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A statistical study on covid-19 infection fatality rate in Tunisia

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Abstract. Corona-Virus Disease (COVID-19), caused by the novel Severe Acute Respiratory Syndrome CoronaVirus 2 (SARS-CoV-2) has been spreading rapidly worldwide causing the world to face a global health crisis. Countries are experiencing a new wave of contamination and are witnessing spikes in the disease without being able to control its spread again. This paper aims to analyze the mortality rate related to the COVID-19 pandemic infection in Tunisia and to assess the effectiveness of health control policies. Data collection for this document was stopped on October, 31st, 2020.

Keywords: COVID-19, SARS-CoV-2, Pandemic, World Health Organization (WHO), Infected cases, Tests, Death cases.

1 Introduction

A novel respiratory disease [1] caused by a previously unknown virus appeared in Wuhan city, province of Hubei, China in December 2019. The virus was rapidly identified as a novel coronavirus infection disease (COVID-19) genetically associated with SARS Coronavirus renamed also SARS-CoV-2. By the end of January 2020, this virus had been transmitted to 19 countries with 11, 791 confirmed infected cases and 213 deaths worldwide. This made the WHO announce it as a Public Health Emergency of International Concern on January 30th, 2020[2]. The common symptoms of this virus are fever, tiredness, cough and it may develop to cause respiratory diseases [3] at later stages. On March 11th, 2020, the WHO considered COVID-19 as a plague disease due to its fast spreading [4]. As of 31st October 2020, 219 infected countries, 64, 434, 367 confirmed cases and 1, 202, 172 death cases were globally reported [5].

Tunisia, a North African country with over 11, 864, 230 of population, was one among the infected countries.

The communicable disease was first confirmed to spread throughout Tunisia on 2nd March 2020, when a Tunisian man was repatriated back from Italy. A cluster of cases was exposed later, starting with 13 confirmed cases on 12th March and 26 added cases with the first death case on 19th March. On 22nd March, the Tunisian government announced an emergency state and declared the beginning of the general public quarantine. Until the 2nd June, confirmed cases had increased slightly to 1, 087

cases out of 53, 161 analyses and the total deaths stabilized for many days with only 49 cases. Based on the obtained data, June 10th was considered as the end of the first wave, given that no new cases had been detected for several days. However, since the reopening of the frontiers on June 27th, and particularly from August onwards, the number of new cases rose steadily reaching 58, 029 confirmed cases and 1, 253 deaths on 31st October which led the Tunisian government to revise the pandemic-related measures. In this paper, we analyze this pandemic situation in Tunisia by studying the infection propagation along with the amount of performed tests and the total death cases for both waves. We also add a comparative analysis between Tunisia, Belgium, and Algeria in order to study the effectiveness of the Tunisian strategies in monitoring the spread of the pandemic.

The rest of this paper is divided into five sections. The following section describes the propagation of coronavirus in Tunisia. Section 3 covers an analysis of the given tests in Tunisia. Section 4 is dedicated to analyzing the propagation of death cases. Section 5 presents the discussion which contains a comparative study between Tunisia and Belgium then Tunisia and Algeria. Finally, section 6 presents our conclusions. All information employed in this statistical study are published by Worldometer [5], the Ministry of Health in Tunisia [6], the Federal Center in Belgium [7] and the Ministry of Health in Algeria [8].

2 Modelization of COVID-19 propagation in Tunisia

Contrary to many other infected countries, Tunisia responded early to the virus in order to control the pandemic as soon as possible by swiftly taking some drastic measures such as border closures, curfews and confinement. In fact, between 2nd March and 10th June, there were only 1,087 confirmed cases, which is considered a small number compared to the numbers reported at the same interval of time in other infected countries. Thus, we can safely assume that the spread of the infection was slowed down throughout the pandemic first wave, the situation stabilized and the epidemic was under control.

However, a second wave was creeping back worldwide, and Tunisia was not spared. Since reopening the borders on June 27th, especially from August onwards, Tunisia declared more cases each day than the first wave and thus, it started to lose control over the pandemic demonstrated by the sharp exponential rise of confirmed cases.

The statistics in Fig. 1 (see appendix) display the daily accumulative cases of laboratory-confirmed COVID-19 cases in Tunisia as of October 31, 2020. As the figure shows, the number of positive cases increased steadily from March to July, but slowly and even stabilized for some period especially in May and June. As a whole, 1, 552 confirmed cases were reported by the end of July. From August onwards, the number of confirmed cases rose dramatically, exponentially, exceeding 58, 000 cases by the end of October. The second wave of infections in Tunisia was much worse than the first one and that was due primarily to the reopening of the borders and the loosening of lockdown restrictions. Given this state, a number of measures were introduced to

slow down the spread of the virus and authorities planned to make masks mandatory in certain locations and changed regulations regarding entry into the country. However, they did not consider a return to general confinement or other more restrictive measures like those taken during the first wave.

3 Modelization of tests

No country can know the exact number of COVID-19 infected individuals. All we all know is the contagion status of those who were tested. Only those who have a laboratory-confirmed infection are counted as confirmed cases. This means that the number of confirmed cases associated with the proportion of performed tests has to be carried out in each country. Thus to understand any data on confirmed cases we need to understand the amount of testing for COVID-19 the country has performed. Fig. 2 (see appendix) presents a comparison between daily accumulative performed tests and confirmed cases.

The figure shows that the number of tests is variable. It ranges between 28 and more than 2, 800 a day. The curve also shows that the daily confirmed cases failed to rely upon daily tests. In general, since the opening of the borders, more tests have been carried out than at the beginning of the epidemic. By August 12th, a total of 179, 035 tests were performed of which a total of 7, 382 positive cases were detected. However, despite the significant increase in the number of cases, there was no intention to adopt a mass screening policy. Only people who have been in contact with infected individuals or those who are presenting the virus symptoms were screened in order to limit the risk of transmission.

4 Death cases modelization

To understand the risks and respond properly, we need to study the COVID-19 death risk [9].

Fig. 3 (see appendix) presents the propagation of death numbers from 28 February to 31 October.

The first death case in Tunisia was reported on 19th March 2020 and then death toll reached 1, 253 cases on 31st October 2020, hence the total coronavirus deaths accounted for 2.15% of all infected cases.

As the figure shows, from March to July the total number of COVID-19 deaths increased slightly until it stabilized at 50 cases by the end of July, which represents 3.2% of all infected cases at that period. However, since the beginning of August mortality rate has been increasing much faster than in the first wave, which makes us conclude that the second wave seems more severe and deadly.

5 Discussion

Since the very beginning of the pandemic spread in the country, Tunisian authorities intended to adopt a containment strategy to limit the virus propagation. However, after the period of stabilization, they started to loosen the COVID-19 regulations, which has led to a second wave of the disease and the country is facing another war with the hope to succeed one more time in controlling the spread of the virus.

A comparative analysis between Tunisia, Belgium, and Algeria was carried out to prove the success of the Tunisian strategies in the first wave [10] and the effect of loosening them in the second wave.

5.1 Comparison with countries with the same population (Belgium)

Belgium is a European country in which the virus began to spread on 4th February 2020 when a Belgian repatriated from Wuhan-China was reported to be infected. Belgium has nearly the same population as Tunisia, which is 11, 589, 623. This encouraged us to make a comparison of the virus propagation between these two countries.

Comparison of the total number of cases

Unlike Tunisia, the virus has spread much faster in Belgium. After the detection of the first infected case, a cluster of confirmed cases was detected later, starting with 53 new cases on 05th March. As of 13th October, the total confirmed cases in Belgium reached 442, 181 with a record of 22, 177 new cases on 28th October 2020, compared to 58, 029 cases with a record of 1, 500 and some cases in Tunisia.

From Fig. 4 (see appendix) it is evident that the number of infected cases was significantly lower in Tunisia compared to Belgium. To summarize, the Tunisian strategies had a major effect in reducing the absolute number of detected cases although regulations were loosened during the second wave.

Comparison of the total tests carried out

A comparison between the number of tests performed in Belgium and those performed in Tunisia is displayed in Fig. 5 (see appendix). This comparison revealed that the Tunisian laboratory testing capacity was extremely limited compared to that in Belgium. Indeed, the total number of tests carried out in Tunisia approximately equaled 7% of total Belgian tests with a record of 6, 118 tests per day on 11 October compared to 38, 042 tests per day in Belgium.

Comparison of total death cases

A comparison of total coronavirus deaths in Tunisia until 31 October 2020 with Belgium indicates that Tunisia confronted the virus in a better way. In fact, Belgium reported to have the world's third highest number of COVID-19-related deaths. This conclusion is well supported by the analysis of Fig. 6 (see appendix). The figure dis-

plays the curves of total death cases in Tunisia and Belgium for the same period of time. As of 31 October, Belgium reported 11, 663 death cases presenting 2.6% of its total confirmed cases, contrary to Tunisia where the death cases reached 1, 253 accounting for 2.15% of its total confirmed cases.

5.2 Comparison with countries with same region (Algeria)

Comparing the virus propagation in Belgium with that in Tunisia, we concluded that Tunisia could control the spread of the virus more than Belgium. But this success may also be related to the region where the countries belong to. This hypothesis encouraged us to make a comparison between Tunisia and Algeria.

In fact, Algeria is an African country that was infected with COVID-19 on 25th February 2020 and it is in the same region as Tunisia, North Africa, which makes the comparison interesting.

Comparison of the total number of cases

As shown in the Fig. 7 (see appendix), SARS-CoV-2 was spreading faster in Algeria than Tunisia during the first wave until Tunisia had the same propagation speed the end of October.

After the detection of the first Algerian infected case, a cluster of confirmed cases was detected later reaching a total of 57, 651 confirmed cases on 31st October 2020 compared to 58, 029 Tunisian confirmed cases.

The success of Tunisia is demonstrated within the first wave by taking 21st August as an example when the total Algerian confirmed cases was 40, 258 whereas Tunisia reached 27, 38 cases. After that date, the Tunisian confirmed cases rose faster until reaching almost the same number of confirmed cases in Algeria by the end of October.

Comparison of total death cases

A comparison with Algeria regarding the total coronavirus deaths until 31st October 2020, demonstrated again that Tunisia was able to fight the virus better than Algeria.

Fig. 8 (see appendix) displays the curves of total death cases in Tunisia and Algeria from 28th February to 31st October. As of 31st October, Algeria reported 1, 956 death cases accounting for 3.39% of its total confirmed cases, contrary to Tunisia where the death cases reached 1, 253 representing 2.15% of its total confirmed cases.

6 Conclusion

Of the 215 infected countries, more than half have been experiencing clear second waves or late first waves that began in July or later. In the context of Tunisia, after its remarkable success in controlling the spread of the virus in the first wave compared to Belgium and Algeria, the authorities have been struggling against the severity of the

pandemic state in the second wave trying to revise the adopted strategies hoping it would avoid a deadly relapse. The limited daily performed tests remain the main problem. Indeed, the daily test numbers do not exceed 2, 800 at best. Additionally, anti-gene medical care is important, since today negatively-tested people can be positively tested tomorrow. To this end, antibody tests would deliver more constant data on how many people have been contaminated. Finally, diagnostic approaches based on new artificial intelligence tools can also be considered such as X-ray [11, 12], and CT images analysis [13, 14].

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Appendix

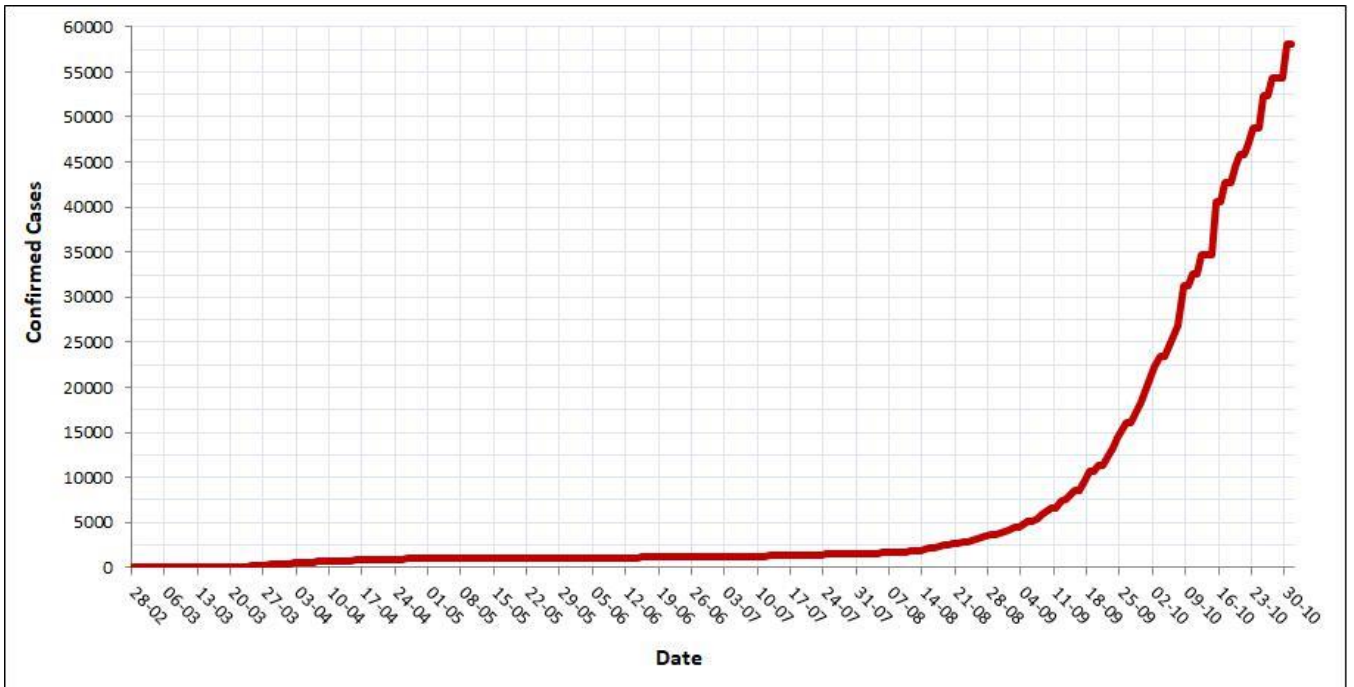


Fig. 1. Total Coronavirus Cases in Tunisia

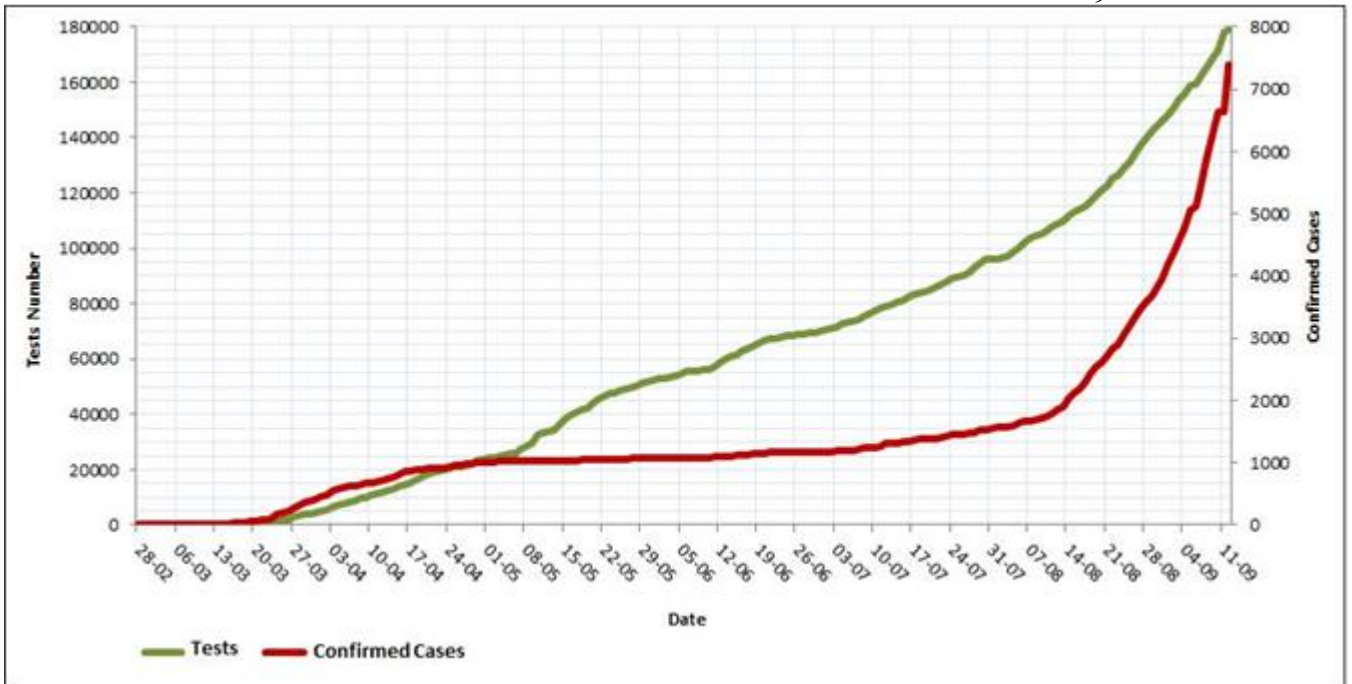


Fig. 2. Confirmed cases number compared to tests number

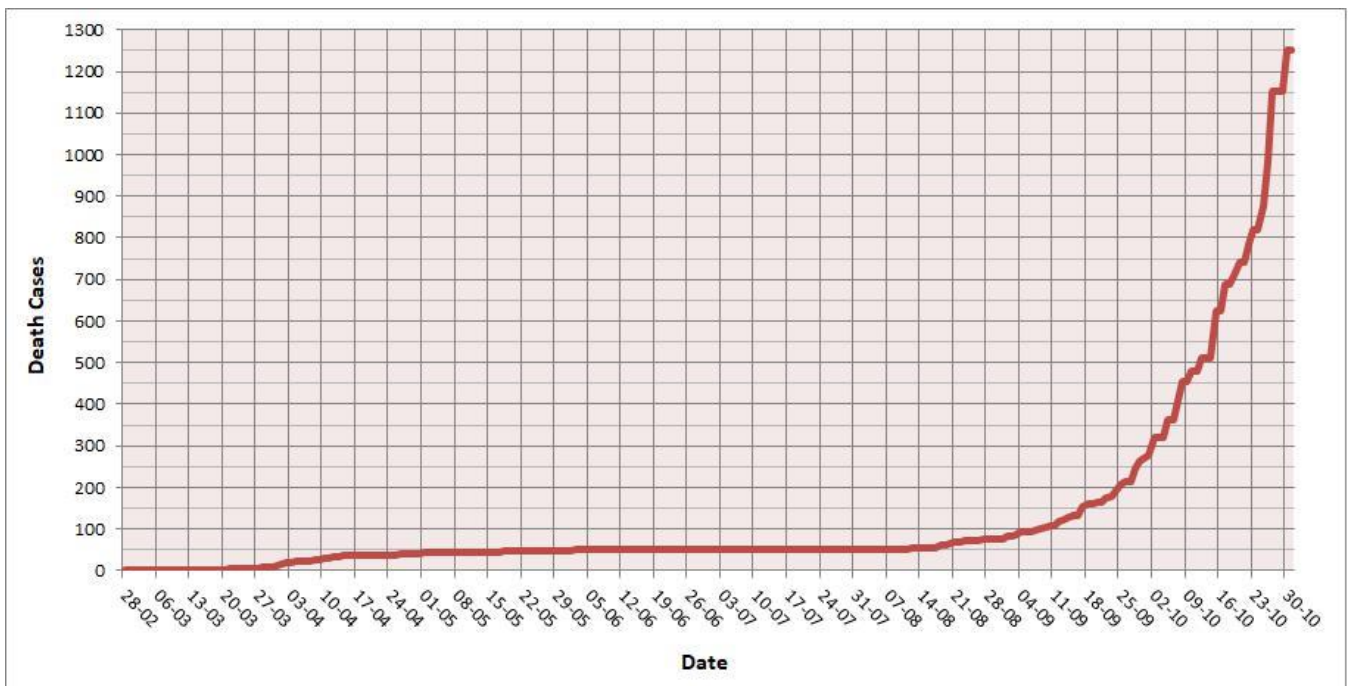


Fig. 3. Total death cases in Tunisia

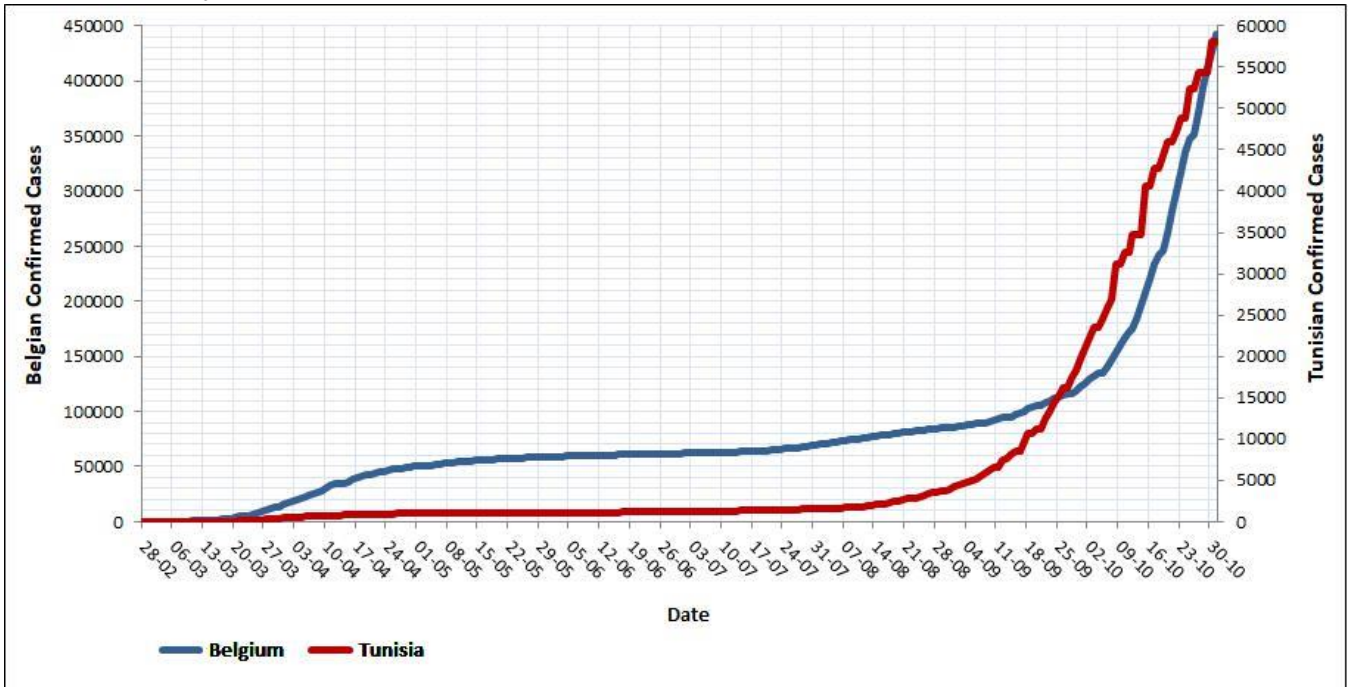


Fig. 4. Total Coronavirus Cases in Tunisia Compared to Belgium

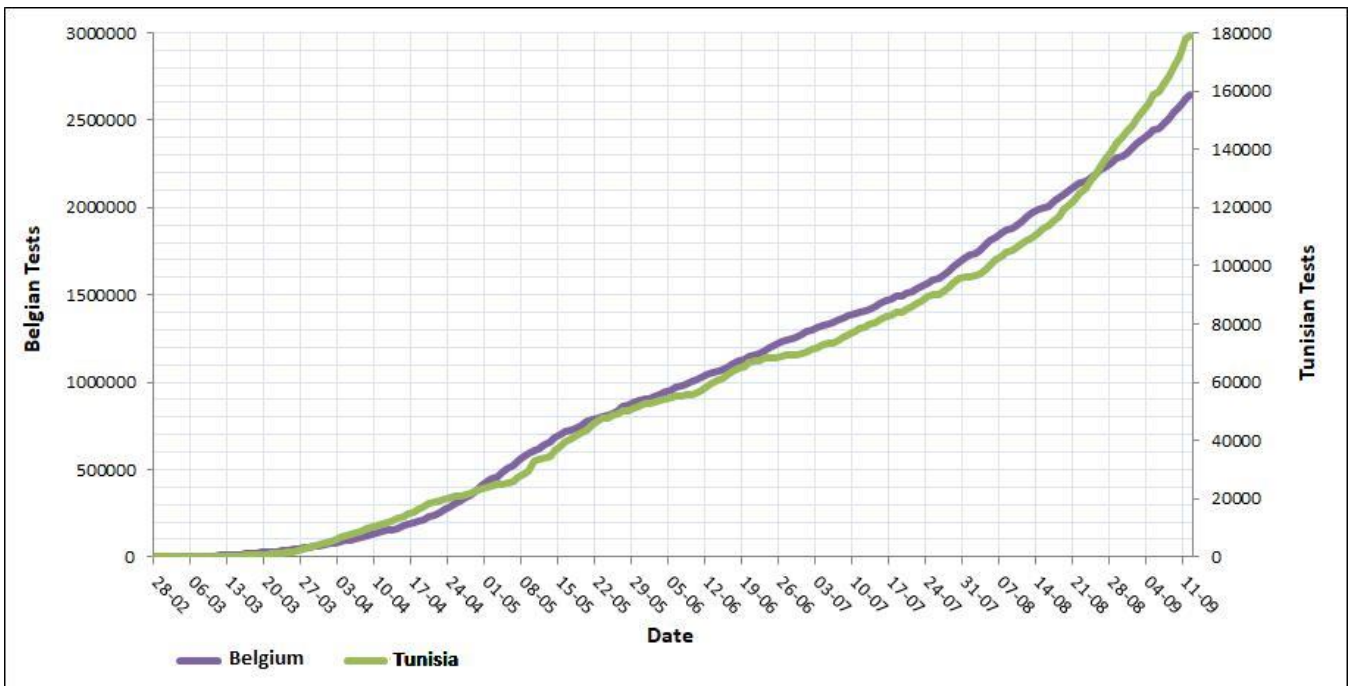


Fig. 5. Total Carried out Tests in Tunisia Compared to Belgium

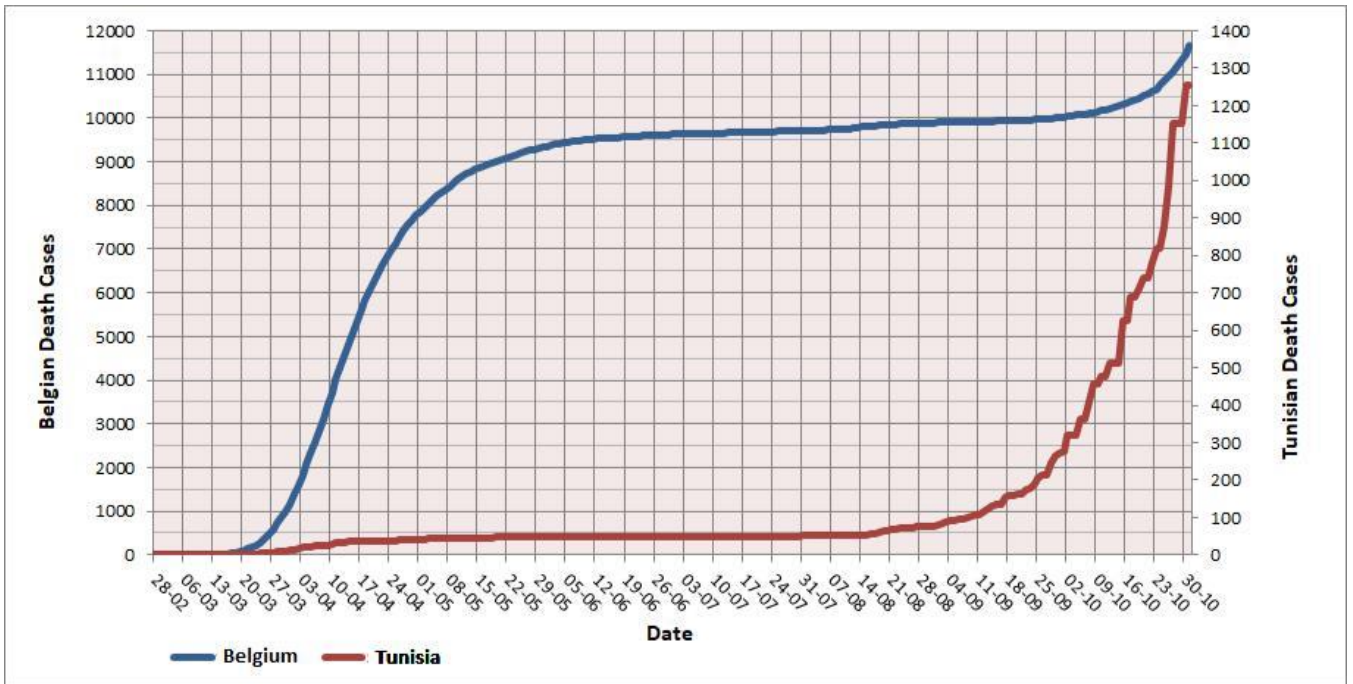


Fig. 6. Total Death Cases in Tunisia Compared to Belgium

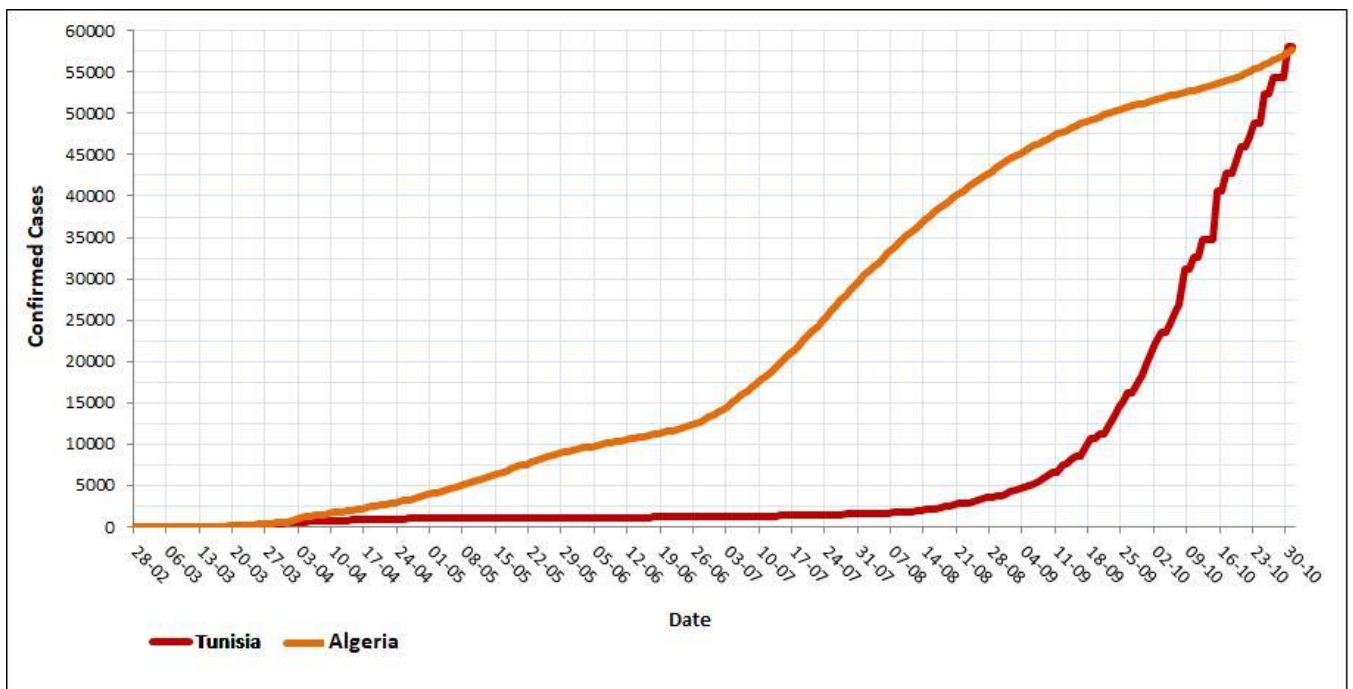


Fig. 7. Total Confirmed Cases in Tunisia Compared to Algeria

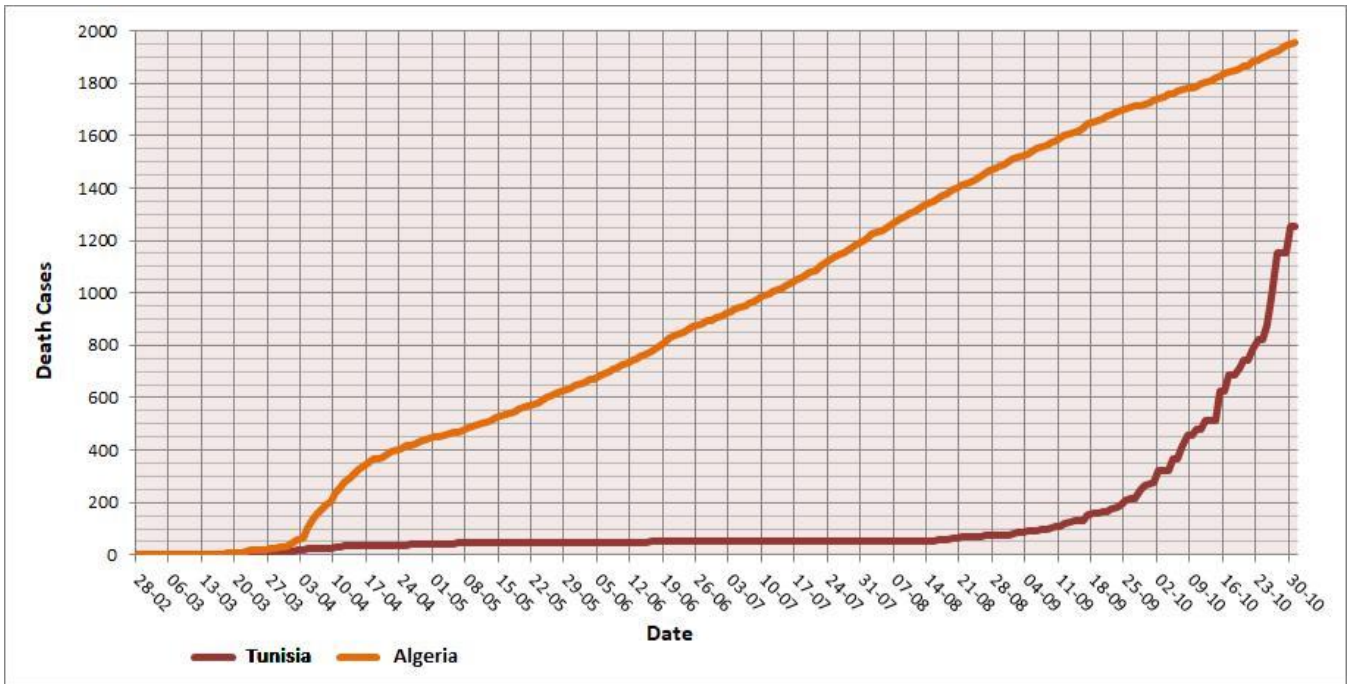


Fig. 8. Total Death Cases in Tunisia Compared to Algeria