



Epidemiology of Covid-19 in Yemen: A Descriptive Study

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Abstract: In Yemen, the first COVID-19 confirmed case was reported on 10 April 2020. The World Health Organization representative in Yemen reported that approximately 65000 deaths and 49,4000 will be hospitalized in Yemen if there are no protection measures at the right time. Therefore, the objective of this study is to identify the epidemiological characteristics of COVID-19 patients in Yemen. From May 20 to 31, 2020, the data were obtained from the National Center of Public Health Laboratories, Ministry of Health and population, Aden, Yemen. Confirmed cases are defined as polymerase chain reaction assay (PCR) positive. Cases included in this study are laboratory-positive cases. A retrospective study was used to determine the first 53 confirmed epidemiological characteristics of patients with COVID-19 in Yemen. This data includes the date of diagnosis, gender, age, governorates, and clinical symptoms. Data analyzed using SPSS V.22. A total number of 53 confirmed cases were obtained from the National Center of Public Health Laboratories, Ministry of Health and population, Aden, Yemen. The majority of the participants were male (72%), age less than 39 years (40%), and from Aden governorate (43%). The most typical symptoms reported among the participants were fever and cough (90%), followed by the sore throat (81%). The COVID-19 is common in Yemen among males, those less than 39 years old, and from Aden. This study's findings may help guide the decision-makers, frontliners, and medical staff in the clinical management outbreak.

Keywords: COVID-19, Yemen, Epidemiology, Aden, Descriptive, Coronavirus

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1. INTRODUCTION

Coronaviruses are a family of viruses transmitted through mammals and birds, with humans being particularly susceptible to infection and transmission of the virus¹. The earlier two coronaviruses outbreaks are the Middle East Respiratory Syndrome Coronavirus (MERS) and Severe Acute Respiratory Syndrome (SARS) in 2015 and 2003, respectively. Another outbreak reported in China in December 2019 showed similarities to the novel coronavirus and is now a pandemic disease affected most countries worldwide². WHO declared on January 30, 2020, declared COVID-19 is a global public health concern, and collaborative efforts of all countries to prevent the rapid spread of COVID-19 are needed³. The coronavirus's primary known transmission method is from person-to-person through sneezing or coughing, touching a contaminated surface⁴. The clinical features of COVID-19 are cough, fever, fatigue, pneumonia, and shortness of breath⁵⁻⁶. There is no particular antiviral treatment or vaccine so far⁴. Hence, the prevention measures should be practised firmly, such as physical distancing, wearing face masks, hand hygiene practices, and wearing eye protection are associated with a significant reduction in COVID-19 infection⁵. WHO reported that 80% of COVID-19 patients with mild symptoms had recovered without any medication. About 20% of COVID-19 infected cases showed severe symptoms such as shortness of breath, multi-organ failure, and septic shock. Around 2% of cases can be fatal³. Recent studies suggested that COVID-19 infected those with a weak immune system such as obese, older males with chronic comorbidities, HIV patients, pregnant women, and long-term users of immunosuppressive medications⁷⁻¹⁰. A recent systematic review reported that the most common comorbidities affected by COVID-19 are cardiovascular diseases, hypertension, and diabetes¹¹. The current mortality rate of COVID-19 infection is predictable to be approximately 4.8% throughout the globe¹². Different mortality rates were reported in different countries as Germany was 1%, and Italy 11.4%¹². The possible explanation is due to the overestimated mortality rate, and health authorities selected severe cases but not mild cases and no symptoms cases. Although the overall fatality rate for clinical cases ranged from 2-5% globally than the previous outbreaks related to viruses such as H7N9 (39.0%), MERS (34.4%), and SARS (9.5%), pathogens continue to emerge and spread to the population at risk. Hence there is an urgent need to move from responsiveness nations to proactive management^{6,13}. The most significant prevention method is not exposing to COVID-19 by washing hands using soap and water, wearing face masks, quarantining suspected and confirmed cases^{4,14}. Prevention measures are essential and curtail, especially there is no vaccine available yet¹⁵. Some measures were taken in the whole country to minimize the exposure and transmission of COVID-19 by closing schools, universities, and activities of large crowds. In Yemen, schools, universities and wedding halls were closed before any COVID-19 confirmed cases reported and the flight to the main airport [Aden] also closed as a prevention measure. WHO endorses the main personal protective actions against the COVID-19 by washes your hands regularly, maintains physical distancing, no touching the nose, eyes, and mouth,

practice respiratory hygiene, and if sick stay home¹⁴. Yemen's health system is already greatly breakable due to the conflict for more than 5 years. In Yemen, the first confirmed case was reported on 10 April 2020 in Hadhramout, Yemen¹⁶. The challenges that faced Yemen to reduce COVID-19 cases are many. One is a minimal number of national laboratories and the lack of PCR reagents and machines for COVID-19 detection. Second, the difficulties of implementing international health strategies of the COVID-19 outbreak due to the civil war and conflict. The government also failed to formulate enough isolation locations at the country entry. Third, due to the long and uncontrollable coastal borders, some refugees and immigrants may enter the country without COVID-19 testing¹⁷. WHO representatives in Yemen reported that approximately 65000 deaths and 494000 would be hospitalized in Yemen if there are no protection measures at the right time. WHO representative added that it is extremely alarming circumstances if the Yemeni people do not make thoughtful changes in their behavior to face the COVID-19 infection¹⁸. Therefore, the objective of this study is to identify the epidemiological characteristics of COVID-19 patients in Yemen.

2. METHODOLOGY

From May 20 to 31, 2020, the data were obtained from the National Center of Public Health Laboratories, Ministry of Health and population, Aden, Yemen. A retrospective study was used to determine the epidemiological characteristics of the first 53 confirmed cases of patients with COVID-19 in Aden, Yemen. Confirmed cases are defined as polymerase chain reaction assay (PCR) positive. Only cases included in this study are positive laboratory cases. The ethics committees of Al-Hikma University, Sana'a-Yemen approved this study. All procedures performed in this study involving human participants were in accordance with the ethical standards of the Al-Hikma University Institute Review Board (IRB NO. 333/50 and COA No.135/2020). Written consent was taken from the patients for participating in the study. The data were obtained from the National Center of Public Health Laboratories, Ministry of Health and population, Aden, Yemen. This data includes the date of diagnosis, gender, age, governorates, and clinical symptoms. Data were key-in into SPSS version 22 software in the principal investigator computer and protected with a PIN at Al-Hikma Research Center, Al-Hikma University, Sana'a-Yemen. Data cleaning and validation were accomplished before the data analysis. Analytical datasets were created in an anonymized manner and categorical variables into percentages.

3. RESULTS

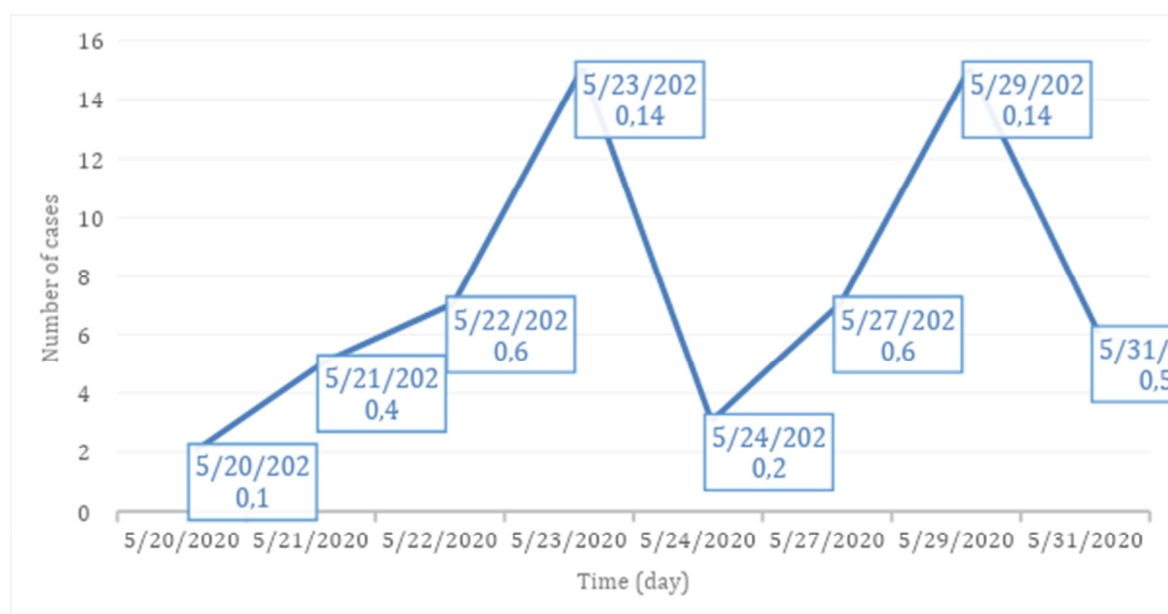
A total number of 53 confirmed cases were obtained from the National Center of Public Health Laboratories, Ministry of Health and population, Aden, Yemen. This data was collected from 20 May 2020 until 31 May 2020. The majority of the participants were male (72%), their age was less than 39 years (40%) and from Aden governorate (43%). The most typical symptoms reported among the participants were fever and cough (90%), followed by sore throat (81%) (Table1).

Table 1: Socio-demographic characteristic and symptoms of 53 COVID-19 confirmed cases in Yemen (N=53)

Characteristics	Confirmed cases	N (%)
Age	≤39	21 (40%)
	40–49	13 (25%)
	50–59	7 (13%)
	60–69	6 (12%)
	≥70	5 (10%)
	Missing	1 (1%)
Sex	Male	38(72%)
	Female	15 (28%)
Governorates	Aden	23 (43%)
	Abyan	8 (15%)
	Lahj	16 (30%)
	Adhale	4 (8%)
	Missing	2 (4%)
Symptoms	Fever	48 (90%)
	Sore throat	43 (81%)
	Cough	48 (90%)

The number of cases confirmed on the 20th of May 2020 was one case. Three days later the confirmed cases jumped into 14 cases. The confirmed cases then dropped again on 24th of May

2020, with two confirmed cases, 5 days later the confirmed cases jumped again to 14 cases. These may due to the behaviour of the residents and their carelessness (Figure 1).

**Fig 1: The frequency of cases per day during the study period**

4. DISCUSSION

Coronaviruses are large, RNA viruses, and enveloped¹⁹. Coronaviruses were considered insignificant pathogens until the early twenty-first century, where we experienced two major outbreaks from MERS and SARS. As of May 28, 2020, 5.85 million people infected with COVID-19 and 359000 deaths worldwide²⁰. To the best of our knowledge, this is the first epidemiological study about COVID-19 in Yemen. This analysis of early confirmed COVID-19 cases in Aden, Yemen provides insight into the epidemiological characteristics and clinical features. Cases are confirmed using PCR testing which is a universal golden standard. Our study showed that the number of men is greater than women of COVID-19 infection (72%). Similar findings reported that COVID-19 infection was more likely to affect males^{6,21}. A previous study indicated that 56% of infections with COVID-19 were males². Another study found that 50.7% were males²². An Italian study reported that men represent 58% of COVID-19

infected patients and 70% of COVID-19 related deaths²³. Similarly during the SARS outbreak, SARS has infected more men than women²⁴. The possible explanation is that fewer females infected with COVID-19 may due to the X-chromosome protection and sex hormones that are reported to have a significant role in the immunity of women^{10,25-26}. Other possible factors such as behavioural and cultural habits have also contributed such as smoking in particular has been implicated as a significant contributor to disease severity^{27,28}. Overall, men are more likely to involve health-related risks activities²⁹. The mean age of confirmed cases of COVID-19 patients in our study is 44.4. Yemen's mean age is lower than several studies reported in a systematic review, which showed that the mean age of COVID-19 patients was 52 years³⁰. Also, lower than the mean age of COVID-19 patients presenting in the Chinese study was 46.5 years²⁴. The highest affected age group was those ≤ 39 years old. Our findings supported by a previous study reported that COVID-19 infection affects mostly those

in the age group of 30-65³¹. Similar findings reported in previous studies during SARS outbreaks that age was a significant factor in both mortality and morbidity of SARS infection³². This may be due to the high growth rate population in Yemen and the United Nation (UN) reported that the Yemeni population's growth rate is one of the highest in the world, at 3%. Approximately 50% of the Yemen population is below 15 years of age³³. In this study, the highest number of COVID-19 confirmed cases were recorded in Aden governorate. The possible explanation is that Aden is the temporary capital of Yemen. It's the only international entry of the country by Air since 2015. Some imported cases came with the local citizens who preferred to back home during this pandemic that hit the whole world. On 11 May 2020, Aden city which is the interim capital of Yemen declared "infested city" after the flooding hit Aden which contributed to the spread of diseases like Dengue, Malaria, Cholera and the new disease COVID-19³⁴. In addition governmental and political conflicts in Aden obstructed national and international efforts to fight the new pandemic COVID-19 infection. Since we can only access the Aden data from the National Center of Public Health Laboratories, Ministry of Health and population, Aden, Yemen. Furthermore, we only got cases from the 20th of May until the 31st of May 2020. The number of cases confirmed on the 20th of May 2020 was one case, three days later the confirmed cases jumped into 14 cases. The confirmed cases then dropped again on 24th of May 2020, with two confirmed cases, 5 days later the confirmed cases jumped again to 14 cases. This may be due to the behaviour of the residents and their carelessness. Furthermore, most people cannot buy face masks, not able to stay home because of the nature of their work, which is a daily earned income. The common symptoms of COVID-19 infections included fever, shortness of breath and cough, sometimes these followed by headache, sore throat, insomnia, frequent urination and nasal congestion. Some severe cases experienced GIT symptoms such as diarrhea, nausea, and vomiting. Our study also reported that 90% of the COVID-19 confirmed cases suffer from fever, cough, followed by the sore throat (81%). Similar findings reported in previous studies that 90% of hospitalized patients were suffering from fever^{5,35}. Similar findings reported in the Chinese study reported that fever is the most common symptom (91.7%), followed by cough (75%)²².

8. REFERENCES

1. Schoeman D, Fielding BC. Coronavirus envelope protein: current knowledge. *Virol J*. 2019;16(1):69. doi: 10.1186/s12985-019-1182-0, PMID 31133031.
2. Li Q, Guan X, Wu P, Wang X, Zhou L, Tong Y, Ren R, Leung KSM, Lau EHY, Wong JY, Xing X, Xiang N, Wu Y, Li C, Chen Q, Li D, Liu T, Zhao J, Liu M, Tu W, Chen C, Jin L, Yang R, Wang Q, Zhou S, Wang R, Liu H, Luo Y, Liu Y, Shao G, Li H, Tao Z, Yang Y, Deng Z, Liu B, Ma Z, Zhang Y, Shi G, Lam TTY, Wu JT, Gao GF, Cowling BJ, Yang B, Leung GM, Feng Z. Early transmission dynamics in Wuhan, China, of novel coronavirus-infected pneumonia. *N Engl J Med*. 2020;382(13):1199-207. doi: 10.1056/NEJMoa2001316, PMID 31995857.
3. WHO. General's opening remarks at the mission briefing on COVID-19. 2020. World Health organization WHO, director. [Available from: <https://www.who.int/dg/speeches/detail/who-director-general-s-opening-remarks-at-the-mission-briefing-on-covid-19>.

This study's limitation is the small sample size with only 53 patients with confirmed COVID-19 were included. However, capturing the early cases is very important to plan and fight coronavirus. Obtaining data from other centers was not possible at this time due to political reasons. More data about the clinical outcome of the COVID-19 was not available at this moment, though, the available data in our study documented an early epidemiological assessment of COVID-19 in Yemen. Patient co-morbidities were also not documented due to the refusal of the authorities. Another limitation is that this study conducted in a short duration and limited by Aden as geographical location is due to some political and logistics reasons. Despite the limitation of our study, the study might offer guidance for policymakers in Yemen and medical staff to manage this outbreak and specific conclusions can be drawn from this study and further studies are needed to be built in this study. More epidemiological multicentres studies in Yemen are urgently needed which can empower epidemiologists to build the COVID-19 model for the Yemen context.

5. CONCLUSION

The COVID-19 is very common in Yemen among male, those with less than 39 years old and those from Aden. This study provides insight into the epidemiological characteristics and clinical features of COVID-19 in Yemen. This study's findings may help guide the decision-makers and frontlines medical staff in the clinical management outbreak.

6. AUTHORS CONTRIBUTION STATEMENT

Prof. Dr. Redhwan Al-Naggar conceptualized the idea of this work. Prof. Dr. Lutfi Almakari and Dr. Salem Madram gathered the data with regard to this work. Prof. Dr. Redhwan Al-Naggar and Dr. Hisham Alshaiikli analyzed these data and necessary inputs for designing the manuscript. Al-Rashidi RR contribution was assist in writing and proof reading. All authors contributed in the methodology and results and reviewed the final manuscript.

7. CONFLICT OF INTEREST

Conflict of interest declared none.

4. How CDC. COVID-19 spreads USA: National Center for Immunization and Respiratory Diseases (NCIRD). Division of Viral Diseases; 2020
5. Wang D, Hu B, Hu C, Zhu F, Liu X, Zhang J, Wang B, Xiang H, Cheng Z, Xiong Y, Zhao Y, Li Y, Wang X, Peng Z. Clinical characteristics of 138 hospitalized patients with 2019 novel coronavirus-infected pneumonia in Wuhan, China. *JAMA*. 2020;323(11):1061-9. doi: 10.1001/jama.2020.1585, PMID 32031570.
6. Chen N, Zhou M, Dong X, Qu J, Gong F, Han Y, Qiu Y, Wang J, Liu Y, Wei Y, Xia J, Yu T, Zhang X, Zhang L. Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study. *Lancet*. 2020;395(10223):507-13. doi: 10.1016/S0140-6736(20)30211-7, PMID 32007143.
7. Wang XF, Shi GC, Wan HY, Hang SG, Chen H, Chen W, Qu HP, Han BH, Zhou M. Clinical features of three avian influenza H7N9 virus-infected patients in Shanghai. *Clin Respir J*. 2014;8(4):410-6. doi: 10.1111/crj.12087.

8. Badawi A, Ryoo SG. Prevalence of comorbidities in the Middle East respiratory syndrome coronavirus (MERS-CoV): a systematic review and meta-analysis. *Int J Infect Dis.* 2016;49: 129-33. doi: 10.1016/j.ijid.2016.06.015.
9. Channappanavar R, Fett C, Mack M, Ten Eyck PP, Meyerholz DK, Perlman S. Sex-based differences in susceptibility to severe acute respiratory syndrome coronavirus infection. *J Immunol.* 2017;198(10):4046-53. doi: 10.4049/jimmunol.1601896, PMID 28373583.
10. Jaillon S, Berthenet K, Garlanda C. Sexual dimorphism in innate immunity. *Clin Rev Allergy Immunol.* 2019;56(3):308-21. doi: 10.1007/s12016-017-8648-x, PMID 28963611.
11. Yang A, Qiu Q, Kong X, Sun Y, Chen T, Zuo Y, Yuan D, Dai W, Zhou J, Peng A. Clinical and epidemiological characteristics of COVID-19 patients in Chongqing China. *Front Public Health.* 2020;8:244. doi: 10.3389/fpubh.2020.00244, PMID 32574309.
12. Tracking BNO coronavirus: Map, data and timeline 2020. Available from: <https://bnonews.com/index.php/2020/04/the-latest-coronavirus-cases/>.
13. Munster VJ, Koopmans M, van Doremalen N, van Riel D, de Wit E. A novel coronavirus emerging in China—key questions for impact assessment. *N Engl J Med.* 2020;382(8):692-4. doi: 10.1056/NEJMp2000929.
14. WHO. How to prevent infection and to slow transmission of COVID-19: world Health Organization; 2020a. Available from: www.who.int/health-topics/coronavirus#tab=tab_2.
15. Qualls N, Levitt A, Kanade N, Wright-Jegede N, Dopson S, Biggerstaff M, Reed C, Uzicanin A, Levitt A, Dopson S, Frank M, Holloway R, Koonin L, Rasmussen S, Redd S, de la Motte Hurst C, Kanade N, Qualls N, Rainey J, Uzicanin A, Biggerstaff M, Jernigan D, Reed C. Community mitigation guidelines to prevent pandemic influenza—United States, 2017. *MMWR Recomm Rep.* 2017;66(1):1-34. doi: 10.15585/mmwr.rr6601a1.
16. OCHA. The Ministry of Health in Aden confirms the first case of COVID-19 in Yemen: un HC Yemen; 2020. [Available from: <https://reliefweb.int/report/yemen/ministry-health-aden-confirms-first-case-covid-19-yemen-enar>.
17. Dureab F, Al-Awlaqi S, Jahn A. COVID-19 in Yemen: preparedness measures in a fragile state. *Lancet Public Health.* 2020;5(6):e311. doi: 10.1016/S2468-2667(20)30101-8, PMID 32334648.
18. Devi S. Fears of “highly catastrophic” COVID-19 spread in Yemen. *Lancet.* 2020;395(10238):1683. doi: 10.1016/S0140-6736(20)31235-6.
19. de Wilde AH, Snijder EJ, Kikkert M, van Hemert MJ. Hosts factors in coronavirus replication. Roles of host gene and non-coding RNA expression in virus infection. *Springer*; 2017. p. 1-42.
20. Worldometer C. coronavirus pandemic 2020. Available from: <https://www.worldometers.info/coronavirus/>. Vol. 19.
21. Huang C, Wang Y, Li X, Ren L, Zhao J, Hu Y, Zhang L, Fan G, Xu J, Gu X, Cheng Z, Yu T, Xia J, Wei Y, Wu W, Xie X, Yin W, Li H, Liu M, Xiao Y, Gao H, Guo L, Xie J, Wang G, Jiang R, Gao Z, Jin Q, Wang J, Cao B. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *Lancet.* 2020;395(10223):497-506. doi: 10.1016/S0140-6736(20)30183-5, PMID 31986264.
22. Zhang JJ, Dong X, Cao YY, Yuan YD, Yang YB, Yan YQ, Akdis CA, Gao YD. Clinical characteristics of 140 patients infected with SARS-CoV-2 in Wuhan, China. *Allergy.* 2020;75(7):1730-41. doi: 10.1111/all.14238, PMID 32077115.
23. Remuzzi A, Remuzzi G. COVID-19 and Italy: what next? *Lancet.* 2020;395(10231):1225-8. doi: 10.1016/S0140-6736(20)30627-9, PMID 32178769.
24. Yang Y, Lu Q, Liu M, Wang Y, Zhang A, Jalali N, et al. Epidemiological and clinical features of the 2019 novel coronavirus outbreak in China. *MedRxiv.* 2020.
25. Sue K. The science behind “man flu”. *BMJ.* 2017;359. doi: 10.1136/bmj.j5560.
26. Schurz H, Salie M, Tromp G, Hoal EG, Kinnear CJ, Möller M. The X chromosome and sex-specific effects in infectious disease susceptibility. *Hum Genomics.* 2019;13(1):2. doi: 10.1186/s40246-018-0185-z, PMID 30621780.
27. Cai H. Sex difference and smoking predisposition in patients with COVID-19. *Lancet Respir Med.* 2020;8(4):e20. doi: 10.1016/S2213-2600(20)30117-X.
28. Statista. Number of individuals who smoke in Italy in 2018, by age and gender Italy. Statista Research Department; 2020. Available from: <https://www.statista.com/statistics/501615/italy-smokers-by-age-and-gender/>.
29. Harris CR, Jenkins M. Gender differences in risk assessment: why do women take fewer risks than men?; 2006.
30. Rodriguez-Morales AJ, Cardona-Ospina JA, Gutiérrez-Ocampo E, Villamizar-Peña R, Holguin-Rivera Y, Escalera-Antezana JP, Alvarado-Arnez LE, Bonilla-Aldana DK, Franco-Paredes C, Henao-Martinez AF, Paniz-Mondolfi A, Lagos-Grisales GJ, Ramírez-Vallejo E, Suárez JA, Zambrano LI, Villamil-Gómez WE, Balbin-Ramon GJ, Rabaan AA, Harapan H, Dhama K, Nishiura H, Kataoka H, Ahmad T, Sah R, Latin American Network of Coronavirus Disease 2019-COVID-19 Research (LANCOVID-19). Electronic address: <https://www.lancovid.org>. Clinical, Laboratory and imaging features of COVID-19: A systematic review and meta-analysis. *Travel Med Infect Dis.* 2020;34:101623. doi: 10.1016/j.tmaid.2020.101623.
31. Yao Y, Tian Y, Zhou J, Ma X, Yang M, Wang S. Epidemiological characteristics of SARS-CoV-2 infections in Shaanxi, China by 8 February 2020. *Eur Respir J.* 2020;55(4). doi: 10.1183/13993003.00310-2020.
32. Cowling BJ, Muller MP, Wong IO, Ho LM, Lo SV, Tsang T, Lam TH, Louie M, Leung GM. Clinical prognostic rules for severe acute respiratory syndrome in low- and high-resource settings. *Arch Intern Med.* 2006;166(14):1505-11. doi: 10.1001/archinte.166.14.1505, PMID 16864761.
33. UN. World population prospects the 2010 revision New York: Department of Economic and Social Affairs population division; 2011. Available from: www.un.org/en/development/desa/population/publications/pdf/trends/WPP2010/WPP2010_Volume-I_Comprehensive-Tables.pdf.
34. National T. Yemen’s Aden declared “infested city” as coronavirus spreads. *The National*; 2020.
35. Wang Y, Wang Y, Chen Y, Qin Q. Unique epidemiological and clinical features of the emerging 2019 novel coronavirus pneumonia (COVID-19) implicate special control measures. *J Med Virol.* 2020; 92(6):568-76. doi: 10.1002/jmv.25748, PMID 32134116

