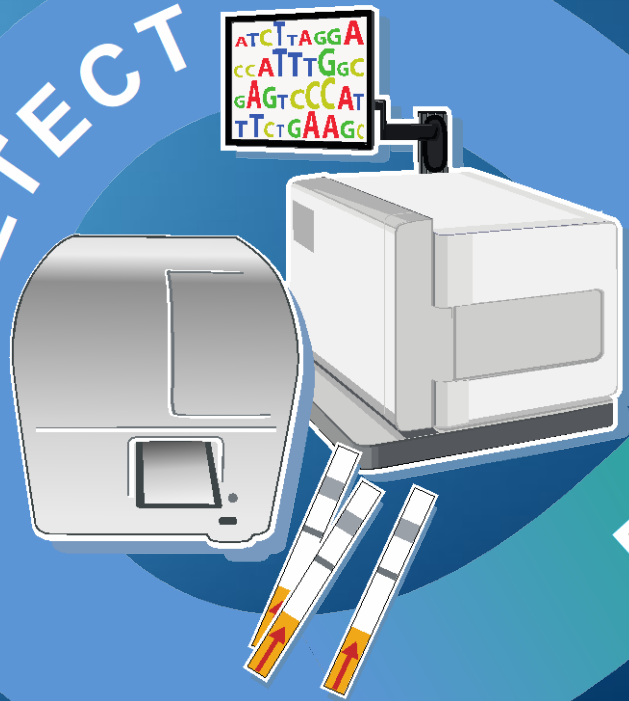


DETECT



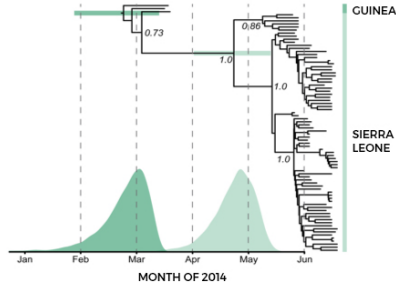
EMPOWER



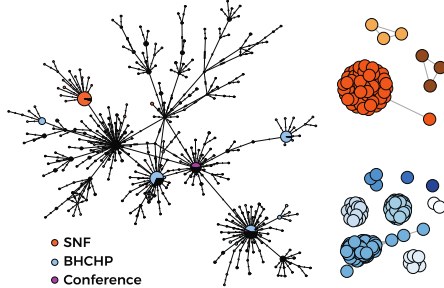
CONNECT

Pathogen Genomic Surveillance

Transmission Patterns

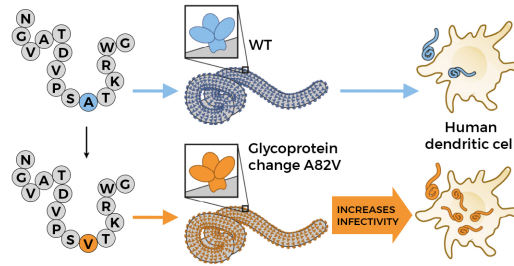


Ebola was spreading
human to human

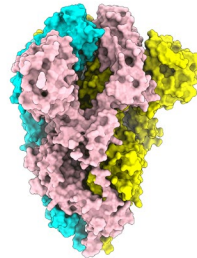


COVID driven by
superspreader events

Novel Mutations

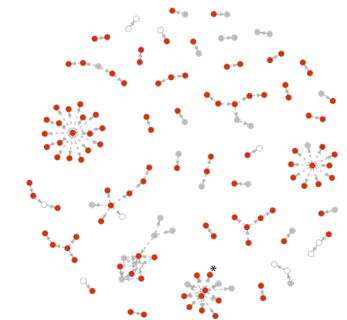
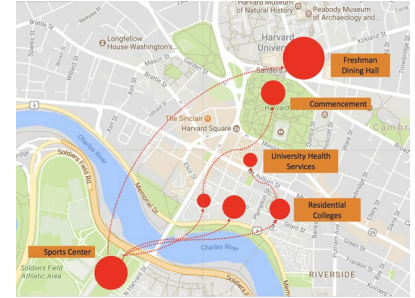


Ebola mutations increased
infectivity



COVID's D614G mutation
does as well

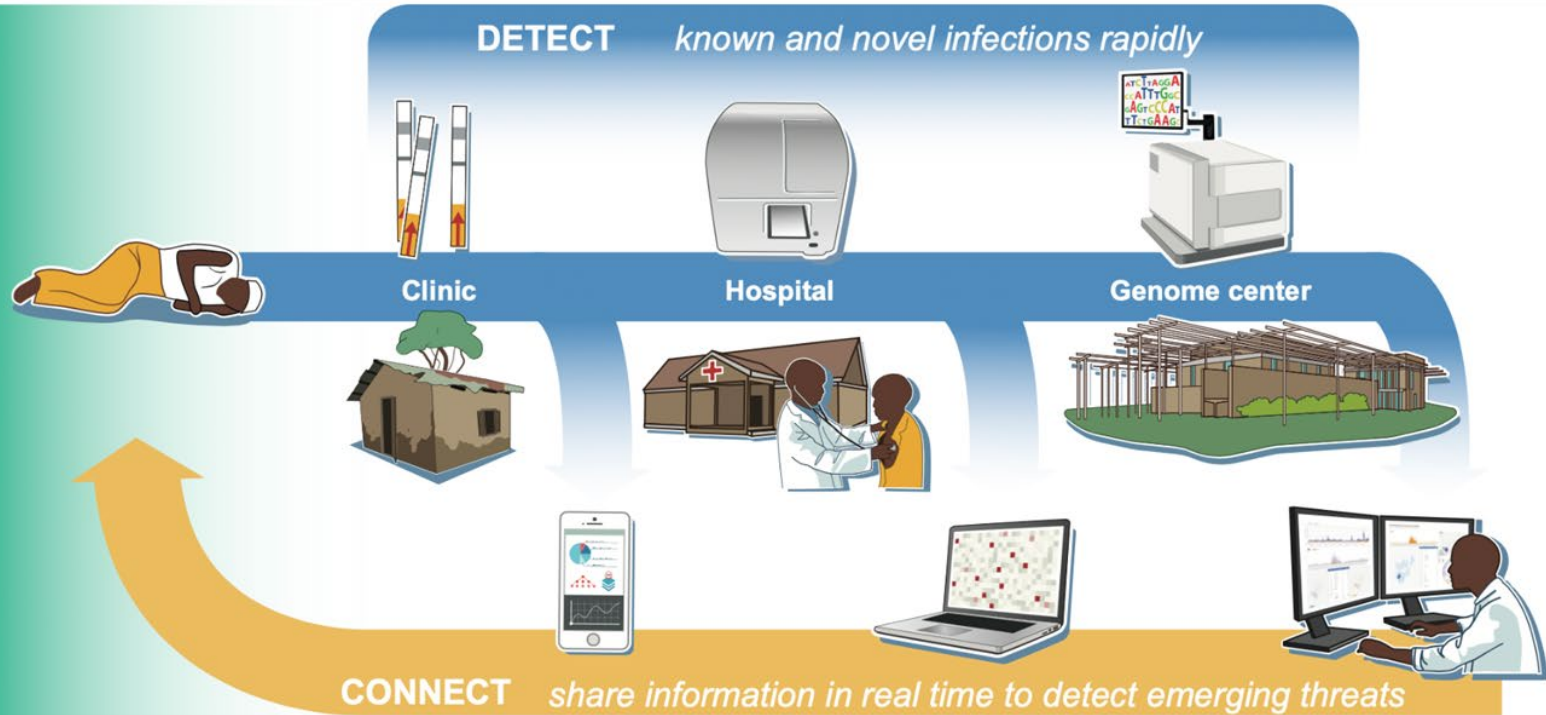
Contact Tracing



COVID was transmitting from

Sentinel: Outbreak Prevention & Response

EMPOWER
the public health
community to improve
pandemic preparedness
anywhere in
the world



Sentinel: Outbreak Prevention & Response

EMPOWER
the public
health
community to
improve
pandemic
preparedness
anywhere in
the world

DETECT

known and novel infections rapidly



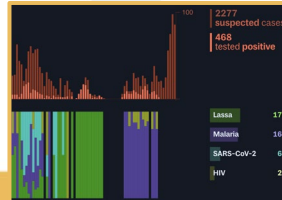
Clinic



Hospital



Genome center



CONNECT

share information in real time to detect emerging threats



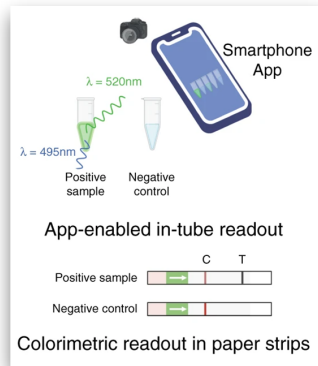
CRISPR- and AI-Based Diagnostics

Point-of-care (SHINE)

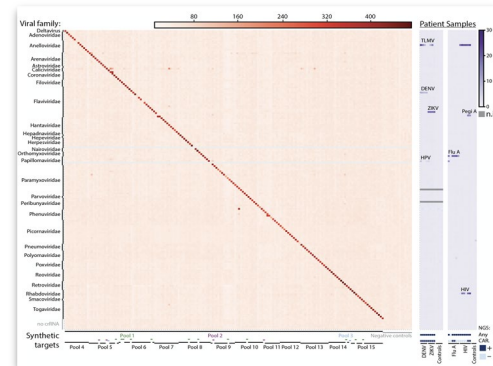
The New York Times

Pregnant Women Anxious as Florida's Zika Test Results Take Weeks

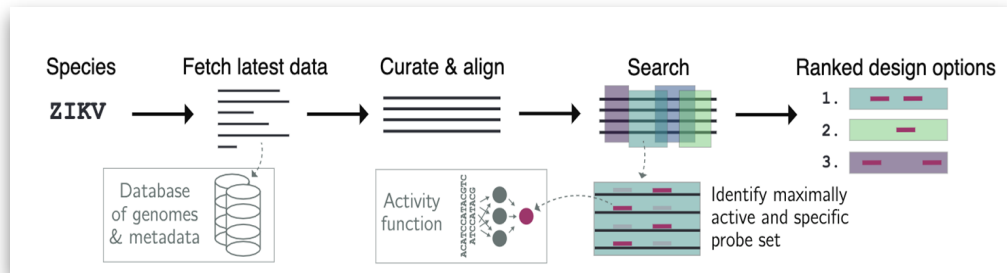
By LIBERTY KAMARIE Sept. 11, 2016



Multiplex (CARMEN)

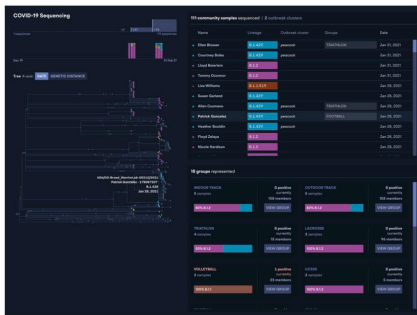


Assay design for any virus (ADAPT)



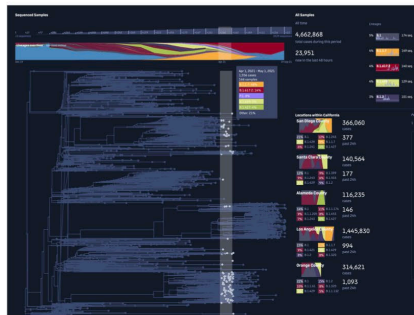
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TGAGTCCACACTGAAAGCATTTAAGAGGGTCCCTGCACAG
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AGTAGGTTAAGAAAAAGCTTGAGGAAGATTAGAAAAAACT
GATGAAGCAGTTGACATTCTTCTCTTGATGTTAAATGGCTA

Data Analysis and Visualization with Fathom



Understanding community transmission

Using genomic data to understand intra-community spread vs. outside introductions



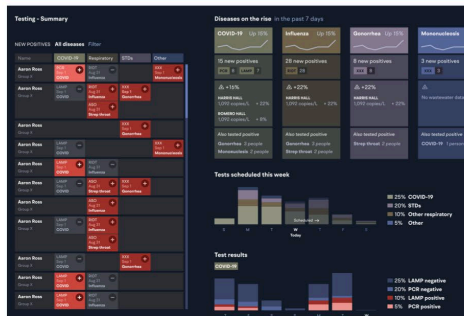
State-level monitoring

State-level sequencing for lineage surveillance



Zoonotic crossover

Lassa surveillance program



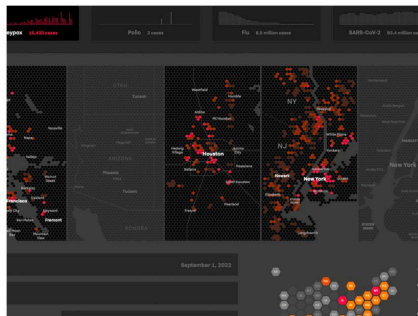
Multiplex testing

Integrating multiplex testing systems like CARMEN into community surveillance tools



Multi-pathogen surveillance

State-level sequencing for lineage surveillance



Multiple outbreak monitoring

Different levels of fidelity depending on scale and type of outbreak aimed at a national surveillance team

Developing capacity across African continent with ACEGID

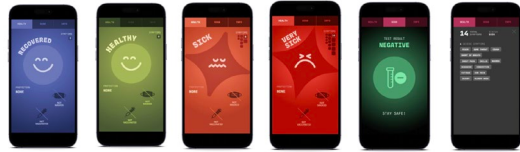
- Education and Training
 - Next Generation Sequencing (NGS)
 - Metagenomic Sequencing
 - Bioinformatics
 - Instrumentation

**53 of 54 Countries across Africa
trained**

- Over 1600 participants



Outbreak Education – Operation Oubtreak



CHAPTER 2 | EPIDEMIOLOGY

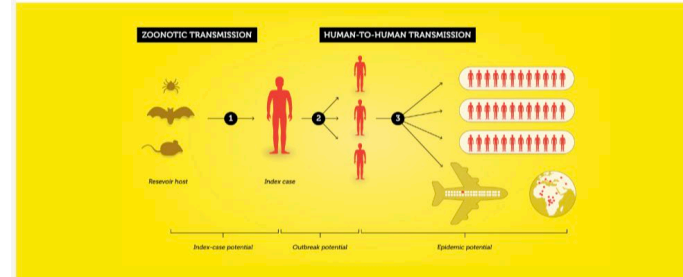


FIGURE 2.3 | Index case. This graphic shows an example of the progression of viral from the reservoir host, to the index case (who may or may not be the primary case), to more individuals, with the potential for epidemic proportions.

COVID-19 app has been used by 16.5 million people out of a population of 34.3 million smartphone users. App users were notified whenever they had been in close contact with another user reported as positive, as well as if they had been exposed by visiting a high risk location. They would also receive information about how to prevent further spreading and suggestions to quarantine after a close contact exposure notification. Although this is a rather new technology, this app proved to be a helpful community measure, and these strategies are being replicated to prepare for future threats.

These digital methods have demonstrated benefit, but as you can imagine, adverse feelings towards the technology may limit uptake. Concerns about digital privacy and government involvement in social contact tracing technologies can not only make the general public wary, but also make the technology dangerous to particular communities – notably undocumented people and survivors

of domestic violence. For these reasons and many more, these technologies need to be used thoughtfully and designed to protect the data privacy of users.

Index Case

By following the course of an outbreak back to its source, epidemiologists are often able to get a better understanding of who may have been exposed, how a disease may be spreading, or what risk the disease may pose to the population. The first case identified by health officials in an outbreak is referred to as the **index case** (colloquially known as *patient zero*); for known infectious diseases that are not endemic, this is often the first signal to researchers that an outbreak could be on the horizon (Figure 2.3). While the index case is the first *identified* case, it may not be the first individual to bring a pathogen into a specific population, who is known as the **primary case**. It often takes some