute on the Tygerberg campus of Stellenbosch University 'was a 10-year dream costing R1.2-billion' to address the major health challenges of Africa.

The Biomedical Research Institute (BMRI) has numerous facilities: a biosafety level 3 (BSL-3) laboratory, a fully automated biorepository which can store up to eight million biomedical samples, electron microscopy, four dissection halls, a surgical skill laboratory and several groups focusing on advanced genomics.

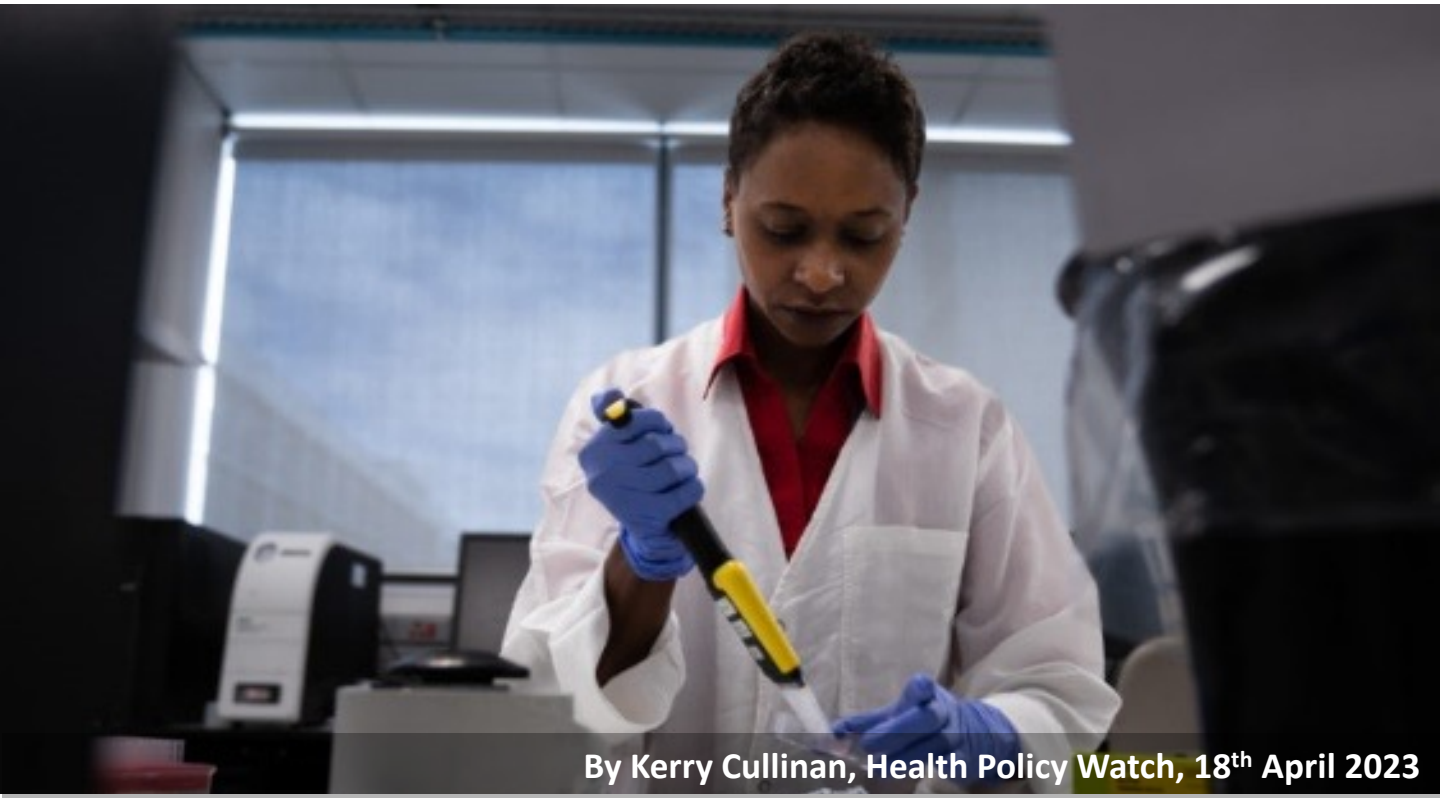
Professor Nico Gey van Pittius, the Vice Dean: Research and Internationalisation of the Faculty of Medicine and Health Sciences, said it became apparent during Covid-19 that Africa had a unique set of health challenges, populations and needs. **"Biomedical research is the basic understanding of disease but it also tries to find solutions, diagnostics and treatments, and to understand the underlying mechanisms of disease,"** he said.

"We receive samples from African countries to produce genomes to characterise pathogens. If you can do this, you can develop the diagnostics, the therapeutics, and vaccines," Professor Tulio de Oliveira says. They do genome sequencing for 26 African countries and provide training for 320 fellows.

Professor Tulio de Oliveira, from the Centre for Epidemic Response and Innovation (CERI), says the BMRI was one of the main reasons he was attracted to the university. "It was this vision of creating a space where we can do the highest level of science… Our mandate is not only to support other African countries with [identifying] and characterising pathogens – with dozens and dozens of pathogens, many of which you may never have heard of.

Link to full article:
https://www.dailymaverick.co.za/article/2023-04-19-a-look-inside-stellies-biomedical-research-unit/

NEWS: Africa's Most Sophisticated Biomedical Research Centre Opens in South Africa



By Kerry Cullinan, Health Policy Watch, 18th April 2023

The most advanced biomedical research centre on the African continent has opened in South Africa, boasting state-of-the-art research and training facilities.

Stellenbosch University's Biomedical Research Institute (BMRI) houses over 500 researchers who are examining the genetic and biomolecular basis for diseases afflicting Africans – including Professor Tuilo De Oliveira, renowned for decoding the COVID-19 variant, Omicron.

De Oliveira's CERI is one of only two specialised genomic facilities on the African continent, the other being Christian Happi's African Centre of Excellence for Genomics of Infectious Diseases at Redeemer's University in Nigeria.

"Our mandate on the continent from the Africa CDC is to support other African countries with identifying and characterising pathogens, and we do that – dozens and dozens of pathogens, many of them that you may not have ever heard," De Oliveira told the media launch. "For example, we sent a team to Malawi last week to help characterise their explosive cholera outbreak. We have a team going to Mozambique to do a similar thing,"

"We also receive samples from other countries in Africa and produce genomes that can better characterise the pathogens because if you can characterise the pathogen, you can develop the diagnostics, you can develop the therapeutics and you can develop a vaccine."

Aside from providing genomic sequencing for 26 African countries in the past year, CERI has is running an African genomics Africa fellowship, and has trained 320 fellows so far to take the technology back to their own countries. De Oliveira is also one of only 20 scientists represented on the World Health Organisation's virus evolution committee that helps to guide the global response to new virus threats as they evolve.

"Unfortunately, that's what viruses do – evolve. We saw that with COVID evolving a lot. We see how HIV evolved to generate drug resistance. We are now very worried about the evolution of the avian pathogenic strain of H5N1 that's decimating the bird populations around the world," says De Oliveira. "Pathogens don't respect borders."

Link to full article:
https://healthpolicy-watch.news/africa-biomedical-research-institute/

FEATURE: Genomics and Bioinformatics Training Workshop

Figure 1: Fellows and trainees at the entrance of the CERI's facilities at the BMRI building

CERI recently hosted 36 fellows from 18 African countries, from the 11 to 21 of April 2023, who attended a two-week training fellowship on genomics and bioinformatics. This forms part of a bigger capacity building initiative to upskill scientists in the Global South with the necessary skills to perform effective genomic surveillance and detection of pathogens using NGS technology, and then to interpret their own data and learn how to communicate this effectively to governments.

By providing this intensive, hands-on training, our mission is to make Africa a genomics powerhouse that can take the lead in pathogen surveillance and pandemic response, not only on home soil, but globally. Special thanks must go to our partners and sponsors who help make this all possible: - Africa CDC, WHO AFRO, The Rockefeller Foundation, Illumina and Abbott.

Figure 2: Training at the CERI lab.

Link to Information of the 36 fellows :
https://genomics.africa

FEATURE: We are featured in the first annual report the WHO Hub for Pandemic and Epidemic Intelligence

Visit of Prof Tulio de Oliveira and Dr Sikhulile Moyo, recipients of the German Africa Award 2022 for discovering the omicron variant of SARS-CoV-2, to the WHO Hub in November 2022

International Pathogen Surveillance Network (IPSN) – A WHO-led initiative designed to address the needs in local-to-global genomic surveillance for timely and appropriate public health actions for pathogens with pandemic potential. The IPSN involves a Technical Connector for networks and laboratories, a Partners Forum for advocacy and resourcing, as well as a Steering Committee. In 2022, the project conceptual approach was finalized, and the project governance established. IPSN also held the first meetings of the community of practice and the country scale-up accelerator, which had active participation from stakeholders.

The WHO Hub for Pandemic and Epidemic Intelligence was established in Berlin with the foundational investment of the Government of the Federal Republic of Germany in September 2021 to support countries, regions, and global actors to avert and manage public health threats more efficiently. Throughout 2022, the WHO Hub has shown itself to be a centre of innovation and excellence in public health surveillance and is filling an important niche for public health actors, as demonstrated by active engagement in its projects and external programmes.

Link to Download the Annual report:

https://pandemichub.who.int/docs/librarieprovider2/default-document-library/who_pandemic_hub_annual_report_2022_final.pdf?sfvrsn=db152470_3&download=true

World Health Organization

FEATURE: We are invited to the launch of the International Pathogen Surveillance Network (IPSN), World Health Assembly, Geneva, 30 May

Professor Tulio de Oliveira was invited by Dr. Tedros Adhanom Ghebreyesus (Director General WHO) and Dr. Chikwe Ihekweazu (Director of WHO pandemic Hub) to take a position on the leadership committee of the International Pathogen Surveillance Network (IPSN). Prof de Oliveira will be a panellist on the official launch of IPSN as part of the World Health Assembly on 30 May 2023 in Geneva.

Forming part of the WHO Health Emergencies Programme, the WHO Hub for Pandemic and Epidemic Intelligence (the WHO Pandemic Hub), facilitates a global collaboration of partners from multiple sectors that supports countries and stakeholders to address future pandemic and epidemic risks with better access to data, better analytical capacities, and better tools and insights for decision-making. With support from the Government of the Federal Republic of Germany, the WHO Pandemic Hub was established in September 2021 in Berlin, in response to the COVID-19 pandemic, which demonstrated weaknesses around the world in how countries detect, monitor and manage public health threats.

The WHO Pandemic Hub works closely with Member States and WHO Regional and Country Offices to strengthen their data-sharing capacities and enable partners from around the world to collaborate and co-create tools to gather and analyse data for early warning surveillance. With a presence in more than 150 countries, six Regional Offices, and its Geneva Headquarters, WHO's reach gives us the ability to treat pandemic, epidemic and public health risks with equal urgency and diligence around the globe.

By linking local, regional, and global initiatives, the WHO Pandemic Hub fosters a collaborative environment for innovators, scientists and experts from across a wide spectrum of disciplines, allowing us to leverage and share cutting-edge technology and anchoring our work in the needs of stakeholders around the world.

IPSN will build on expertise across disciplines, sectors, and regions, it will leverage WHO's convening power to foster global solutions built on an architecture of global collaboration and trust.

CERI & KRISP Papers

OPEN ACCESS

Rapid epidemic expansion of chikungunya virus-ESCA lineage in Paraguay.
Giovanetti M, Vazquez C, Lima M, Castro E, Tegally H, Lessells RJ, Holmes EC, de Oliveira T, Fonseca V. et *al.* **medRxiv preprint** doi: https://doi.org/10.1101/2023.04.16.23288635

HIV-1 drug resistance in people on dolutegravir-based ART: Collaborative analysis of cohort studies
Loosli T, Hossmann S, Ingle SM, Gill MJ, Sabin CA, Maartens G, Sterne AC, Lessells RJ, Egger M, Kouyos R. *et al.* **medRxiv preprint** doi: https://doi.org/10.1101/2023.04.05.23288183

Increased interregional virus exchange and nucleotide diversity outline the expansion of the chikungunya virus ECSA lineage in Brazil
Xavier J, Alcantara L, Fonseca V, Lima M, Castro E, Fritsch H, Carneiro T, Nardy V, de Filippis MB, Giovanetti M. *et al.* **medRxiv preprint** doi: https://doi.org/10.1101/2023.03.28.23287733

Evaluation of miniaturized Illumina DNA preparation protocols for SARS-CoV-2 whole genome sequencing
Pillay S, San JE, Tshiabuila D, Naidoo Y, Pillay Y, Maharaj A, Anyaneji UJ, Wilkinson E, Tegally H, Lessells RJ, Baxter C, de Oliveira T, Giandhari J. PLoS One 2023; doi: 10.1371/journal.pone.0283219

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