












The Forefront of Innovation

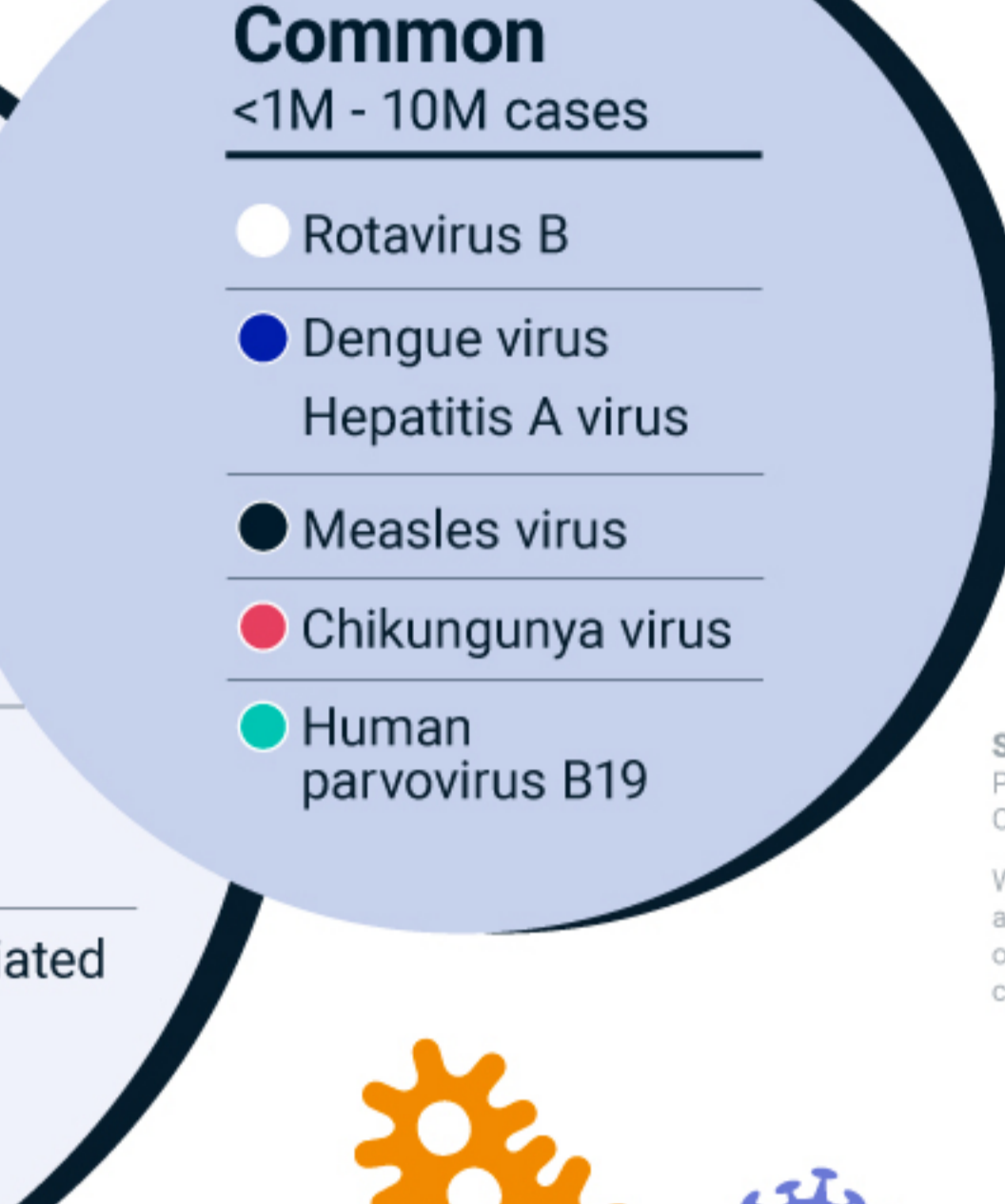
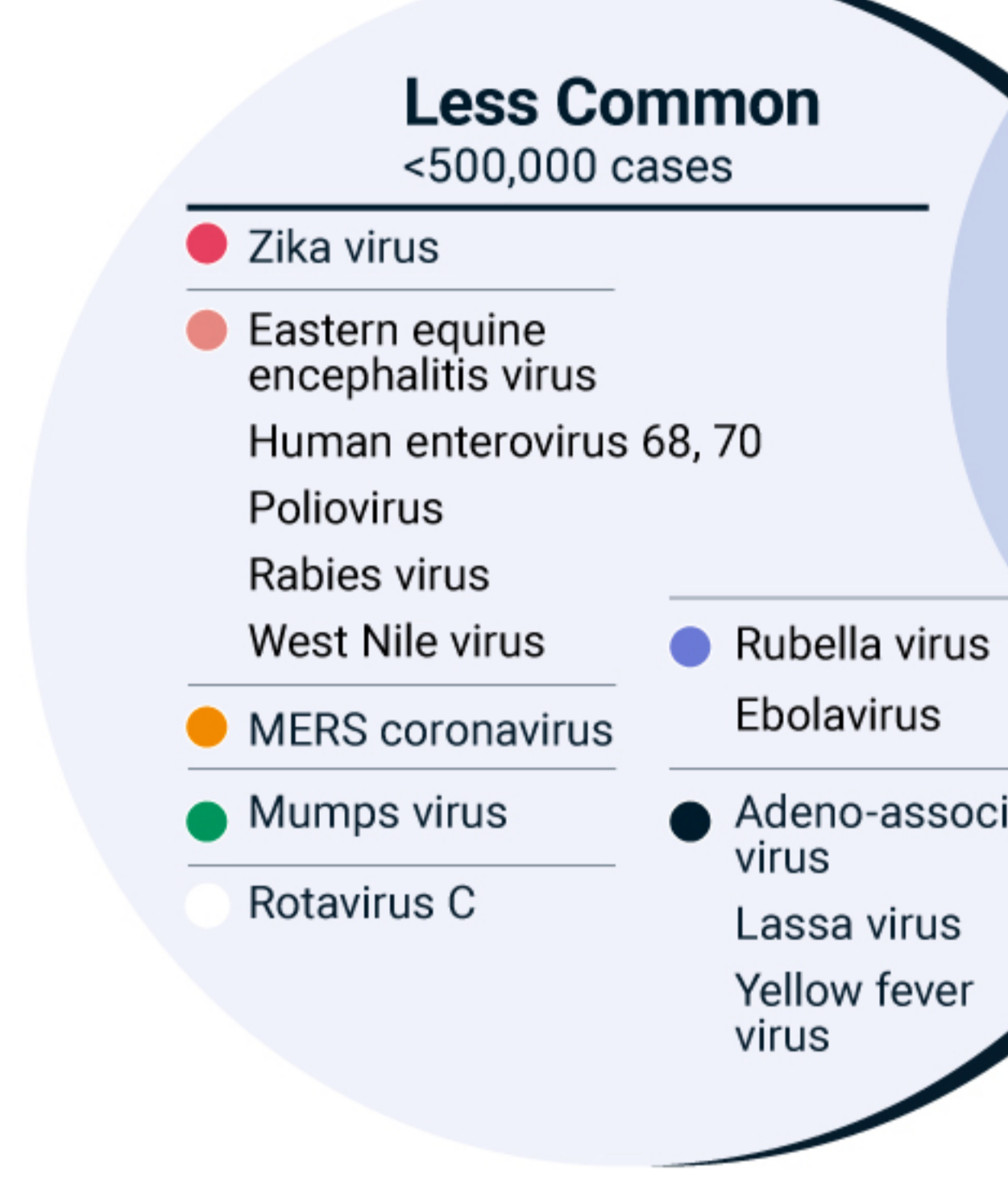
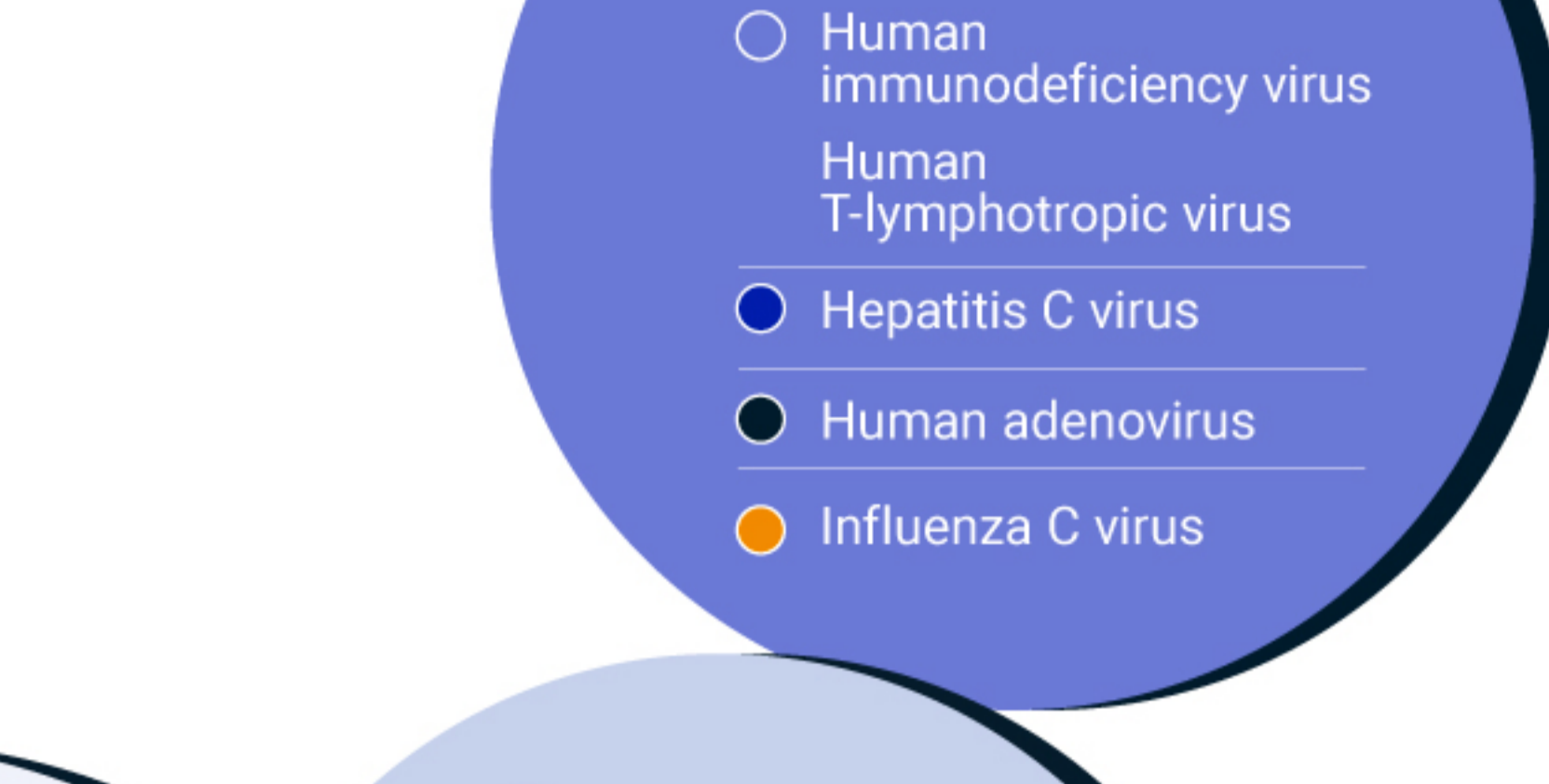
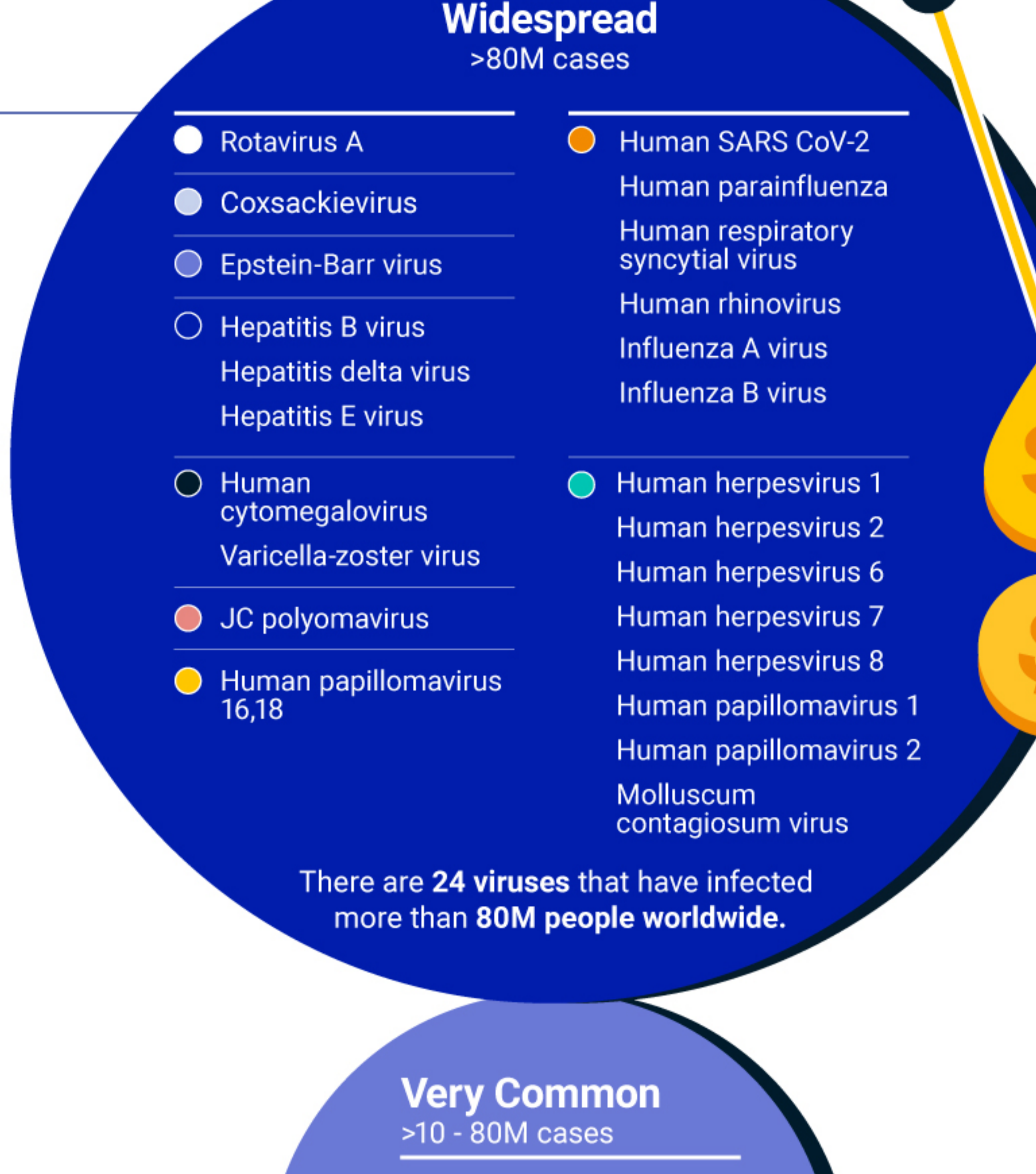
Vaccines and Antivirals

COVID-19 has affected millions of people worldwide, bringing renewed focus to viruses.

However, viruses extend far beyond the SARS-CoV-2 virus that causes COVID-19.

Common Human Viruses by Type and Prevalence

-  Gastrointestinal
-  Heart
-  Immune system/cells
-  Liver
-  Multiple organs targeted
-  Muscle and Brain
-  Nervous System
-  Reproductive organs
-  Respiratory
-  Salivary glands
-  Skin



Source: Expaty - Swiss Bioinformatic Resource Portal (Jan 2011), World Health Organization, Center for Disease Control (Mar 2022). Widespread viruses refer to those that affect greater than 1% of the population or are mentioned as being "extremely common" by the sources.

What is a virus?

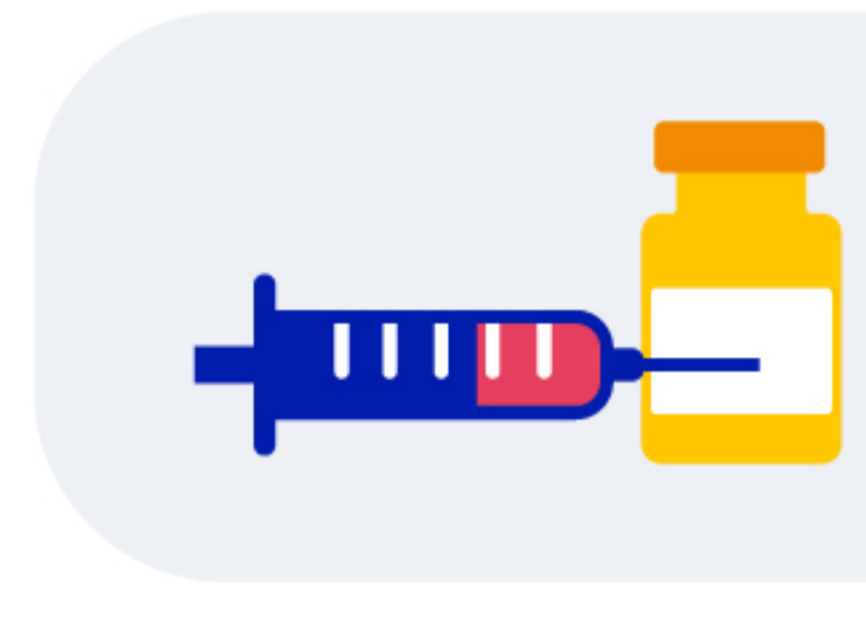
A virus is a microscopic infectious agent that replicates within living cells. It may cause disease in its host.

New viruses can emerge at any time as a result of mutation, or when viruses transfer from animals to humans.



Rapid Innovation

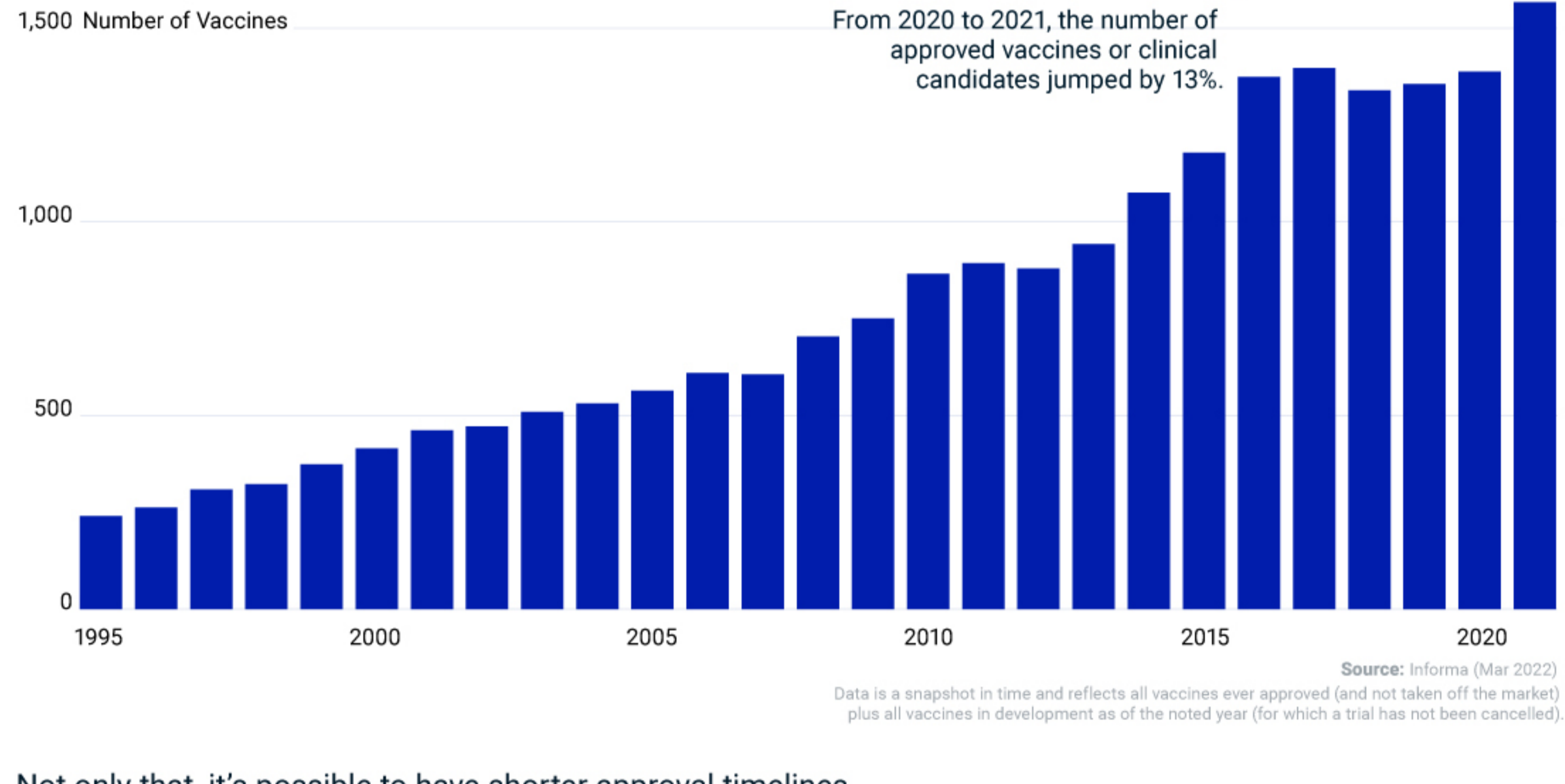
Through virology, the study of viruses, scientists are continuously finding new ways to fight against infectious diseases. Two main types of anti-infectives are available: **vaccines and antivirals**.



Vaccines

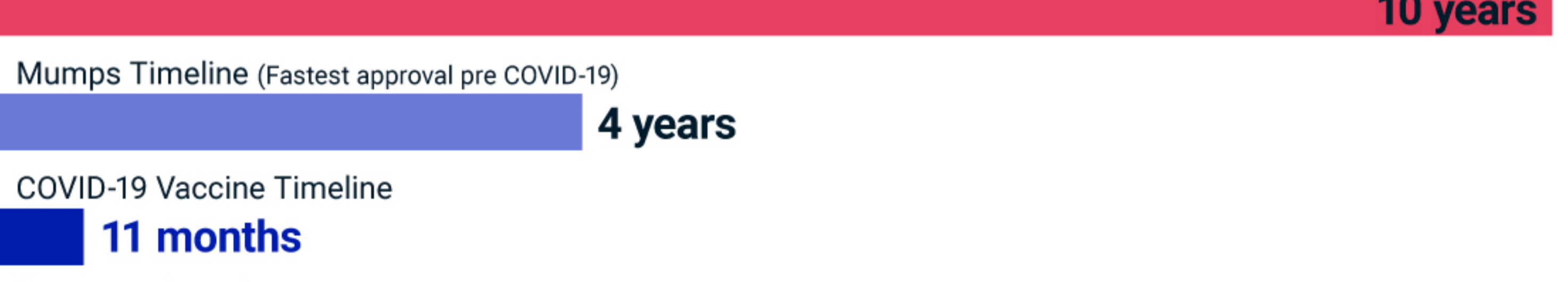
Vaccines are substances designed to prevent people from getting infected with a disease or experiencing serious symptoms. In the last three decades, the number of vaccines has increased dramatically.

Vaccines Approved or in Development Over Time (1995-2021)



Not only that, it's possible to have shorter approval timelines. COVID-19 vaccines were approved much more quickly than previous industry norms.

Vaccine Approval Timeline



Some factors that sped up approval were specific to the pandemic.

But some aspects, such as more efficient clinical trials and better collaboration with regulators, can be applied to future vaccine developments.

Innovation may also help reduce development timelines.

-  **mRNA technology** can be used as a base "software" that scientists build on to prevent various infectious diseases, rather than starting from scratch.
-  **Artificial intelligence** is being introduced to identify shared characteristics between viruses and iteratively test vaccines.

Source: Harvard Business Review, The Coalition for Epidemic Preparedness Innovations (Apr 2022)

In the time between an outbreak and vaccine development, antivirals can play a vital role.

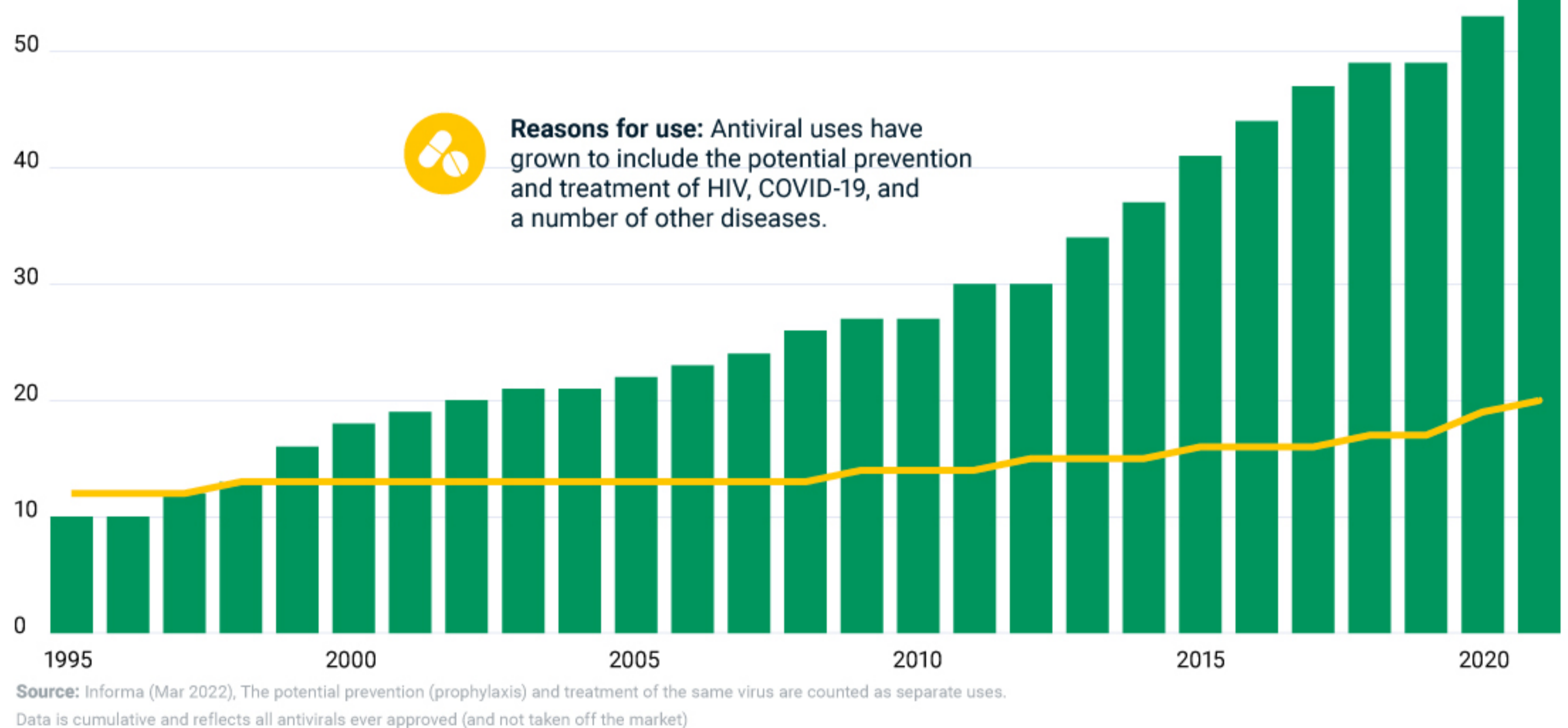


Antivirals

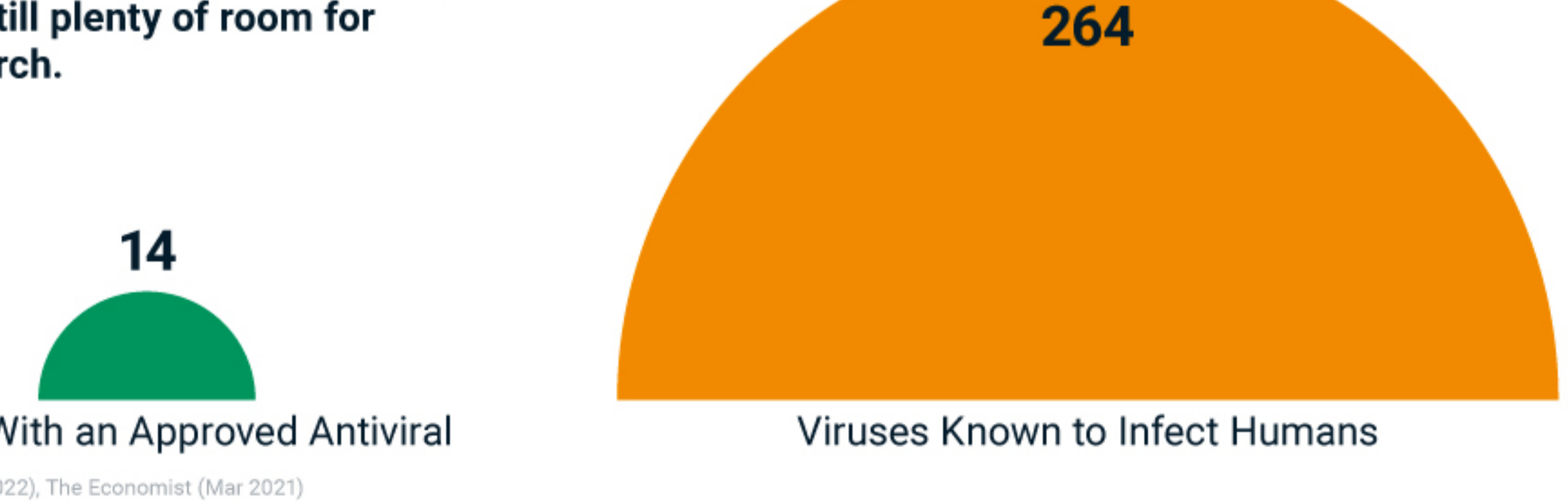
Antivirals are drugs that slow or prevent the growth of a virus and treat disease symptoms. They are especially important tools for diseases that do not have an associated vaccine.

In 2021, there were nearly 6x as many approved antivirals as there were in 1995.

Growth of Antiviral Treatments in the U.S. (1995-2021)



Antiviral development has been strong, but there is still plenty of room for further research.

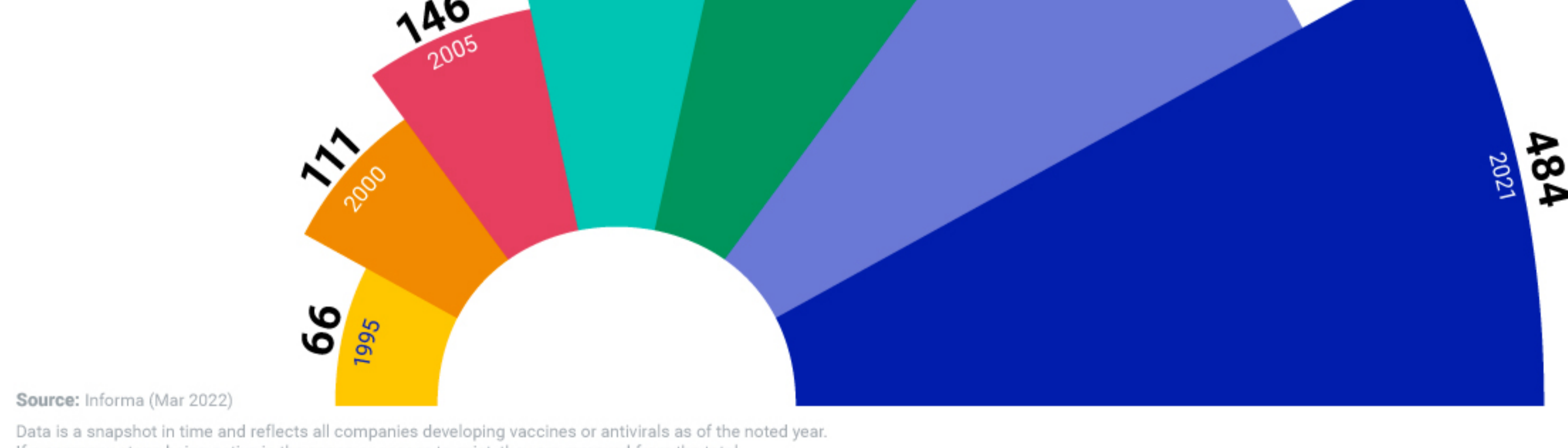


Innovation in virology, and the potential for future developments, is leading to a growing industry.

Expanding Market Opportunities

With opportunities growing and approval times shortening, more companies are entering the market.

Companies Developing Vaccines/Antivirals Over Time



As they work to develop new vaccines and antivirals, companies are conducting clinical trials for many diseases beyond COVID-19.

Diseases With Most Clinical Trials Apart From COVID-19



Virology is leading to groundbreaking technologies and therapies, transforming healthcare along the way.

