

WHAT IS A SARS-COV-2 VARIANT OF CONCERN?

20200604 - FREDERICO SANTOS
20200613 - TIAGO RAMOS
20200994 - RUPESH BARADI

INTRODUCTION

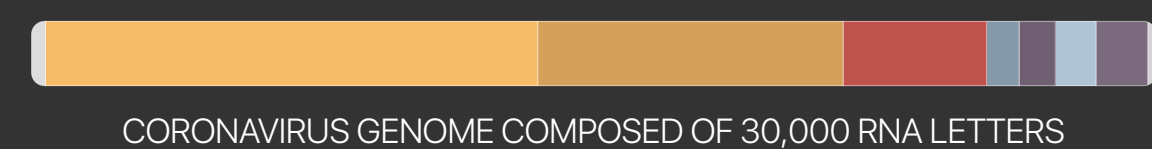
Conversations surrounding the concern for emerging variants of SARS-CoV-2, the virus that causes COVID-19, have been increasing rampantly since the turn of the year 2021.

This infographic explores the terminology, understanding, and general knowledge of this emerging subject, tracking and visualizing the global growth, spread, and probable impact of the three current variants of concern (VOC).

WHAT IS A MUTATION, VARIANT, STRAIN?

Confusion regarding these terms is commonplace.

The genetic material of SARS-CoV-2 is called ribonucleic acid (RNA). Instructions for the virus to replicate are encoded in 30,000 "letters" of RNA — a, c, g and u — which the infected cell reads and translates into many kinds of virus proteins.

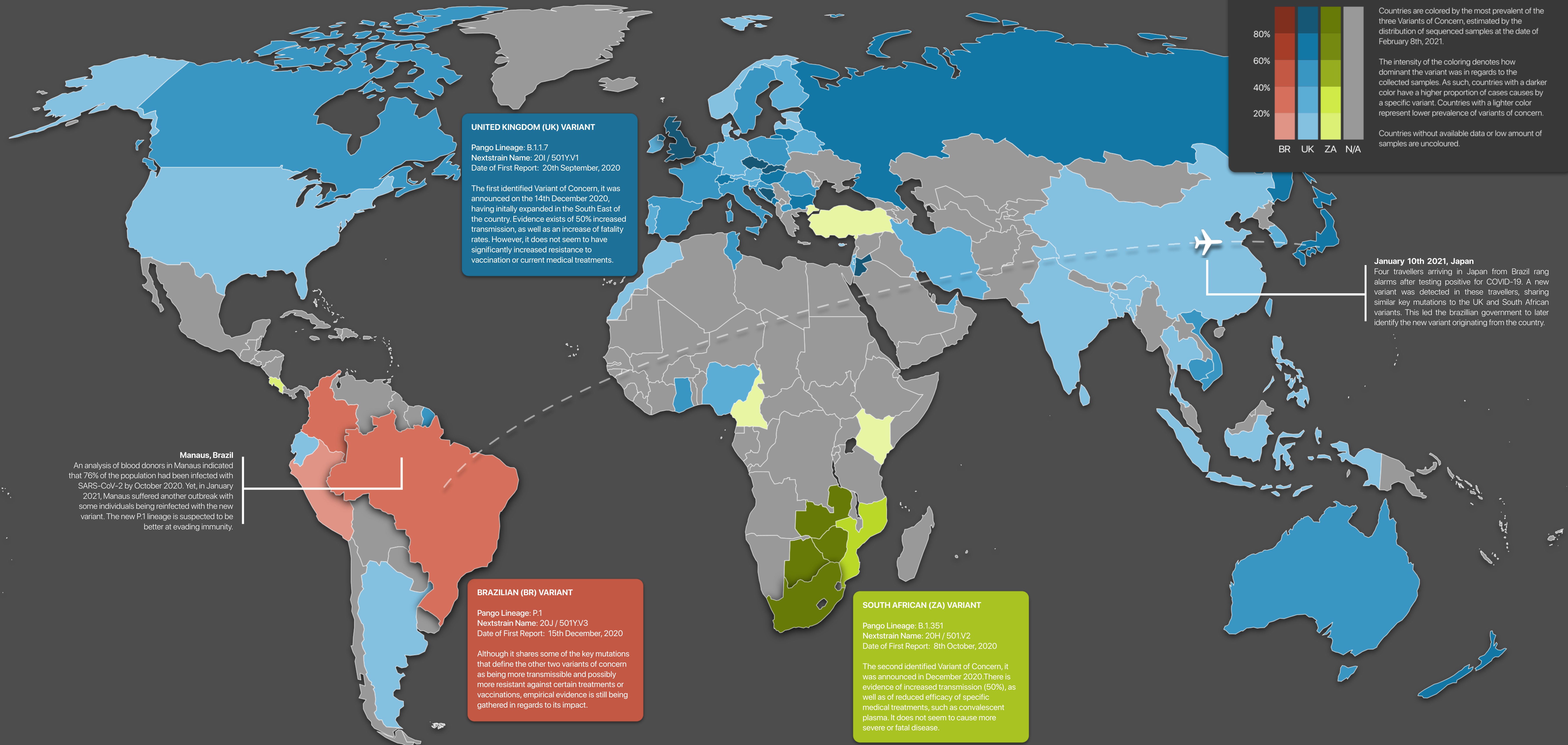


CORONAVIRUS GENOME COMPOSED OF 30,000 RNA LETTERS

Small errors originate in the process of duplicating RNA, generating a non-exact copy of the sequence. These are the so-called mutations, characterized by the different letters in the sequence. Despite this, viruses with mutations can still retain the parent's properties and behave exactly like the original virus - these are called silent mutations.

As time passes, the genome for the virus acquires many documented mutations. Some such mutations significantly alter the virus' properties or behavior, originating a new strain of the virus. Some of these altered properties may translate to higher transmissability, altered resistance to medical treatment, or even an increased severity of the disease. This has been the case with some recently detected strains (named Variants of Concern).

Because of these threats, sequencing, closely monitoring, and documenting these mutations is paramount to combat the ongoing pandemic, including preparing and containing potentially dangerous strains.



UNITED KINGDOM (UK) VARIANT

Pango Lineage: B.1.1.7
Nextstrain Name: 20I / 501Y.V1
Date of First Report: 20th September, 2020

The first identified Variant of Concern, it was announced on the 14th December 2020, having initially expanded in the South East of the country. Evidence exists of 50% increased transmission, as well as an increase of fatality rates. However, it does not seem to have significantly increased resistance to vaccination or current medical treatments.

Manaus, Brazil

An analysis of blood donors in Manaus indicated that 76% of the population had been infected with SARS-CoV-2 by October 2020. Yet, in January 2021, Manaus suffered another outbreak with some individuals being reinfected with the new variant. The new P.1 lineage is suspected to be better at evading immunity.

BRAZILIAN (BR) VARIANT

Pango Lineage: P.1
Nextstrain Name: 20J / 501Y.V3
Date of First Report: 15th December, 2020

Although it shares some of the key mutations that define the other two variants of concern as being more transmissible and possibly more resistant against certain treatments or vaccinations, empirical evidence is still being gathered in regards to its impact.

SOUTH AFRICAN (ZA) VARIANT

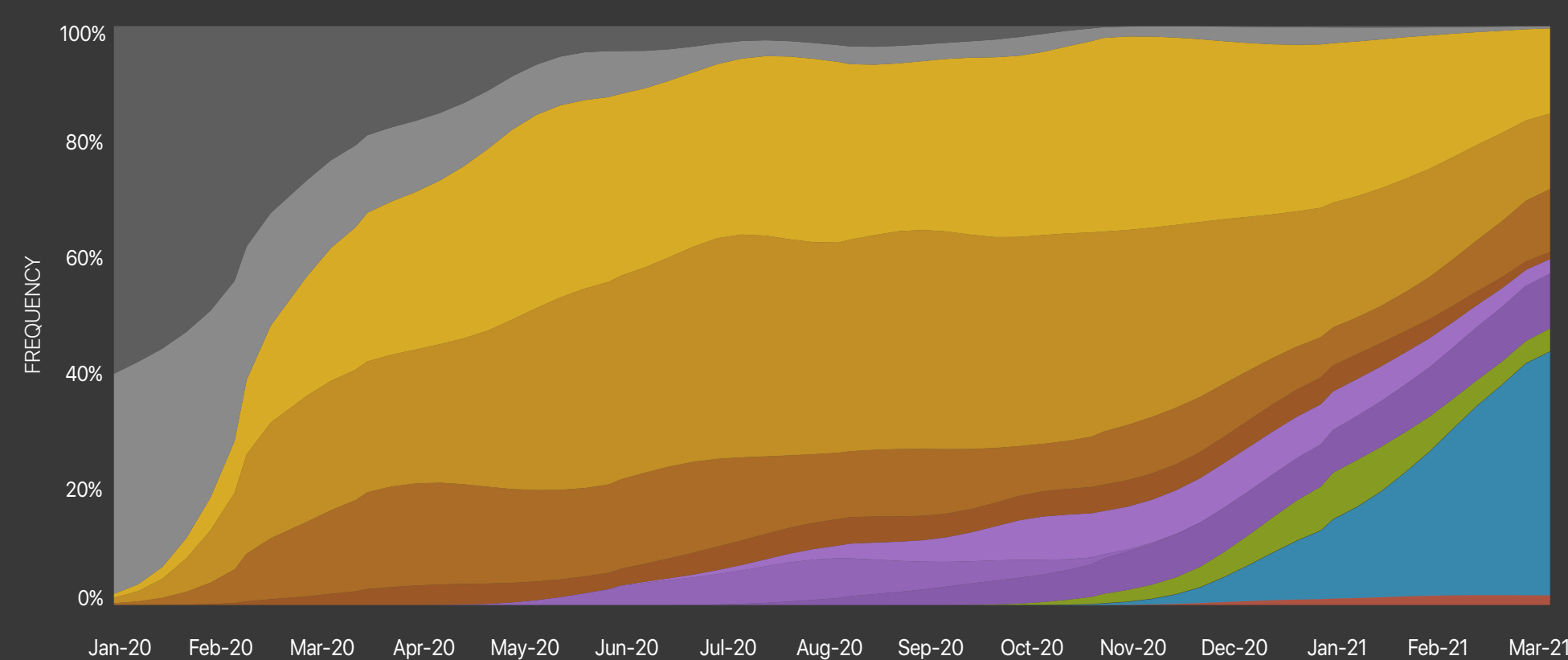
Pango Lineage: B.1.351
Nextstrain Name: 20H / 501.V2
Date of First Report: 8th October, 2020

The second identified Variant of Concern, it was announced in December 2020. There is evidence of increased transmission (50%), as well as of reduced efficacy of specific medical treatments, such as convalescent plasma. It does not seem to cause more severe or fatal disease.

FREQUENCIES BY LINEAGE

STRAIN IDENTIFIER

20J (BR)
20I (UK)
20H (ZA)
20E / 20F / 20G
20A / 20B / 20C / 20D
19A / 19B



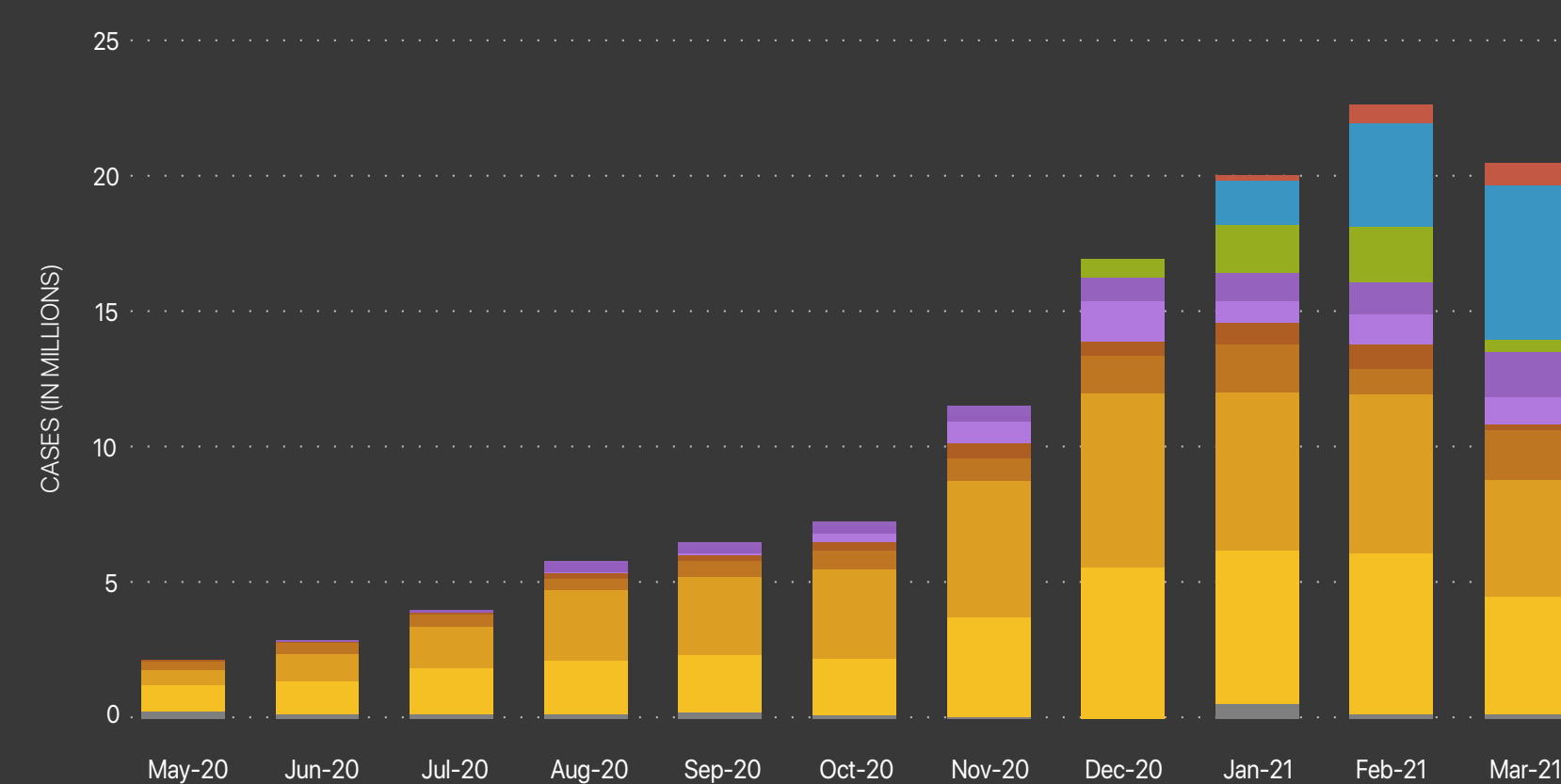
VARIANT 19A / 19B

The initial strains mutated quickly, giving way to the more stable and dominant 20A and 20B strains which accounted for about 60% of all collected sequences in 2020. This is aligned with the observation of a slower rate of mutation of the SARS-CoV-2 virus when compared to other flu-like viruses.

VARIANT 20A / 20B / 20C / 20D

The virus remained relatively stable during 2020, with no new major variants being detected. Moreover, they did not significantly alter key characteristics of the disease such as vaccine immunity, transmissability, or lethality.

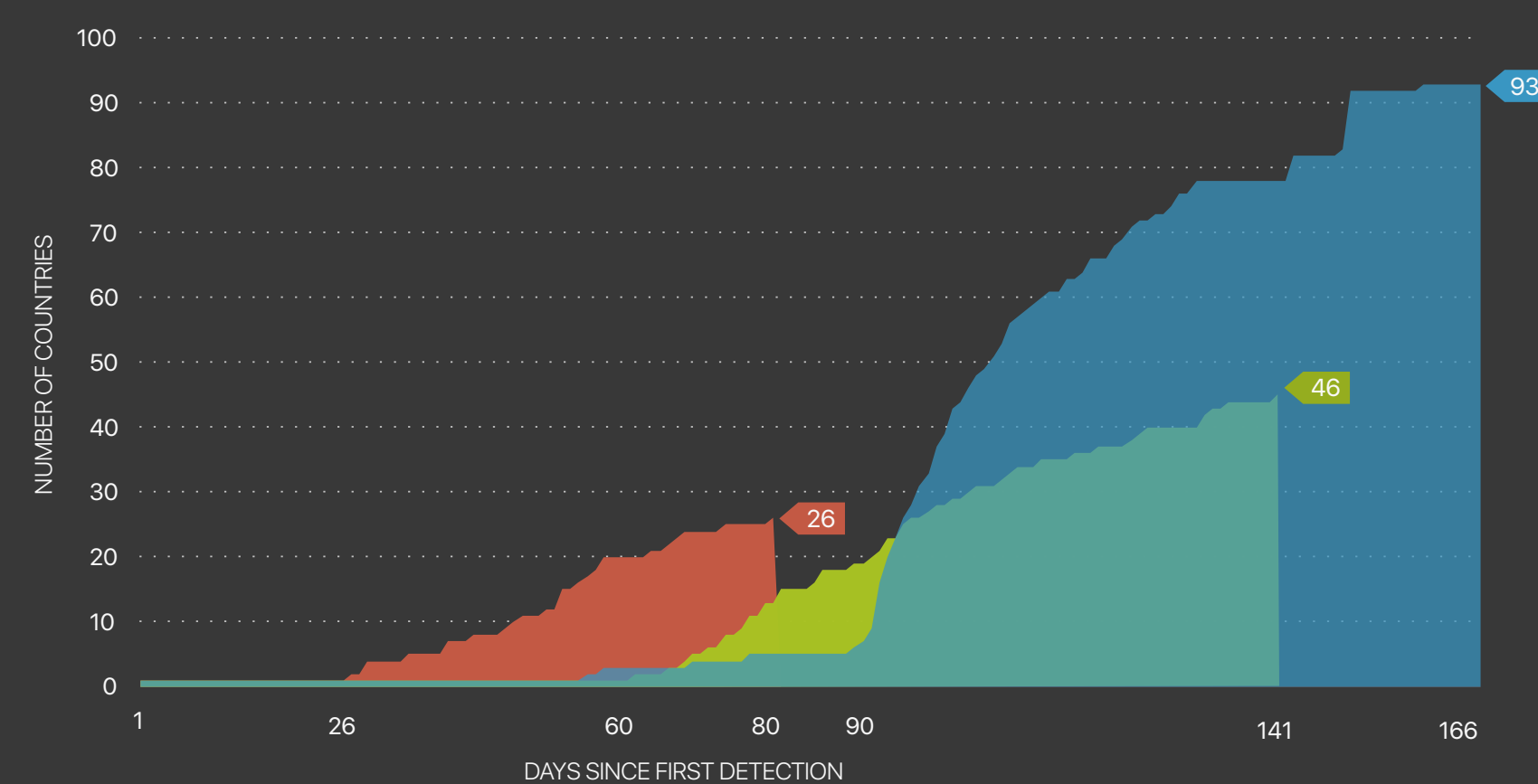
ESTIMATED DISTRIBUTION OF VARIANTS ON ACTIVE GLOBAL CASES



VARIANT 20I (UK)

After being first detected, the UK strain spread unlike any other so far. By March 1st, sequences of the UK variant accounted for an estimated 44% of active cases, signalling an extreme growth not characteristic of the virus' pattern of stable and slow mutation.

GLOBAL SPREAD OF VARIANTS OF CONCERN



The growth and spread of these variants seems linked to the severity of lockdown measures. After weeks of contained spread, the UK variant's worldwide presence exploded, increasing its presence sevenfold over the course of late December. This is indicative of the increased travel and exposure during this time, but is also a consequence of the increased transmissability of this strain. The Brazilian and South African variants show similar growth to each other (roughly 3.5 new countries per week), despite the Brazilian strain spreading earlier.

WHERE DO WE STAND?

The year of 2020 was marked by an event of unseen proportions, that forced the worldwide population to adapt quickly in order to overcome worst-case scenarios. As a new year arrives, and with the world being vaccinated at record pace, the war against Covid-19 is still far from over. The spread of the UK variant and the emergence of new strains, with potentially more dangerous characteristics, show that humans are not the only beings that adapt quickly. All three variants of concern originated independently from each other, but share a common mutation. The possibility of the same mutation emerging in other clusters is a threat that must be considered in the strategic plan against the pandemic in the upcoming years. Containing and slowing the spread of the virus is as crucial as it was in 2020. Failure to do so risks undoing the effort done in the past year, as new mutations may originate even more dangerous strains.

REFERENCES

Dong E, Du H, Gardner L. An interactive web-based dashboard to track COVID-19 in real time. *Lancet Inf Dis*. 20(5):533-534. doi: 10.1016/S1473-3099(20)30120-1

Rambaut A, Holmes EC, O'Toole A, Hill V, McCrone JT, Ruis C, du Plessis L & Pybus OG (2020) A dynamic nomenclature proposal for SARS-CoV-2 lineages to assist genomic epidemiology. *Nature Microbiology* DOI: 10.1038/s41564-020-0770-5

Elbe, S., and Buckland-Merrett, G. (2017) Data, disease and diplomacy: GISAID's innovative contribution to global health. *Global Challenges*, 1:33-46. DOI: 10.1002/gch2.1018PMCID: 31565258