Erciyes Med J 2020; 42(4): 468–73 • DOI: 10.14744/etd.2020.80270
BRIEF REPORT – OPEN ACCESS

Estimating COVID-19 Dynamics in Afghanistan

Abbas Ali Husseini[1], Anton Abdulbasah Kamil[2]

ABSTRACT

Little reliable information on novel coronavirus (COVID-19) outbreak is available from war-torn countries, including Afghanistan. The current study estimates the pandemic features based on currently available data to forecasting future challenges of preventive strategies and emergency response using mathematical modeling. The infection fatality and recovery rates were estimated by 1.8% and 20.8%, respectively. The average growth rates of infection, death, and recovery among the Afghanistan population were estimated as 0.2, 0.2, and 0.5, respectively. Also, it was estimated that approximately 6 million people infected in the urban area, which may lead to approximately 11 thousand deaths. However, the features of the pandemic, marks that Afghanistan needs more time to pass the pandemic. Along with this, inadequate community engagement and low abiding to health advice, including social distancing, lack of personnel and testing capacities in the provinces, shortage of laboratory testing supplies, insufficient infection prevention, and control measures in health facilities in some of the provinces, limited access to and response capacities are the main challenges to fight against COVID-19. Therefore, the majority of infected cases and deaths may not be reported, and preventive strategies effectively in Afghanistan could severely be disrupted by several socio-cultural, financial, political, and administrative obstacles.

Keywords: COVID-19, growth rate, exponential distribution, estimation

Cite this article as:
Husseini AA, Kamil AA. Estimating COVID-19 Dynamics in Afghanistan. Erciyes Med J 2020; 42(4): 468-73.

[1]İstanbul Gelişim University, Life Science, and Biomedical Engineering Application and Research Center, İstanbul, Turkey
[2]İstanbul Gelişim University Faculty of Economics, Administrative and Social Sciences, İstanbul, Turkey

Submitted
31.05.2020

Accepted
30.06.2020

Available Online Date
13.07.2020

Correspondence
Abbas Ali Husseini,
İstanbul Gelişim University, Life Science, and Biomedical Engineering Application and Research Center, 34310 İstanbul, Turkey
Phone: +90 555 069 75 92
e-mail: ahusseini@gelisim.edu.tr

INTRODUCTION

On March 11, 2020, World Health Organization (WHO) announced a novel outbreak of coronavirus in Wuhan, China, which latter named COVID-19 and subsequently spreading all around the world and convert to a severe global pandemic ever since (1). Now, the disease has established in almost all countries over the world. In Afghanistan, since 24 February 2020, which index case of COVID-19 had been confirmed, till the middle of June, 26320 infected cases and 487 deaths have been confirmed over the 34 provinces of Afghanistan officially (2).

Afghanistan has a young population structure, with approximately 38 million people live all over the country, which a significant part lives in rural areas (3, 4). Although officials have been implementing prevention programs from the beginning, disease prevention strategies face many obstacles.

Supply and access to health services are limited. As part of the measures taken to combat COVID-19 in the country, national isolation centers in capital Kabul, and regional and provincial isolation centers with approximately overall 1541 beds are currently operational in Afghanistan. Currently, a total of eight testing and health facilities centers in the regional centers, with a maximum of 2000 tests per day, provide diagnostic services. Lack of workforce in the health sector is another aspect of the problem. The proportion of health workers and physicians per 10000 individuals is 9.4 and 1.9, respectively. The access of rural area to physicians and health services are to a shortage, while 74% of the population lives in rural areas (5–7). Therefore, the burden of the pandemic may exceed the potential of the Afghanistan health system.

Using mathematical models to understand the pandemic features and transmission dynamics of outbreaks to estimate the future challenges of the crisis and making correct preventive strategies to emergency response have a long background (8). The population-based studies that consider the epidemiology of COVID-19 in Afghanistan are too limited. In the current study, we use mathematical modeling to understand the pandemic COVID-19 dynamics and current challenges in Afghanistan.

MATERIALS and METHODS

The confirmed infected cases, death cases, and recovery cases on 24 February 2020–15 June 2020, which reported daily by the Ministry of Public Health, Afghanistan, were organized in the frequency distribution table (Appendix 1).

To calculate the daily growth rate of the infection, the growth rate of the death and recovery among population following formula was applied:

$$g = \frac{a_t - a_{t-1}}{a_{t-1}}$$

Where: g=growth rate

at=present case

at-1=previous case (lag 1)

t=time

To calculate the linear regression in the exponential growth phase, IBM SPSS statistics 24 software was used.

The infection fatality rate and recovery rate until the middle of June was estimated based on officially reported data via the following formulas:

The infection fatality rate=total deaths/total cases

Recovery rate=total recovery/total number of cases

The actual infected case number in urban areas estimated via following formula and assumptions;

Assumptions

Minimally 27% of the population living in urban areas.

Unofficial reports estimate 60% of people living in cities infected with COVID-19.

The current population of Afghanistan is approximately 38 million based on the Worldometer elaboration of the latest United Nations data.

Therefore

Actual infected case=0.27×38 million×0.6

Actual death number also is estimated based on infection fatality rate obtained from official data and assumption that only 10 percent of infected persons may need hospitalization based on the Ministry of Public Health report (2):

Actual death=actual infected case×0.1×infection fatality rate

RESULTS

On 24 February 2020–15 June 2020, a total of 26320 infected cases were reported from Afghanistan. The average growth rate of the pandemic among the Afghanistan population in this time was calculated as 0.2. In the same time, 487 deaths were reported officially. Therefore, the infection fatality rate until the middle of June in Afghanistan was estimated by 1.8%. The average daily death growth rate among Afghanistan cases was estimated at 0.2. Also, 5490 patients recovered during this time. The data show an overall recovery rate of 20.8%, with an average of the daily recovery growth rate of 0.5.

Based on the confirmed infected cases, distribution in time series seem exponential, as shown in Figure 1. Approximately every 10 days, the number of infected individuals is doubled. The R square index of linear regression analysis of the exponential phase was 0.75.

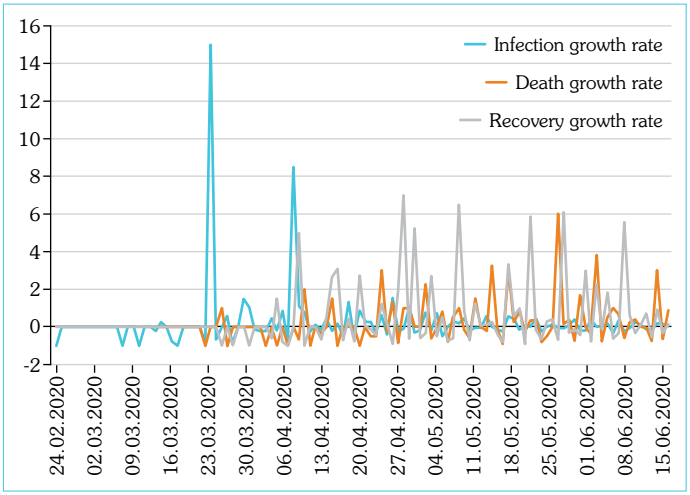

Figure 1. The daily growth rate of infection, death, and recovery among Afghanistan patients

In a lack of population-based study, the actual number of infected cases is calculated by 6 million based on unofficial reports and assumptions. Also, more than 11 thousand COVID-19-related deaths would be expected from Afghanistan.

DISCUSSION

Evidence shows that the pandemic growth exponentially in Afghanistan. It is expected that the cumulative numbers of confirmed cases will highly increase during July and August. The average growth rate of infection among the Afghanistan population was calculated as 0.2. However, the infection's daily growth rate remains approximately stable by the time, but the death and recovery growth rate highly changes (Fig. 1). Stability in the daily infection growth rate may be due to a lack of change in the daily potential of diagnostic services and limited access to health facilities. Since the maximum capacity of all diagnostic centers is approximately 2,000 tests daily and health services accessibility is highly limited, and also most of the infected persons are asymptotic official data validity must be discussed cautiously. Besides, the high differences between infected and recovered person rates can be related to inadequate treatment facilities in this country, and infected individuals stay active carriers for more time and subsequently increase the burden on the health system (Fig. 2). All of these, together with a positive death growth rate (0.2) mark, that Afghanistan needs more time to pass the pandemic.

Among the fatalities, 94% had at least one underlying disease, such as cardiovascular disease, lung disease, and diabetes. Age 40–69 includes the most fatalities. Kabul is now the most affected part of the country, followed by Hirat concerning confirmed COVID-19 cases (4, 6, 9).

There are some obstacles that contribute to making obvious restrictions for testing to detect infected cases and subsequently contact tracing, quarantine measures, case management, and even recording of death because of COVID-19.

Limited centers of testing with a limited capacity of testing, which is very difficult for suspected cases to have access to these few centers. Currently, eight laboratories, including two in Kabul, two in

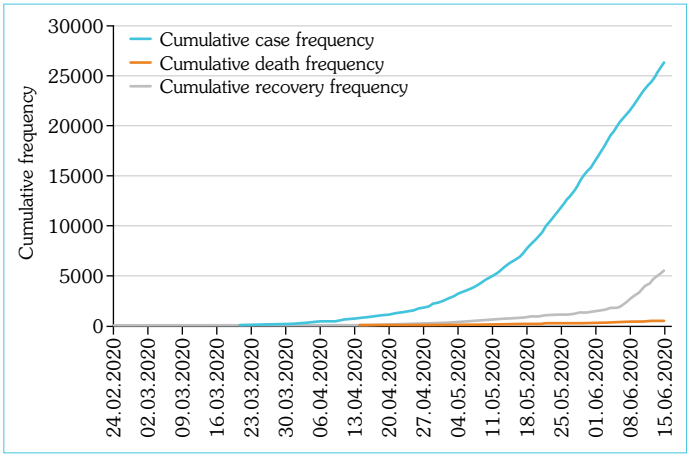

Figure 2. Cumulative frequency of the COVID-19 infection, death, and recovery cases in Afghanistan

Hirat, one in Nangarhar, one in Mazar-e-Sharif, one in Paktya, and one in Kandahar with a total capacity of maximum 2000 test per day are operational in Afghanistan. Particularly movement restriction is applied, and normal transportation was disturbed. These centers sometimes are stock out of diagnostic cartridges. Even reach in the center and the diagnostic cartridge is available at the center; it needs to stay sometimes in waiting row to get the sample and some other times to obtain the result. All of these issues further make difficult access to the diagnostic facilities.

The shortage of trained medical and health personals is also another problem. During the outbreak, a total of 283 medical doctors, 962 nurses/paramedics, and 614 reporters/community influencers are specifically trained to collaborate in COVID-19 combat activities (7).

Crimean Congo Hemorrhagic Fever (CCHF) have been common since 2017, and now it has been considered as an endemic public health problem in approximately all-around Afghanistan with high incidence in Herat and Kabul which has put another burden on already limited capacities, including admission space, lack of personnel, and testing capacities in the province (10).

Poverty is another issue; 54% of people are living under the poverty line. Poor people cannot stay in their homes (quarantine), and they have to work to earn their essential needs and food. Besides, it is not affordable to them for reaching to the diagnostic center.

Security is another crucial issue that disturbs people to seek diagnosis and treatment. During this time, security precautions are significantly increased. Therefore, because of the above-mentioned obstacles, only a few percent of infected people are detected and reported. The majority of infected cases and deaths are not reported. Certainly, the infection growth rate and death growing rate so much higher than this estimation.

Conclusion

Since several socio-cultural, financial, political, and administrative factors influence pandemic dynamics, the prediction models only useful to understand the feature of epidemiology of the disease. However, the pattern may rapidly change by increasing the capacity of diagnostics services.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept – AAH; Design – AAH; Supervision – AAH; Resource – AAH, AAK; Materials – AAH; Data Collection and/or Processing – AAH, AAK; Analysis and/or Interpretation – AAK; Literature Search – AAH; Writing – AAH; Critical Reviews – AAH.

Conflict of Interest: The authors have no conflict of interest to declare.

Financial Disclosure: The authors declared that this study has received no financial support.

REFERENCES

1. Shah J, Karimzadeh S, Al-Ahdal TMA, Mousavi SH, Zahid SU, Huy NT. COVID-19: the current situation in Afghanistan. Lancet Glob Health 2020; 8(6): e771–2. [CrossRef]
2. The Islamic Republic of Afghanistan, Ministry of public health. Afghanistan Covid-19 Cases online dashboard. Available from: URL: http://covid.moph-dw.org/#/.
3. Islamic Republic of Afghanistan National Statistics and Information Authority. Afghanistan Statistical Yearbook 2018–19. Available from: URL: https://www.nsia.gov.af:8080/wp-content/uploads/2019/11/Afghanistan-Statistical-Yearbook-2018-19_compressed.pdf. Accessed March 24, 2020.
4. United Nations, Population Division. World Population Prospects: The 2019 Revision.Available from: URL: https://population.un.org/wpp/.
5. World Health Organization. A universal truth: no health without a workforce. Report. November 2013. Accessed March 24, 2020.
6. OCHA, WHO. Afghanistan Flash Update: Daily Brief: COVID-19, No. 40 (30 April 2020). Available from: URL: https://reliefweb.int/sites/reliefweb.int/files/resources/daily_brief_covid-19_30_april_2020.pdf.
7. WHO, Afghanistan Country Office. Coronavirus disease 2019 (COVID-19), Weekly Situation report no. 15. (4-10 May 2020).
8. Chowell G, Sattenspiel L, Bansal S, Viboud C. Mathematical models to characterize early epidemic growth: A review. Phys Life Rev 2016; 18: 66–97. [CrossRef]
9. OCHA, WHO. Afghanistan: COVID-19 Multi-Sectoral Response Operational Situation Report, 29 April 2020.Available from: URL: https://reliefweb.int/sites/reliefweb.int/files/resources/covid_sitrep2_final.pdf.
10. WHO. Weekly epidemiological monitör. WHO 2020; 13(18): 18. Available from: URL: https://reliefweb.int/sites/reliefweb.int/files/resources/22244220201318-eng.pdf.

Appendix 1. Frequency distribution and growth rates of the infection, death, and recovery of COVID-19 in Afghanistan*

Date	No of case	Growth rates	No of death	Death growth rate	No of recovery	Recovery growth rate
24.02.2020	1		0		0	
25.02.2020	0	-1	0	0	0	0
26.02.2020	0	0	0	0	0	0
27.02.2020	0	0	0	0	0	0
28.02.2020	0	0	0	0	0	0
29.02.2020	0	0	0	0	0	0
1.03.2020	0	0	0	0	0	0
2.03.2020	0	0	0	0	0	0
3.03.2020	0	0	0	0	0	0
4.03.2020	0	0	0	0	0	0
5.03.2020	0	0	0	0	0	0
6.03.2020	0	0	0	0	0	0
7.03.2020	3	0	0	0	0	0
8.03.2020	0	-1	0	0	0	0
9.03.2020	0	0	0	0	0	0
10.03.2020	3	0	0	0	0	0
11.03.2020	0	-1	0	0	0	0
12.03.2020	0	0	0	0	0	0
13.03.2020	5	0	0	0	0	0
14.03.2020	4	-0,2	0	0	1	0
15.03.2020	5	0,25	0	0	0	-1
16.03.2020	5	0	0	0	0	0
17.03.2020	1	-0,8	0	0	0	0
18.03.2020	0	-1	0	0	0	0
19.03.2020	0	0	0	0	0	0
20.03.2020	0	0	0	0	0	0
21.03.2020	0	0	0	0	0	0
22.03.2020	18	0	1	0	0	0
23.03.2020	2	-0,888888889	0	-1	0	0
24.03.2020	32	15	0	0	0	0
25.03.2020	10	-0,6875	1	0	1	0
26.03.2020	10	0	2	1	0	-1
27.03.2020	16	0,6	0	-1	1	0
28.03.2020	0	-1	0	0	0	-1
29.03.2020	10	0	0	0	0	0
30.03.2020	25	1,5	0	0	2	0
31.03.2020	51	1,04	0	0	0	-1
1.04.2020	43	-0,156862745	0	0	0	0
2.04.2020	34	-0,209302326	2	0	0	0
3.04.2020	26	-0,235294118	0	-1	5	0
4.04.2020	38	0,461538462	1	0	2	-0,6
5.04.2020	30	-0,210526316	0	-1	5	1,5
6.04.2020	56	0,866666667	4	0	1	-0,8
7.04.2020	2	-0,964285714	0	-1	0	-1

Appendix 1 (cont.). Frequency distribution and growth rates of the infection, death, and recovery of COVID-19 in Afghanistan*

Date	No of case	Growth rates	No of death	Death growth rate	No of recovery	Recovery growth rate
8.04.2020	19	8,5	3	0	2	0
9.04.2020	40	1,105263158	1	-0,666666667	12	5
10.04.2020	71	0,775	3	2	0	-1
11.04.2020	52	-0,267605634	0	-1	0	0
12.04.2020	58	0,115384615	3	0	6	0
13.04.2020	49	-0,155172414	2	-0,333333333	2	-0,666666667
14.04.2020	70	0,428571429	2	0	3	0,5
15.04.2020	56	-0,2	5	1,5	11	2,666666667
16.04.2020	66	0,178571429	0	-1	45	3,090909091
17.04.2020	27	-0,590909091	0	0	13	-0,711111111
18.04.2020	63	1,333333333	3	0	19	0,461538462
19.04.2020	35	-0,444444444	3	0	4	-0,789473684
20.04.2020	66	0,885714286	0	-1	15	2,75
21.04.2020	84	0,272727273	4	0	16	0,066666667
22.04.2020	106	0,261904762	2	-0,5	14	-0,125
23.04.2020	69	-0,349056604	1	-0,5	8	-0,428571429
24.04.2020	112	0,623188406	4	3	18	1,25
25.04.2020	68	-0,392857143	3	-0,25	18	0
26.04.2020	172	1,529411765	7	1,333333333	1	-0,944444444
27.04.2020	125	-0,273255814	1	-0,857142857	3	2
28.04.2020	111	-0,112	2	1	24	7
29.04.2020	232	1,09009009	4	1	8	-0,666666667
30.04.2020	164	-0,293103448	4	0	50	5,25
1.05.2020	134	-0,182926829	4	0	21	-0,58
2.05.2020	235	0,753731343	13	2,25	14	-0,333333333
3.05.2020	190	-0,191489362	5	-0,615384615	52	2,714285714
4.05.2020	330	0,736842105	5	0	24	-0,538461538
5.05.2020	168	-0,490909091	9	0,8	37	0,541666667
6.05.2020	171	0,017857143	2	-0,777777778	10	-0,72972973
7.05.2020	215	0,257309942	3	0,5	4	-0,6
8.05.2020	255	0,186046512	6	1	30	6,5
9.05.2020	369	0,447058824	5	-0,166666667	56	0,866666667
10.05.2020	285	-0,227642276	2	-0,6	16	-0,714285714
11.05.2020	276	-0,031578947	5	1,5	36	1,25
12.05.2020	263	-0,047101449	5	0	38	0,055555556
13.05.2020	413	0,570342205	4	-0,2	43	0,131578947
14.05.2020	414	0,002421308	17	3,25	54	0,255813953
15.05.2020	349	-0,157004831	15	-0,117647059	33	-0,388888889
16.05.2020	262	-0,249283668	1	-0,933333333	6	-0,818181818
17.05.2020	408	0,557251908	4	3	26	3,333333333
18.05.2020	581	0,424019608	5	0,25	40	0,538461538
19.05.2020	492	-0,153184165	9	0,8	80	1
20.05.2020	531	0,079268293	6	-0,333333333	8	-0,9
21.05.2020	540	0,016949153	8	0,333333333	55	5,875

Appendix 1 (cont.). Frequency distribution and growth rates of the infection, death, and recovery of COVID-19 in Afghanistan*

Date	No of case	Growth rates	No of death	Death growth rate	No of recovery	Recovery growth rate
22.05.2020	782	0,448148148	11	0,375	47	-0,145454545
23.05.2020	584	-0,253196931	2	-0,818181818	17	-0,638297872
24.05.2020	591	0,011986301	1	-0,5	22	0,294117647
25.05.2020	658	0,113367174	1	0	31	0,409090909
26.05.2020	625	-0,050151976	7	6	10	-0,677419355
27.05.2020	580	-0,072	8	0,142857143	71	6,1
28.05.2020	623	0,074137931	11	0,375	50	-0,295774648
29.05.2020	866	0,390048154	3	-0,727272727	44	-0,12
30.05.2020	680	-0,2147806	8	1,666666667	25	-0,431818182
31.05.2020	545	-0,198529412	8	0	100	3
1.06.2020	759	0,39266055	5	-0,375	22	-0,78
2.06.2020	758	-0,001317523	24	3,8	72	2,272727273
3.06.2020	787	0,038258575	6	-0,75	63	-0,125
4.06.2020	915	0,162642948	9	0,5	178	1,825396825
5.06.2020	582	-0,363934426	18	1	67	-0,623595506
6.06.2020	791	0,359106529	30	0,666666667	45	-0,328358209
7.06.2020	575	-0,273072061	12	-0,6	296	5,577777778
8.06.2020	542	-0,057391304	15	0,25	480	0,621621622
9.06.2020	684	0,26199262	21	0,4	324	-0,325
10.06.2020	747	0,092105263	21	0	351	0,083333333
11.06.2020	656	-0,121820616	20	-0,047619048	602	0,715099715
12.06.2020	556	-0,152439024	5	-0,75	273	-0,546511628
13.06.2020	664	0,194244604	20	3	524	0,919413919
14.06.2020	761	0,146084337	7	-0,65	365	-0,303435115
15.06.2020	783	0,02890933	13	0,857142857	418	0,145205479
	Total cases	**Growth rate**	**Total death**	**Death growth rate**	**Total of recovery**	**Recovery growth rate**
	26320	**0,246958369**	**487**	**0,209648578**	**5490**	**0,481128997**

*: Data cover the 24 February 2020–15 June 2020