SARS-CoV-2 and its effects on Africa

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Background and Overview

This research analysis is aimed to answer the initial predictions that Africa would be one of the continents that would be heavily affected by the SARS-CoV-2 pandemic (Gilbert, 2020). Africa is currently second in the world in terms of total population - containing roughly 1.3 billion people. Africa is also known for their lack of an adequate health care system and they are currently battling and recovering from other epidemics. With this information, it is only expected that Africa would be one of the continents that is deemed vulnerable to SARS-CoV-2 (Lone and Ahmad, 2020).

It has roughly been over a year since the pandemic has affected the entire world. Perversely, Africa is doing extremely well in the fight against the virus. After analyzing relevant COVID-19 datasets, Africa is significantly lower in the number of COVID-19 cases and deaths when compared to other nations.

There are two primary factors why Africa has not been affected by SARS-CoV-2 in the way researchers have predicted. First, the majority of African countries took swift actions to prepare for the inevitable pandemic. Due to the fact that African nations already have prior experience in dealing with viruses or outbreaks, they have a strong nation that understands proper precautions and procedures in order to prevent the spread of the virus (M. *et al.*, 2020). Second, while Africa has an enormous population size, it turns out that the majority of the population are adolescents; for example, the average age in Mozambique, Africa wavers around 17 years old. This can make all the difference since the SARS-CoV-2 is known to be fatal towards the older population (Zhou *et al.*, 2020).

Overall, since Africa seriously prepared for the pandemic, paired with their vast population consisting of young adolescents, Africa was and is able to adequately battle the pandemic and prevent high numbers of cases & mortality rates when compared to other nations.

Methods

To answer the initial predictions, an adequate COVID-19 dataset is needed; this analysis uses *Our World in Data* or *OWID* COVID-19 dataset. This dataset is compiled using reliable sources, such as *JHU*, *WHO*, *CDC*, and more. It is updated daily and also contains dates, location, continent, and other corresponding information. For this analysis, the dataset was downloaded on May 3rd, 2021.

Once the *OWID* COVID-19 dataset is acquired, the dataset is then processed in R Studio to organize the data. Once organized using `readr` (Wickham and Hester, 2020), `dplyr` (Wickham *et al.*, 2020) is used directly after to filter the dataset to only include the African continent and its nations. Then, `ggplot2` (Wickham, 2016) is applied to create different graphs to assist in the comparison of Africa and outside nations to determine if Africa was or is impacted by SARS-CoV-2.

A Mozambique SRA runtable (SRA Bioproject ID: PRJNA718451) was also used for distinct SNP or variant analysis. It was downloaded on *NCBI* on April 26, 2021.

Results and Discussion

Results

With the figures produced from the *OWID* dataset, Africa contains a mean total reported COVID-19 cases above 80,000 as of recent (Figure 1a). On the other hand, USA has an average total case of well over 30,000,000 (Figure 1b). In a related case, three African countries - Malawi, Mozambique, and Niger - each have a total of under 1,200 COVID-19 related deaths (Figure 2a). With Malawi having the highest out of the three, with a little under 1,200 and Niger having the lowest, containing far below 300 deaths. When compared to three other countries - Italy, United Kingdom, and United States - Italy and United Kingdom fluctuate under 200,000 COVID-19 related deaths, while USA staggers right below 600,000 deaths (Figure 2b).

Despite Africa having an enormous population, pre-existing epidemics, and inadequate health care systems, Africa is successfully fending off COVID-19. Other nations like Italy, United Kingdom, and United States - who have adequate health care systems, smaller total population, and are technologically advanced - have substantial COVID-19 related cases and deaths.

Discussion

Africa being minimally affected by SARS-CoV-2 is a great phenomenon, they were able to stay resilient because of two important factors: preparedness and age.

The majority of African governments efficiently and effectively placed proper COVID-19 procedures - implementing restrictions, closing borders, and spreading proper information to their respective communities (Lone and Ahmad, 2020). In addition, Africa's experience with epidemics continues to serve a crucial role. Several African nations have improved their health care systems as a result of prevalent epidemics - malaria, HIV, tuberculosis, and Ebola (Mwisongo and Nabyonga-Orem, 2016). Furthermore, Africans are accustomed to the precautions they need to take to prevent the spread or the infection of the virus - a survey in Mozambique, Africa displayed a compliance rate well above 90% when it came to basic face mask usage, proper cough regimens, and constant hand-washing (Júnior *et al.*, 2021).

In nations like Italy, United Kingdom, and United States, the average population age falters around the 40-50 range (Figure 3a). Compare that to the average age of the African countries - Malawi, Mozambique, and Niger - and there is a clear discrepancy. Malawi, Mozambique, and Niger all have an average population age below 20 (Figure 3b). This crucial aspect greatly contributes to Africa's resilience, since the majority of the population are young and healthy, less COVID-19 related deaths occur (Diop *et al.*, 2020; Nikolai *et al.*, 2020).

Rise in numbers

From late December 2020 to early February 2021, Africa experienced a sudden upsurge in new COVID-19 cases (Figure 4a). It isn't clear why this has occurred, but since this sudden spike occurred during prime holiday time, it is most likely due to foreigners and their visits to Africa. These increase of cases is the possible result of high distinct SNPs in places like Mozambique, especially in the S gene - which is directly responsible for binding the virus to the host cells (Figure 4b & 4c). This can be problematic as a mutated S gene can possibly affect the efficacy of the pre-existing COVID-19 vaccines. (Gilbert *et al.*, 2020; Koyama *et al.*, 2020)

Figures

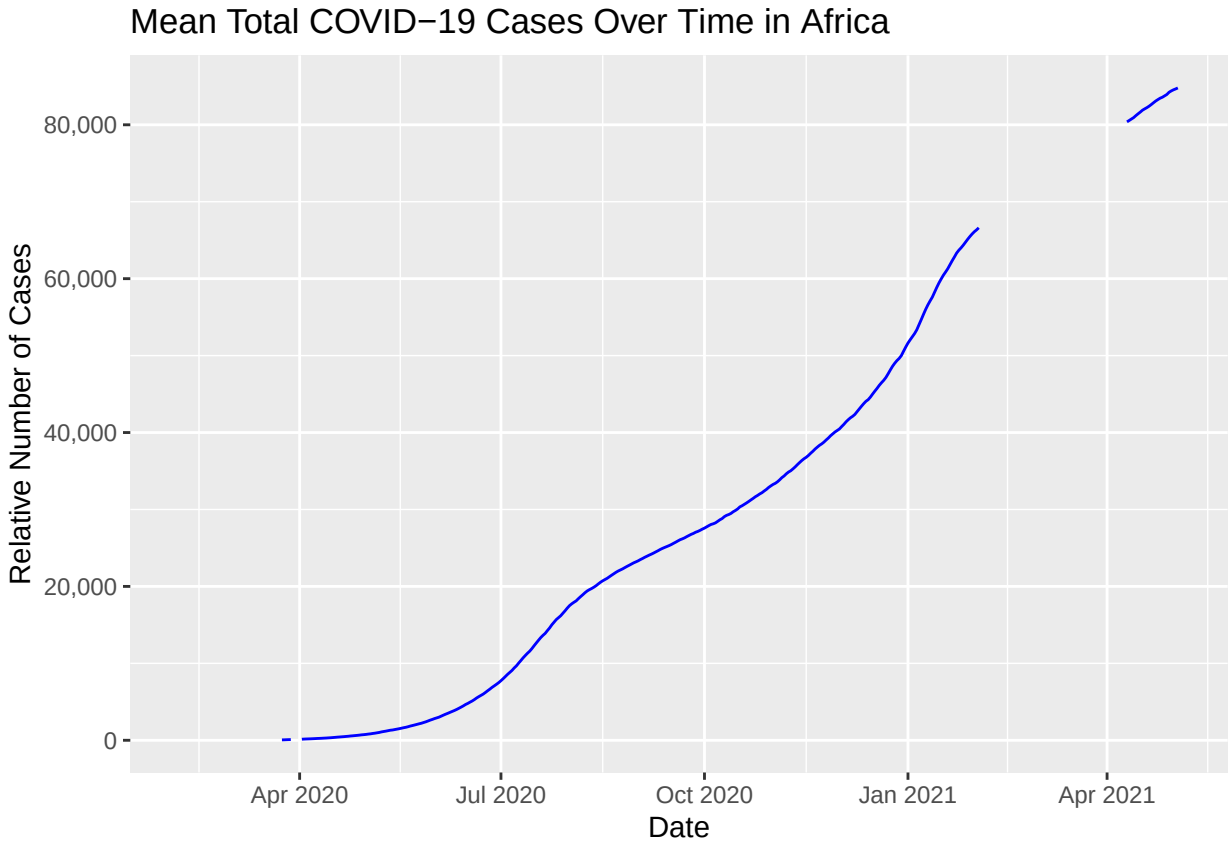

Figure 1a: The timeline of total COVID-19 cases in Africa.

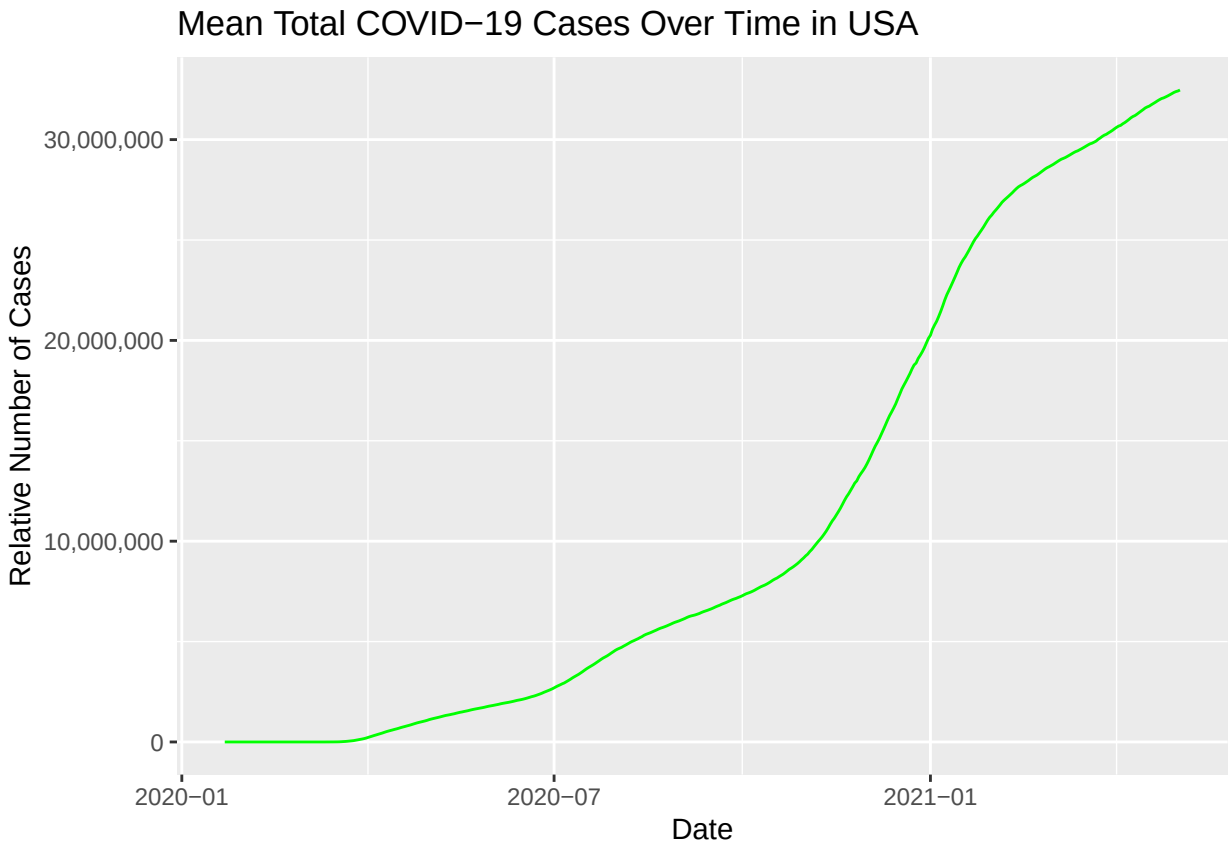

Figure 1b: The timeline of total COVID-19 cases in USA.

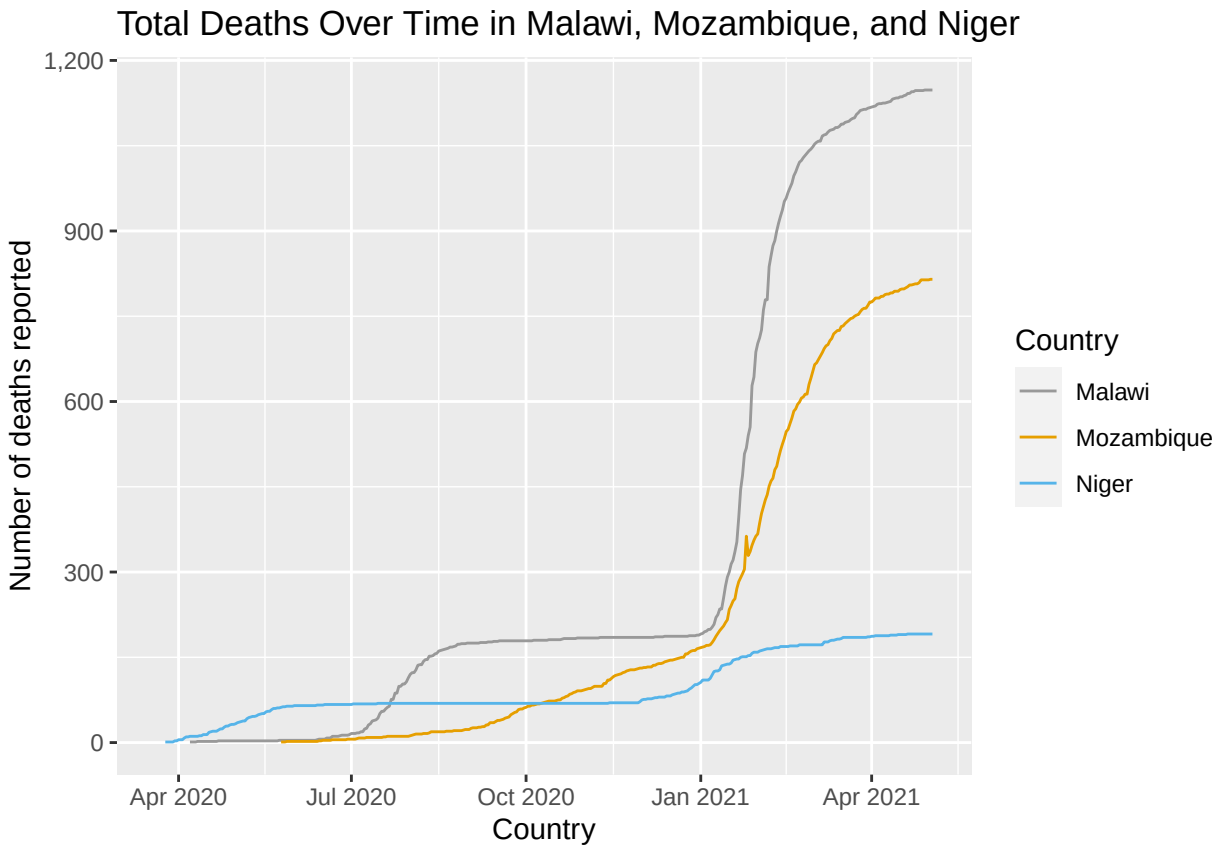

Figure 2a: Total deaths over time in Mozambique, Niger, and Malawi.

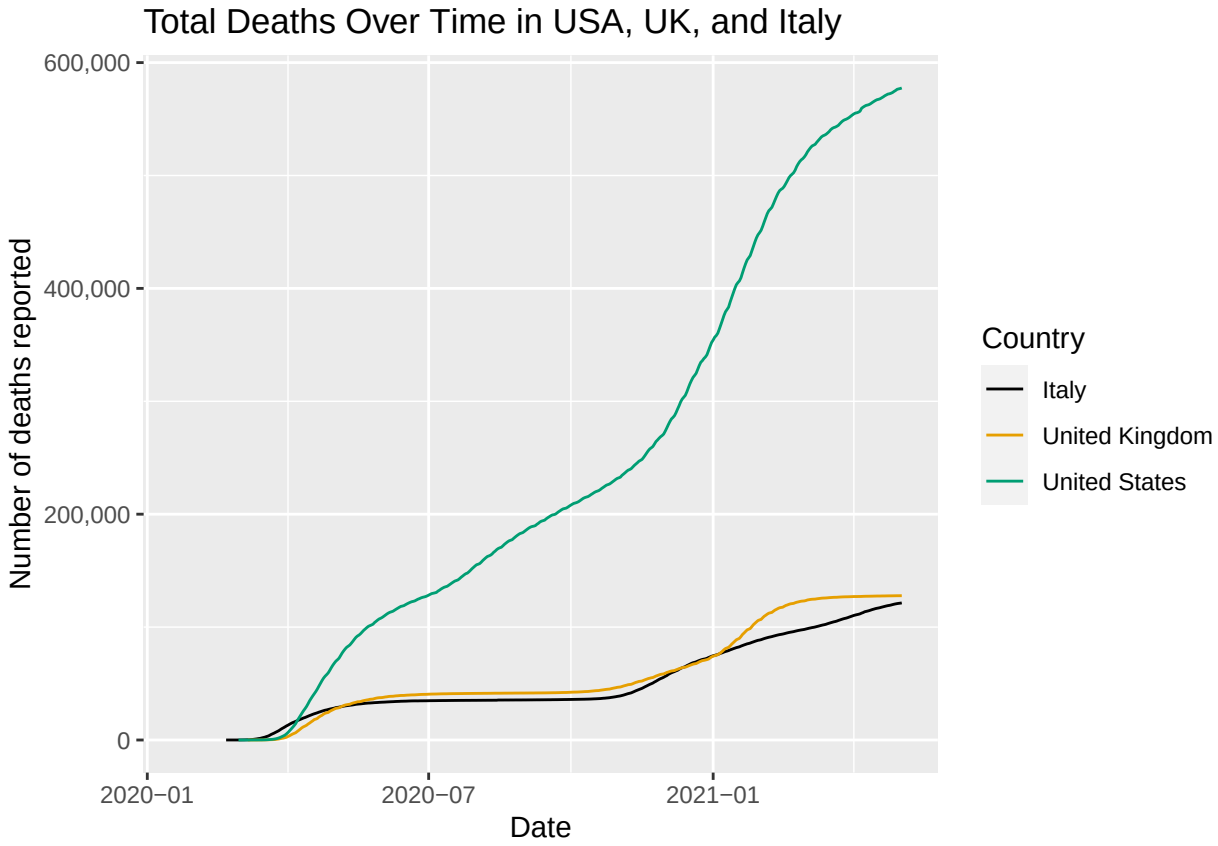

Figure 2b: Total deaths over time in Italy, United Kingdom, and United States.

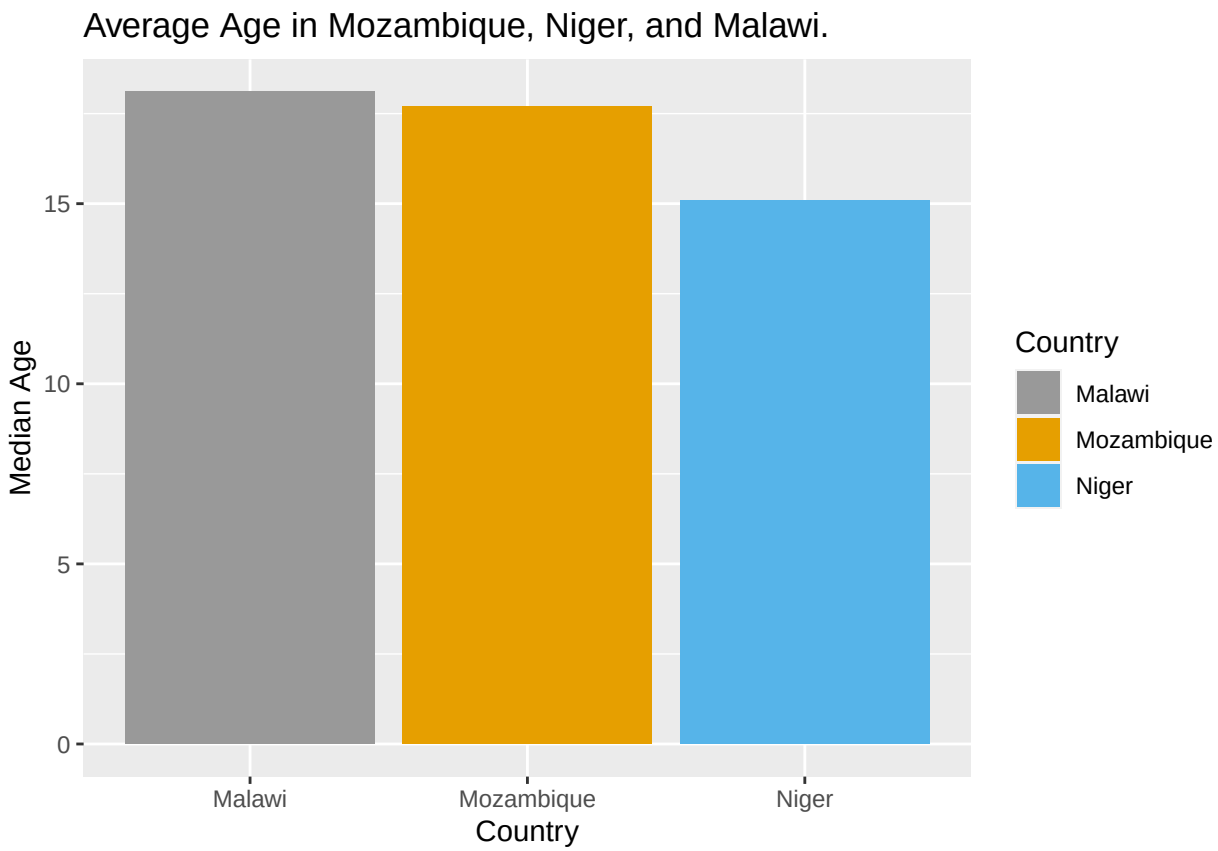

Figure 3a: Median Age in Mozambique, Niger, and Malawi, Africa.

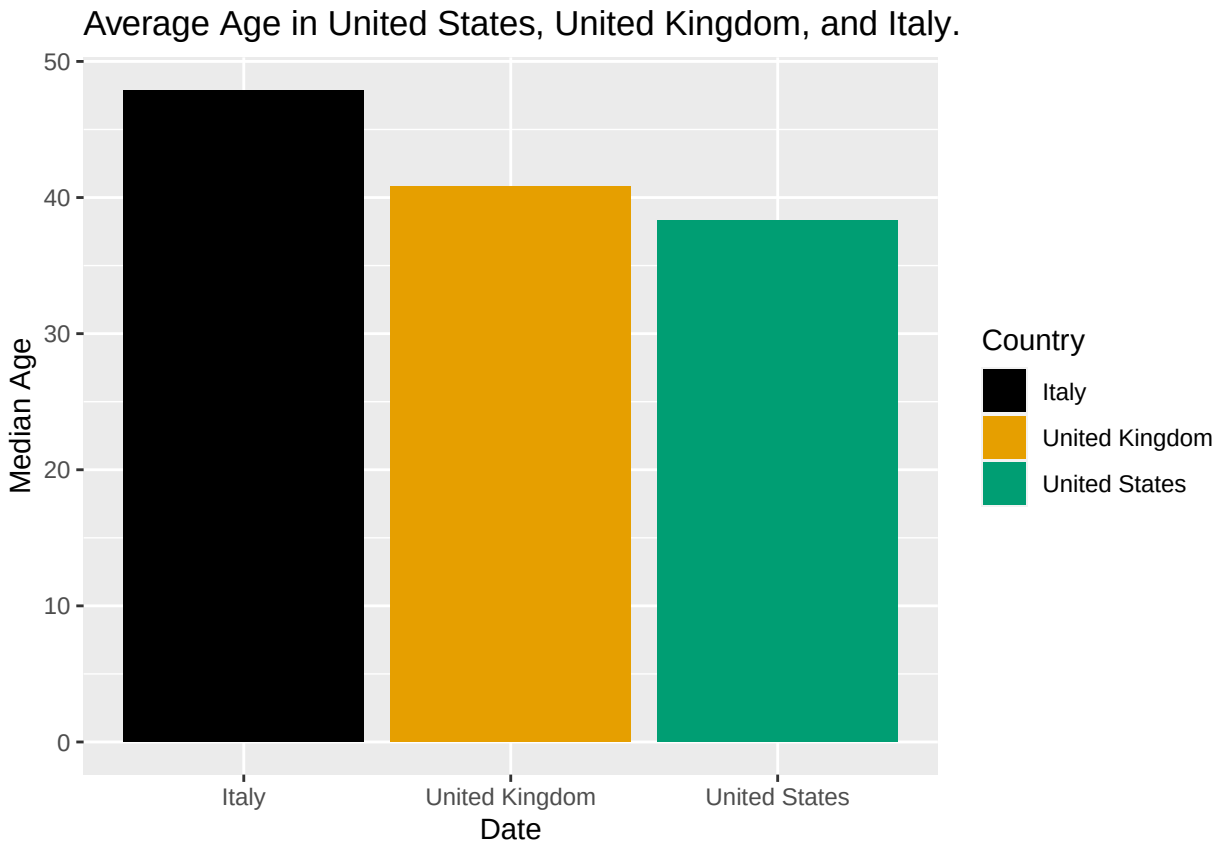

Figure 3b: Median Age in Italy, United Kingdom, and United State.

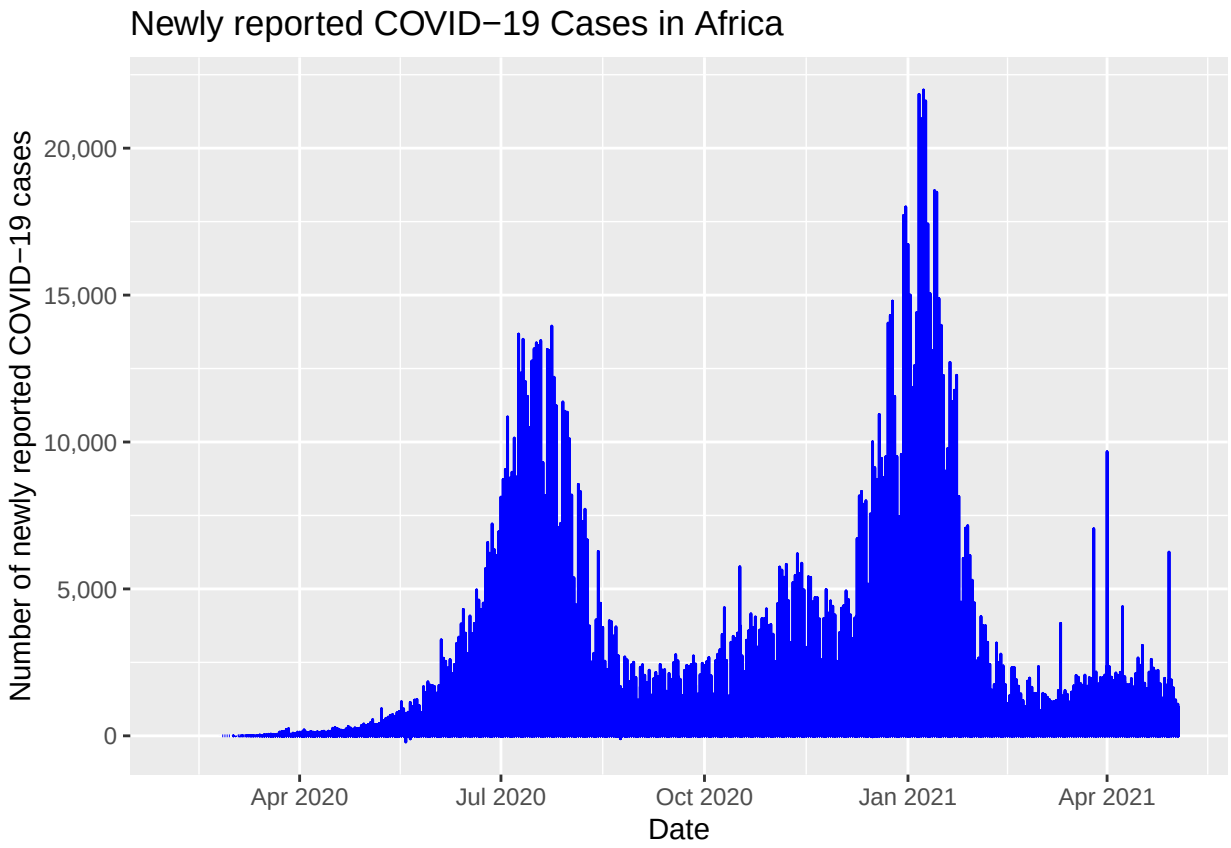

Figure 4a: Number of newly reported COVID-19 cases in Africa

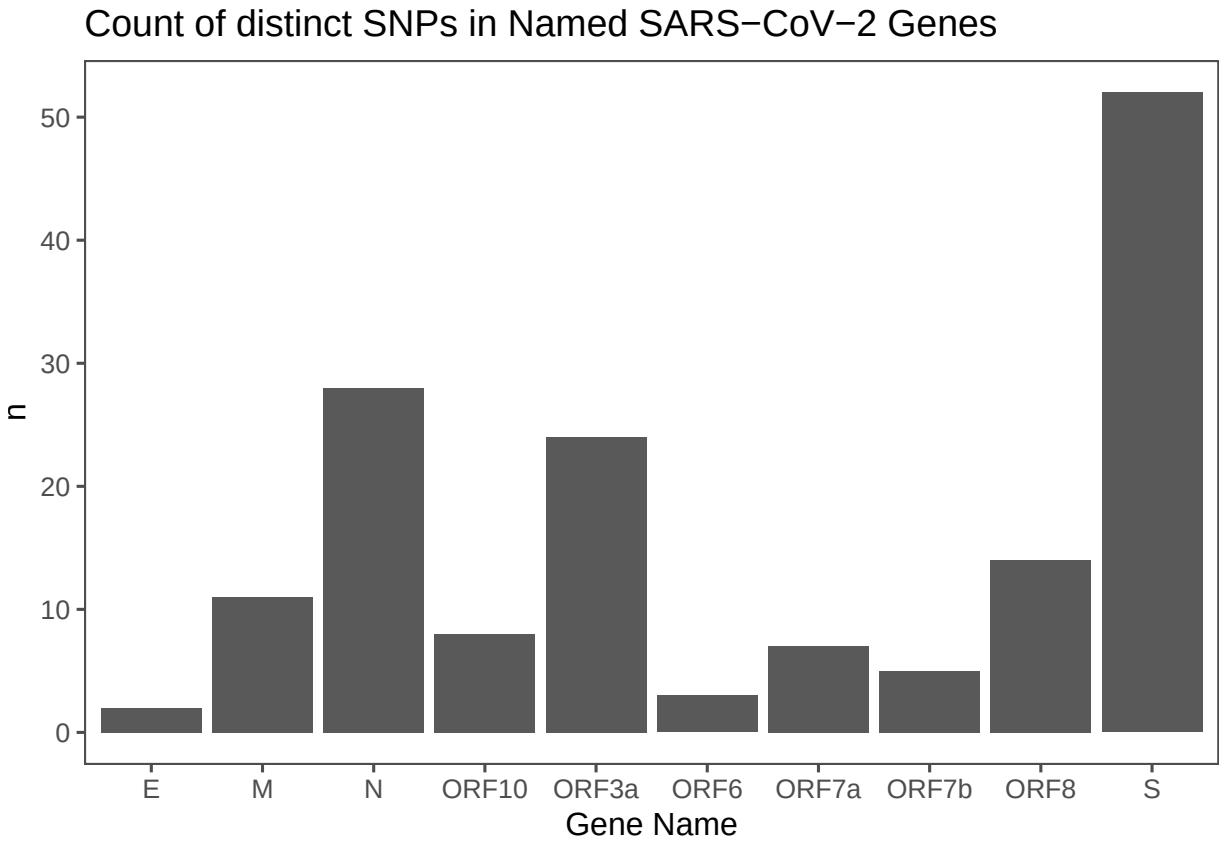

Figure 4b: N and S genes have more unique SNPs in the set of samples analyzed.

Tables

Gene Name	Start	End	Length
S	21563	25384	3821
ORF3a	25393	26220	827
E	26245	26472	227
M	26523	27191	668
ORF6	27202	27387	185
ORF7a	27394	27759	365
ORF7b	27756	27887	131
ORF8	27894	28259	365
N	28274	29533	1259
ORF10	29558	29674	116

Table 4c: Gene names, locations, and lengths in the SARS-CoV-2 genome. Higher SNP counts in the S and N genes may be related to the larger size of these genes.

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