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Original Article

One-Year Analysis of Trends of COVID-19 in Libya: Cases, Deaths, and Laboratory Testing

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Abstract

Introduction: The coronavirus disease 2019 (COVID-19) epidemic in Libya started at the end of March 2020. Since then, the number of daily reported cases has progressively increased. **Objectives**: This study aims to analyze the trends and dynamics of the epidemic in Libya. **Materials and Methods:** The study analyzed the data reported daily by the Libyan national center of disease control. **Results:** The total number of tests performed per thousand people was 121.08 test/1000 people, which is a modest rate compared with countries categorized in the same income group. The overall positivity rate of all performed tests over 1 year was 18.1%. During most of the weeks, the positivity rate was far higher than the 5% rate indicating that the epidemic was out of control most of the year. The level of community transmission was moderate to substantial during most of the year, reflecting the weakness in applying the public health control measures. The calculated 1-year instant case-fatality rate of COVID-19 in Libya was 1.89%, comparable to that in other upper-middle-income countries. **Conclusions:** The number of performed tests in Libya during the 1st year of the COVID-19 epidemic is inadequate and must be at least doubled to increase the chances of diagnosing more potential cases. Based on the current positivity rate, the epidemic appears to be out of control since July 2021. This should urge the authorities to impose further enforcement of the standard public health measures.

Keywords: Community transmission, COVID-19, Libya, mortality, recovery

Introduction

Severe acute respiratory syndrome coronavirus-2, coronavirus disease 2019 (COVID-19), was declared a pandemic after its rapid spread across the globe.[1] Libya is a North African country, with an estimated population in 2020 of 6,931,061 million, according to the country's Bureau of Statistics.[2]

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The first confirmed case in the country was reported from Tripoli on March 24, 2020; the case was imported from Saudi Arabia.[3] Since then, the number of cases started to increase slowly with negligible mortality until May 27, 2020, when a cluster of 19 cases was reported altogether from the city of Sebha in the country's Southern region. Since then, the number of daily reported cases has progressively increased.[4]

Currently, the trends and dynamics of the epidemic in Libya are not clear. This study aims to analyze these trends to assess the adequacy of testing, the pattern of the epidemic curve, level of community transmission, the effectiveness of the control measures, and the severity of the disease.

Materials and Methods

Design and settings

This is a descriptive ecological study conducted to assess the spread of COVID-19 in Libya and estimate the trends and dynamics of the epidemic in the country. The study was conducted over 52 weeks, from March 24, 2020 to March 21, 2021.

Source of data

The data were collected from the daily report posted on the Libya National Centre for Disease Control (NCDC).[5] The Libyan NCDC began monitoring and issuing online reports for the COVID-19 epidemic in Libya as routine surveillance. Since the reported figures varied significantly from day to day, authors choose to estimate the 7-day rolling average of all the reported data as this is less affected by the daily variation in reporting.

Definitions and data synthesis

The collected data included the number of performed tests, number of positive tests, the number of reported deaths, and the number of reported recoveries. A confirmed case was defined as the case approved by the real-time reverse transcription-polymerase chain reaction (RT-PCR). The positivity rate was calculated by dividing the number of positive tests by the number of total tests. The level of community transmission was estimated based on the total number of new confirmed cases per 100,000 persons in the past 7 days. The level of community transmission is categorized as low transmission: 0–9.99, moderate transmission: 10–49.99, substantial transmission: 50–99.99, and high transmission: ≥100.[6] The case fatality rate (CFR) was calculated by dividing the number of cumulative deaths by the sum of the number of cumulative deaths and the number of cumulative recovered cases.[7]

$$\frac{\text{Number of cumulative deaths}}{\text{Number of cumulative deaths} + \text{number of cumulative recoveries}}$$

Statistical analysis

Collected data were analyzed with IBM SPSS (statistical program for social science version) version 23.0 (IBM Corp. Released 2015. IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY, USA: IBM Corp.). Descriptive statistics were conducted including frequencies, percentages, averages, and histograms.

Results

Frequency of testing

The total number of performed tests over 1 year was 839,225 tests. The actual tests performed per thousand people were 121.08 test/1000 people. The average weekly performed tests were 16,139, progressively escalated from 69 tests in the 1st week of the epidemic to 33,888 in 52nd week [Figure 1]. However, during weeks 47 and 48 of the epidemic (February 9 to 24, 2021), the average weekly number of performed tests dropped by 56.6% from 28,986 tests in week 46 to 12,577 tests in week 48, then started rising again.

Frequency of confirmed cases

The total number of confirmed cases over 1 year was 152,369. The average number of weekly confirmed cases was 2930 (1–7274), which was equal to an average incidence of 46.6 cases per 100,000 population per week (0.01–104.9), with the lowest number in weeks seven and eight (May 5–18, 2020) and the highest number in week 31 (October19–25, 2020) [Figure 2].

The level of community transmission was classified as low in the first 18 weeks of the epidemic. Then it increased to moderate in the weeks 19–23. Then,

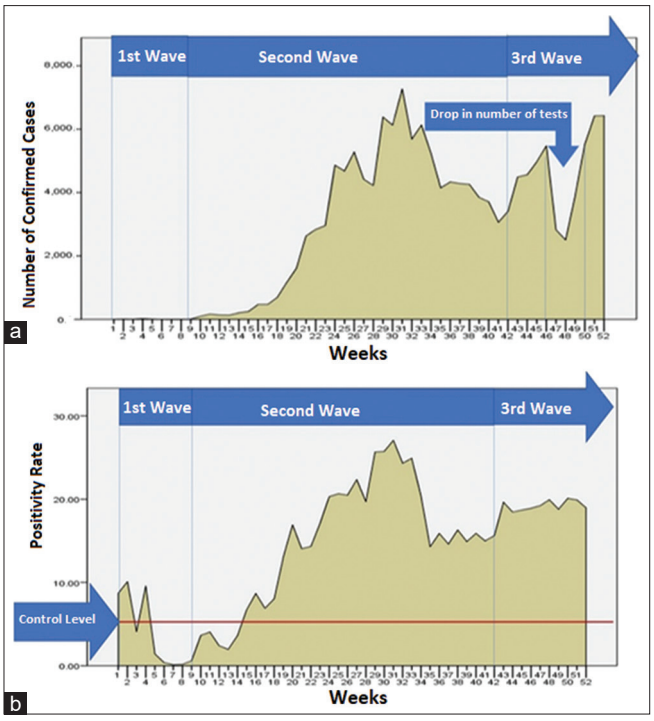

Figure 1: The weekly trends of COVID-19 confirmed cases (a) and weekly trends of COVID-19 positivity (b) in Libya between March 24, 2020 and March 21, 2021

starting from week 24, it became substantial most of the time [Figure 2].

The average number of performed tests per confirmed case (testing per case) every week was 6.3 tests per confirmed case, ranging from 3.69 tests per confirmed case in week 31 to 915 tests per confirmed case in week 7.

The overall positivity rate of all performed tests over 1 year was 18.1%. The average weekly positive rate was 15.7% (0.11%–27%), with the lowest rate in week 7 (May 5–11, 2020) and the highest rate in week 31 (October 19–25, 2020). The positivity rates during weeks 47 and 48 were 19.23% and 19.93%, compared to 18.91% in week 46 and 18.8% in week 49. A positivity rate of <5% was only observed during the 3rd week and weeks 5–14 of the epidemic [Figure 1].

The first wave started on March 24, 2020 (the 1st week of the epidemic) and continued for 9 weeks, resulting in 74 confirmed cases and two deaths. The second wave started by the 10th week and continued for 33 weeks, peaked in week 31, and ameliorated to a low plateau between weeks 35 and 42, and resulted

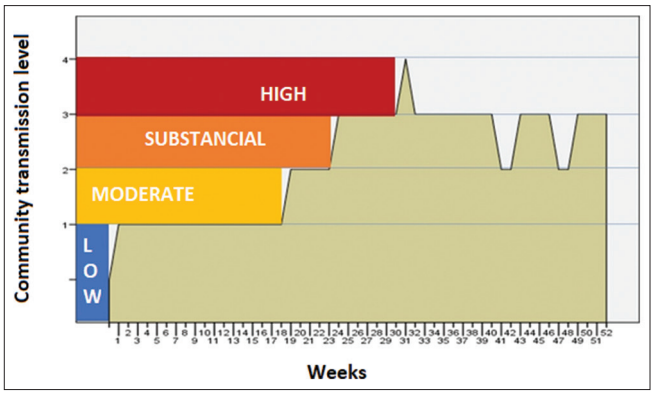

Figure 2: Weekly trends of COVID-19 community transmission level in Libya from March 24, 2020 to March 21, 2021

in 105, 163 confirmed cases, and 1582 deaths. The third wave started in week 43 and still storming. Up to the end of this study, this wave resulted in 47,132confirmed cases and 924 deaths.

Deaths and recoveries

The total number of deaths over 1 year was 2508 deaths. The average weekly deaths were 59.5 (0–114), with the highest number of deaths reported in week 51 [Figure 3]. The 1-year instant CFR was 1.89%. The total number of recovered cases over 1 year was 129,762. The average weekly recovery rate was 29.5 cases in the first 24 weeks. Then, starting from week 25, the average jumped to 4556 cases per week [Figure 4].

Discussion

The number of performed tests is widely variable from one country to another according to each country's economic status and the adopted testing policy. There are huge differences between rich and developing countries regarding the extent of testing. The more affluent countries, in general, have done more testing. For instance, low-income countries such as some African nations have done only a few tests per thousand people. In contrast, high-income countries such as Europe, North American, and Arabian Gulf countries have done hundreds and even thousands of tests per thousand people.[8] According to the world bank report, in 2019, Libya was classified as an upper-middle-income country with a gross domestic product per capita of 7685.9$.[9] The actual tests performed per thousand people in Libya during the study period were 121.08 tests/1000

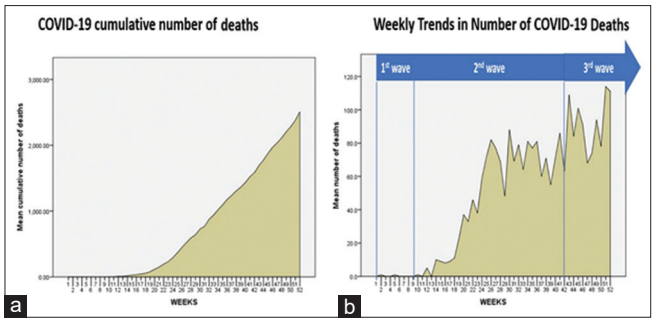

Figure 3: COVID-19 deaths in Libya between March 24, 2020 and March 21, 2021

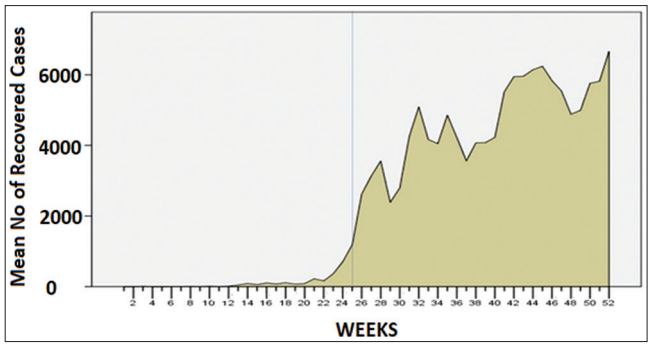

Figure 4: Weekly trends in the number of COVID-19 recoveries in Libya between March 24, 2020 and March 21, 2021

people, which is a modest rate compared to the countries categorized in the same income group.

Another way of examining the extent of testing is by estimating how many tests a country performs to find one COVID-19 case. In WHO recommendation, 10–30 tests are required to confirm the testing adequacy. Countries that do very few tests per confirmed case are unlikely to be testing widely enough to find all cases.[8] The average number of weekly tests per confirmed case during the study period was 6.3 tests per confirmed case, indicating inadequate testing. To reach the WHO targets, the average weekly testing rate has to be increased by about 2–5 folds of the current rate.

Since it is almost impossible to know the exact number of infected persons in a specific country, the number of confirmed cases can be an indirect indicator for spreading the epidemic.[8] However, when there is a decrease in the frequency of testing for any reason, the number of confirmed cases will drop, giving a false impression that the situation is improving. This is precisely what has happened between weeks 47 and 48 of the epidemic (February 9–24, 2021). The average weekly number of performed tests dropped from 28,986 in week 46 to 12,577 in week 48 (reduction by 56.6%), resulting in a large notch in the epi curve even though the actual number of the cases was not dropping. In such a situation, the positivity rate could be used as a proxy for figuring out (or approximation) the actual growth of cases.

Positivity rate is considered one of the most important metrics for tracking the spread of COVID-19 in the society. It refers to the share of tests returning a positive result. This metric helps to understand the spread of the virus when the positive rate rises in a country, the virus spreads faster and vice versa.[8]

The overall positivity rate of all performed tests over 1 year was 18.1%, while the average weekly positivity rate was 15.7% (0.11%–27%), with the lowest rate in week 7 (May 5–11, 2020) and the highest rate in week 31 (October 19–25, 2020). The overall pattern of the positivity rate curve was correspondent to the pattern of the epi curve.

The distribution of the confirmed cases over time on the histogram gave a visual representation of the onset, size, pattern of spread, and time trend of the current outbreak. The mode of spread depicted in the epi curve of COVID-19 in Libya fitted with a propagated outbreak pattern with a series of irregular peaks. The curve takes the shape of three significant waves. The third wave is still storming, up to the date of the end of this study.

The total new cases per 100,000 persons in the past 7 days are an indicator of the level of community transmission.[6] The transmission level was low (<10) in the first 18 weeks of the epidemic, then the curve followed a staircase pattern, and since the 24th week of the epidemic leveled up and maintained a plateau at the substantial level (50–99.99), most of the time. Moreover, according to the WHO criteria of May 2020, a positive rate of <5% in 2 consecutive weeks indicates that the epidemic is under control in fa country.[10] This rate was only observed during the 3rd week and weeks 5–14 of the epidemic (April, May, and June 2020). During the rest of the weeks, the positivity rate was far higher than the 5%, indicating that the epidemic has been out of control since then. These two indicators suggest the weakness of the

adherence to the public health measures implemented to slow down the spread of the virus. These figures should urge authorities to enforce the standard public health measures that help control the spread of the disease including social distancing, universal masking, avoidance of public gatherings, hand hygiene, and ultimately COVID-19 vaccination.

The total number of deaths over 1 year was 2508 deaths. This is higher than the 2200 cumulative number of deaths previously estimated by Brendan and Bakoush.[11] However, Brendan and Bakoush also assumed that COVID-19 deaths in Libya are under-reported by about 30%. Hence, Libya's actual numbers of deaths are likely to be much higher than these two figures because the NCDC only reports the PCR confirmed cases. The phenomenon of underreporting of death from COVID-19 has been described in different places.[12] About 63% of the deaths occurred during the second wave, and about 36.8% occurred during the third wave. However, the third wave is not over yet, and the possible cumulative number of deaths is expected to be much higher.

The case-fatality ratio refers to the proportion of deaths from a particular disease compared to the total number of people diagnosed with the disease for a particular period. It represents a measure of disease severity. The classical way of calculating CFR is by dividing the number of deaths from the disease by the total number of confirmed disease cases. However, this method is not accurate during the ongoing outbreak as it ignores the possible outcome of the active cases. This leads to a wide variation in CFR estimates throughout an epidemic. The accurate CFR of an infectious disease can only be obtained after an outbreak is over based on the final numbers of confirmed cases and deaths. One solution to mitigate the bias due to delays to case resolution during an ongoing epidemic is to restrict the analysis to resolved cases.[7] Some authors called this instant case-fatality rate. Moreover, the CFR could not be calculated classically from the available data. The NCDC reports the number of positive tests rather than the number of people who have tested positive. Because some people get tested more than once, the number of positive tests will be larger than the number of people who have tested positive. Ultimately, if this figure is used to calculate the case-fatality rate, this will result in a falsely lower case fatality. The 1-year instant CFR of COVID-19 in Libya was 1.89%, comparable to the CFR in other upper-middle-income countries.[13]

The number of recovered cases showed a marked increase in week 25. In the first 24 weeks of the epidemic, the adopted definition of cure was two negative RT-PCR results on sequential samples taken at least 24 h apart. However, since September 11, the NCDC applied the newer WHO criterion of recovery, which is 10 days after a positive test for asymptomatic cases and ten days after symptoms onset plus three additional days without symptoms for symptomatic cases,[14] therefore the number of declared cured raised sharply since then. The situation of COVID-19 has been a very dynamic field and is likely to remain unpredictable in the foreseeable future.[15]

Although this study reports some critical information regarding the trends of the COVID-19 epidemic in Libya, it has some limitations. First, it reports only the overall trends of the epidemic in the whole country. However, these trends vary between different cities and geographical territories according to the onset of the epidemic, social habits, and the degree of adherence to protective measures. Therefore, these trends might not apply to individual cities, and a separate subnational analysis is advisable. Moreover, the study reports the overall number of confirmed cases and deaths. However, the number of confirmed cases and deaths could not be described according to gender and age groups because the NCDC does not report these data. The epidemic trends, particularly the mortality, are expected to be highly variable between different age groups. Finally, the hospitalization rate could not be calculated because the NCDC does not report it.

Conclusions

This study showed that the number of performed tests in the country during the 1st year of the epidemic was inadequate and must be doubled to increase the chances of diagnosing more potential cases. Based on the current positivity rate, the epidemic appears

to be out of control since July 2021; this should urge the authorities to impose further enforcement of the standard public health measures that help control the spread of the disease and accelerate the vaccination program against COVID-19. The lack of essential data in the daily report from NCDC makes it impossible to monitor some of the critical metrics of the epidemic. Thus, we do recommend the NCDC to report more details.

Authors' contributions

All named authors participated in the conception of the study, data collection and analysis, and drafting and revising the manuscript. They have all approved the final version of the article.

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Nil.

Conflicts of interest

There are no conflicts of interest.

Compliance with ethical principles

The study was approved by Benghazi Medical Center's Ethics Research Board (Ref 2021-90-44). However, consent was waived due to the retrospective nature of the study. All data were collected and analyzed anonymously.

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