



# When COVID-19 hit Yemen: dealing with the pandemic in a country under pressure from the world's worst humanitarian crisis

Mohammed Alsabri<sup>1\*</sup>, Brandon Nightingale<sup>2</sup>, Mody Amin<sup>3</sup>, Jennifer Cole<sup>4</sup>

## ABSTRACT

A recent history of internal conflict in Yemen has left the country in shambles, with much of its infrastructure and healthcare system destroyed. The UN considers the situation in Yemen to be the world's worst humanitarian crisis, with more than 80% of the population – 24 million people, including 12 million children – dependent on humanitarian aid for basic needs including food and clean water, as well as healthcare. In the aftermath of a devastating civil war, the spread of COVID-19 has hit the country hard, exacerbating an already dire situation in which the Yemeni people face daily challenges from food insecurity, lack of sanitation infrastructure, continuing conflict and outbreaks of infectious disease. A cholera outbreak, ongoing since 2016, has claimed nearly 1.5 million lives. The situation is made worse by a lack of medical equipment and, most recently, the COVID-19 pandemic. With only 50% of Yemeni hospitals and medical facilities in full working condition, the country is in desperate need of medical equipment, healthcare workers and money to ensure conditions do not deteriorate further in the coming months.

**Keywords:** Yemen, COVID-19, Cholera, War, Humanitarian Crisis

## INTRODUCTION

Yemen is an Asian country located directly south of the tip of the Arabian Peninsula<sup>1</sup>. Covering an area of 527,970 square kilometers, it is surrounded by a number of islands, including Socotra (designated a UNESCO World Natural Heritage Site in 2008) and extends approximately 620 miles inland eastward from the Red Sea, where its current capital, the port city of Aden, sits in a natural harbour. Historically, Yemen was powerful in international trade: it is known to have traded spices and fragrances, including incense, since 1,200 BCE<sup>2</sup>; coffee was first refined in Yemen in the 15<sup>th</sup> century<sup>3</sup>. The country's beautiful plains, upland deserts, highlands and western coast on the Red Sea made it a popular travel and tourist destination for centuries, but this has declined sharply during recent decades as extremism and internal conflict have grown<sup>4</sup>, culminating in a civil war that began in September 2014 and led to a takeover of the country by Houthi rebels in March 2015<sup>5</sup>. Whilst Yemen has been known

as a beautiful country with breathtaking views, its history of conflict in recent decades has left it devastated: it is now one of the poorest countries not only in the Middle East but also in the entire world<sup>6</sup>. In recent years its people have suffered through a series of increasingly devastating humanitarian crises. This already difficult situation has been made worse by the COVID-19 pandemic and, at the same time, the COVID-19 crisis is just one part of the total health emergency in Yemen<sup>7</sup>.

## A HISTORY OF CONFLICT

Yemen has been riven by conflict throughout its history but this has been particularly acute since the official unification of the Yemen Arab Republic (North Yemen, including the historic capital city of Sana'a) with The People's Democratic Republic of Yemen (South Yemen, also known as Aden) in May 1990<sup>5</sup>. The unification designated specific functions to the newly reconstituted regions: the political capital remained in Sana'a in Northern Yemen, while

GJMEDPH 2020; Vol. 9, issue 2

<sup>1</sup> Pediatric Department, Brookdale University Hospital Medical Center, Brooklyn, NY 11212, USA

<sup>2</sup> Saba University School of Medicine, Church Street, The Bottom, Saba, Dutch Caribbean

<sup>3</sup> College of Osteopathic Medicine, NYIT, 101 Northern Blvd, Glen Head, NY 11545, USA

<sup>4</sup> Geography Dept, Royal Holloway University of London, Egham, Surrey TW20 0EX, UK

\*Corresponding Author

Mohammed Alsabri, Pediatric Department, Brookdale University Hospital Medical Center, Brooklyn, NY 11212, USA. Tel: 7186 6399248  
[alsabritop@yahoo.com](mailto:alsabritop@yahoo.com)

Conflict of Interest—none

Funding—none

Southern Yemen controlled the country's economics. Yemen now consists of 21 governorates – Abyan, Aden, Al-Baidha, Aldhalae, Al-Hodeida, Al-Jawf, Al-Mahrah, Al-Mahwit, Amran, Dhamar, Hadramout, Hajjah, Ibb, Lahj, Mareb, Reimah, Sadah, Sana'a, Sana'a City, Shabwah and Taiz; each local government has its own local health department, which reports to the central Ministry of Public Health and Population (MOPHP).

These new governance structures should have seen Yemen moving forward and upwards on a development trajectory as it entered the 21<sup>st</sup> century. Lingering obstacles to true peace remain, however, including social, historical and geographic tensions. These became heightened in 2011<sup>8</sup>, in the wake of Arab Spring, leading to the Yemeni Revolution amid protests over economic conditions and widespread unemployment, calls for political reform, and allegations of corruption. President Ali Abdullah Saleh, (the first leader of the united Yemen, he had previously been President of North Yemen from 1978-1990) was eventually forced out of power in 2012<sup>8</sup>. He was initially replaced by Abdrabbuh Mansur Hadi, who had been Vice President since 1994<sup>9</sup>, but Hadi's presidency in turn hit a rocky road when he too faced backlash over his policies, including a decision to increase fuel subsidies. In September 2014, an armed group of rebels from the Houthi movement – a political group that had emerged from North Yemen in the 1990s to make accusations against the government of financial corruption and damaging foreign policy – gained control of Sana'a in a fast-paced rebellion. President Hadi fled the country.

#### TOWARDS A NEW REGIME

President Hadi was called to resign by the Houthi rebels in January 2015<sup>8</sup> but, backed by a coalition of forces supported by Saudi Arabia and endorsed by countries including the United States and United Kingdom, Hadi's supporters launched airstrikes against Yemen in March 2015, in an attempt to restore order to the country.<sup>10</sup> The airstrikes only escalated the situation, however, eventually leading to full-blown conflict. After the Houthi army attacked and the President retaliated with more violence,

Yemen was left in shambles, with much of its infrastructure destroyed. Instead of heading toward greater development and the eradication of poverty, which had been the hoped-for outcome of the late 20<sup>th</sup>-century unification, Yemen was torn apart by civil war. Its people have faced increasing hardship.

#### DISRUPTIONS TO HEALTHCARE

Since the 2015 conflict, the health system in Yemen has collapsed. Only around 50% of Yemen's 5,056 pre-war health facilities are functional, and there is a widespread shortage of essential emergency medical equipment even in those that are still operational.<sup>10,11</sup> Since the conflict began, the number of healthcare workers has dropped sharply, due to deaths in the medical community caused by conflict injury; infectious disease; a gradual exodus of medical personnel to places of greater safety; and disruptions to higher education that have resulted in the country being unable to educate the next generation of skilled medical professionals.<sup>10,11</sup> Current estimates suggest that 18% of Yemen's 333 districts have no doctors.<sup>10,12</sup> Hospitals that are operating are doing so at nowhere near their full potential, as they are in dire need of necessary equipment and money, not least to pay staff, many of whom have not been paid in more than two years.<sup>10,12</sup> There have been more than 150 recorded attacks on Yemeni healthcare facilities since the start of hostilities and around 100,000 men and women have been severely injured or have died from conflict injuries.

As, sadly, is common in conflict-affected regions, the violence has brought with it a secondary disaster of infectious disease outbreaks<sup>13</sup>. A severe cholera outbreak began in Yemen in 2016 and resurged in April 2017<sup>14</sup>. The World Health Organization (WHO) recorded a cumulative total of 1,236,028 reported cases in the period to October 7, 2018. Of these, 2556 have been fatal, a crude case fatality rate of 0.21%.<sup>15</sup> The aftermath of the civil war has been devastating. The people face many problems: ongoing hostilities, hunger, infections and lack of medical equipment or facilities. Added together this is considered to be the world's worst humanitarian crisis.<sup>12</sup> Even prior to 2015, only 56% of Yemenis in urban areas, and 45% in rural areas, had access to a water supply network.<sup>10,12</sup>



In 2019, the Human Development Index (HDI), ranked Yemen 177th out of 189 countries.<sup>16</sup> In the same year, the UN estimated that 24.1 million people – almost 80% of the total population – was at high risk of hunger and disease, of whom roughly 14.3 million were badly in need of urgent humanitarian assistance. The World Bank wrote: “poverty is projected to remain high with over three quarters of the population in 2019 living below US\$3.20 PPP (purchasing power parities, a metric that compares income based on the equivalent cost of a basket of goods) a day”. Approximately half of the population lived below US\$1.90 PPP a day.<sup>16</sup> The number living in poverty has since risen: 22 million people are currently estimated to require some form of humanitarian assistance<sup>10,12</sup> and eight million are thought to be at risk of famine.<sup>12,16</sup>

In 2019, WHO reported that, “an estimated 5.2 million children under 5 years died [in Yemen annually] mostly from preventable and treatable causes. Children aged 1– 11 months accounted for 1.5 million of these deaths while children aged 1– 4 years accounted for 1.3 million deaths. Newborns (under 28 days) accounted for the remaining 2.4 million deaths”.<sup>17</sup> In 2020, UNICEF appealed for US\$535 million for the Yemen Humanitarian Action for Children (HAC) but collected only US\$ 183 million, leaving a deficit of around 65%.<sup>18</sup> These numbers indicate that Yemen will need a continuous flow of aid money and support from international funds to secure the essential life-saving supplies it needs and to undertake essential infrastructure reconstruction during the post-conflict era.

### ENTER COVID-19

On top of these existing problems, now the country is having to deal with the spread of COVID-19. Trying to quell the impact of a pandemic is difficult to begin with, but this difficulty is exacerbated when the unpredictability of the impact of the SARS CoV-2 virus is compounded by societal instability and a devastated healthcare system. The hospitals that are functioning at all are experiencing a shortage of ventilators, oxygen and other equipment essential for the treatment of COVID-19 patients.<sup>19</sup>

The healthcare systems of many developed countries, such as Italy and France, have not been able to withstand the sudden increase in the demand for medical care: while it has been hard for better established and wealthier countries to cope with the pandemic, it has been impossible for the fragile healthcare system in Yemen. Key challenges include:

- 1) Inadequacies in the infrastructure necessary for COVID-19 prevention and management in nearly all hospitals.
- 2) Insufficient testing capabilities across the country, which has obscured accurate estimates for morbidity and mortality rates.
- 3) A lack of supplies for COVID-19 treatment, e.g., medical supplies such as ventilators and oxygen.
- 4) An acute shortage of trained healthcare workers, due to migration and mortality during duty. Since the beginning of 2020, the COVID-19 outbreak has been aggressively exhausting the remains of Yemen’s least-replaceable human resource: its health workers.<sup>10</sup> Healthcare workers and their families have been threatened during ongoing conflict and tensions.
- 5) Public confusion, and lack of public awareness about COVID-19, have created an extra load on the healthcare system.
- 6) A funding deficit in the healthcare budget, which extends not only to the shortage of supplies but also to salary reduction and potential downsizing of healthcare facility staffing levels.

As of 31 August of 2020, UNICEF reported that 1,983 officially confirmed cases of COVID-19 had been reported in Yemen, with 572 associated deaths and 1,197 recovered cases. This equates to a 28.8% case fatality rate (CFR), which means that one out four confirmed cases in Yemen has resulted in death.<sup>19</sup> The CFR in Yemen is five times higher than the global average.<sup>10,19</sup> Furthermore, the screening and diagnosis process in Yemen is far from ideal and there is a severe shortage of testing facilities. The confirmed cases reported by UNICEF came only from the southern 11 governorates: the testing situation in the northern governorates is vague and higher



numbers of confirmed cases in the countries bordering Yemen raise suspicion that the numbers coming from Yemeni health authorities are not accurate. A defective testing process, in addition to poor preventive measures, increases the risk of silent transmission and undetected mortality.<sup>19</sup>

Within Yemen, there are currently six central public health laboratories, but only four of these are capable of conducting reverse transcriptase polymerase chain reaction (RT-PCR) tests for COVID-19.<sup>7</sup> Four testing facilities in a country of almost 30 million people is clearly insufficient to meet the acute needs of the inhabitants relative to the pandemic. Further complicating this fundamental issue is that additional capacity cannot be raised quickly: few Yemeni citizens already possess the skill set needed to properly execute RT-PCR testing. People cannot be properly trained quickly on the techniques needed to perform the test, and so capacity cannot be increased quickly. Nor do enough local people have the foundational knowledge required to interpret the results; shortages are inevitable.<sup>7</sup>

Yemen relies heavily on outside resources, specifically the World Health Organization (WHO), to support its healthcare capacity but pandemic restrictions on international travel have put this under threat. Agencies that have traditionally offered aid to Yemen have also experienced turmoil. Aid workers have been subject to harassment and detention; some have seen their acquisition of permits impeded.<sup>7</sup>

A further challenge to containing the coronavirus outbreak in Yemen is that the current civil unrest makes organizing healthcare extremely difficult.<sup>20,21</sup> Poor working conditions for healthcare professionals threatens make the situation even more dire. There is a lack of funding for healthcare workers and a shortage of personal protective equipment (PPE). Healthcare workers have to work without proper equipment and many are working for free.

It is estimated that around 3.6 million people have been involuntarily displaced from their homes.<sup>22</sup> Coupled with unsafe living conditions, this creates a

landscape that is very fragile and in which it would be extremely difficult to control any threat, let alone the COVID-19 pandemic.<sup>23,24</sup>

All the above-mentioned issues aggravate existing challenges and add more obstacles to delivering essential, and proper, healthcare services to a population in need. Without a strong and comprehensive response to mitigate the effects of COVID-19 and suppress its transmission, the numbers of COVID-19 deaths, including amongst doctors, is expected to rise rapidly and lead to deadlier and longer-lasting consequences than in most other countries.<sup>10,19</sup> If the current unrest in Yemen is not halted, it will be extremely difficult to make any meaningful progress against COVID-19, cholera or infant and child mortality. Therefore, it is imperative that the health situation in Yemen becomes a focal point for international agencies across the globe. If a second wave develops, it will be catastrophic and potentially even more fatal than the first wave, due to the pressures the already damaged healthcare system has been put under. Yemen has already seen a drop in vaccination rates since the start of the war in 2015.<sup>23</sup> If people are unvaccinated it threatens a situation in which multiple diseases can spread<sup>24</sup> – a recipe for disaster in a region where rolling out an effective, population-wide COVID-19 vaccination programme will be virtually impossible.

#### CONTINUING AND COMPLEX CHALLENGES

The impact of COVID-19 must not distract from additional challenges the country continues to face, particularly those that will only add to the health emergency. In July 2020, Yemen suffered from heavy rainfall and flooding across the country. The floods washed away houses, schools, sanitation infrastructure and healthcare centers. Damage to sanitation facilities lead to the contamination of drinking water and a shortage of clean drinking water supplies. The result of this contamination was a sharp increase in the incidence of infectious diseases including cholera, dengue fever and malaria<sup>24</sup>.

UNICEF field reports estimate that by the first week of August 2020, 160,216 people had been affected by floods in 32 districts in Yemen and were in need of



immediate assistance.<sup>19</sup> Malnutrition continues to have a profound effect across the country. On July 22 2020, the United Nations made a statement indicating that nearly 40% of Yemen’s population were likely to experience food insecurities within the next six months.<sup>19</sup>

**CONCLUSION: THERE IS URGENT WORK TO BE DONE**

To truly overcome the current humanitarian crisis in Yemen, there will need to be an internal restructuring of the healthcare system. There are far too few physicians to meet the population demands, and there is not enough laboratory support to aid in making correct diagnoses. This problem extends to the current issue – the COVID-19 pandemic – but is symptomatic of far deeper challenges. Healthcare workers have not been afforded the proper amount of PPE, making their jobs immensely difficult. Some have quit their jobs, while others have succumbed to the virus. However, it is a formidable task for aid agencies to operate within Yemen and even to offer equipment such as PPE when their own countries have seen similar shortages. The civil unrest that continues to take place creates a landscape of chaos for both the citizens of Yemen and those who are trying to offer support.

The availability of fully-functioning medical facilities in Yemen is inadequate. Increasing the number of operating hospitals and laboratories will be necessary to help Yemen get through its current crises: having the appropriate tests to detect COVID-19 is also extremely important. As mentioned above, however, only a few laboratories in Yemen are capable of running RT-PCR tests, and the number of people trained to carry them out and interpret them is also very limited. Therefore, it may be beneficial to provide the country with more immunological assays such as antigen detection kits, as these kits need far less experience and training to operate and are a better resource for areas of the country that are hard to reach or currently experiencing conflict.

Contaminated water is a breeding ground for disease and therefore it is imperative that clean water becomes a viable and ready option for Yemenis. Too few people have this luxury: this is simply inhumane.

The best way to combat this issue would be to establish a clean water source from within the country itself, though the current war makes this quite challenging. Two more immediate possibilities are for aid agencies to bring in mass quantities of clean water, or for the same agencies to try to distribute filtering devices.

If the current political unrest can be lessened, then WHO and other international agencies should focus their resources towards helping Yemen renovate and expand its healthcare facilities, reconstruct its road network and increase its number of medical workers, as well as offering shorter-term solutions such as the adequate amounts of PPE. A potential longer-term solution could be building new healthcare facilities in designated safe areas where ceasefires can be called and observed. Though this would require an agreement between two competing entities, it would offer the people of Yemen a place where they could receive medical attention safely. This would allow medical facilities to remain free from damage and would go a long way in aiding in Yemen’s gradual recovery not only from COVID-19, but from decades of conflict and internal strife.

**ACKNOWLEDGEMENTS**

Hadeel Mohammed Alsabri and Aya Mohammed Alsabri for their great contribution.

**REFERENCES**

1. Hadden RL. The geology of Yemen: an annotated bibliography of Yemen’s geology, geography and earth science. Alexandria, Virginia: US Army Corps of Engineers , Army Geospatial Center; 2012. p. 385.
2. Fischel WJ. The Spice Trade in Mamluk Egypt: A Contribution to the Economic History of Medieval Islam. *Journal of the Economic and Social History of the Orient.* 1958 Apr 1;1(2):157-74.
3. Morris, J., 2018. *Coffee: A Global History.* Reaktion Books.
4. Avraham E. Image repair strategies adopted by MENA national tourism boards during and following crises. *Routledge Handbook on Tourism in the Middle East and North Africa.* 2019:241-56.
5. Rabi U. Yemen: revolution, civil war and unification. Bloomsbury Publishing; 2014 Dec 17.

6. Laub Z. Yemen in crisis. Council on Foreign Relations. 2016 Nov;19:1-7.
7. Dhabaan GN, Al-Soneidar WA, Al-Hebshi NN. Challenges to testing COVID-19 in conflict zones: Yemen as an example. *Journal of global health*. 2020 Jun;10(1).
8. Central Intelligence Agency. CIA The World Factbook Middle East: Yemen. Available from: [www.cia.gov/library/publications/resources/the-world-factbook/geos/print\\_ym.html](http://www.cia.gov/library/publications/resources/the-world-factbook/geos/print_ym.html). Accessed 29 Mar 2018.
9. Byers A, Stewart F. Yemen: An Escapable Disaster-Why the United States Should Avoid Military Intervention. *Journal Article* | January. 2018;22(11):23pm.
10. MedGlobal. A tipping point for Yemen's health system: the impact of COVID-19 in a fragile state. 22 Jul 2020.
11. Al-Awlaqi S, Dureab F, Annuzaili D, Al-Dheeb N. COVID-19 in Conflict: The devastating impact of withdrawing humanitarian support on universal health coverage in Yemen. *Public Health in Practice*. 2020;1:100015.
12. Mousavi, S. M. and Anjomshoa, M. COVID-19 in Yemen: A Crisis within Crises. *International Journal for Equity in Health*. 2020; 19(1).
13. Cole J. Conflict, Post-Conflict and Failed States: Challenges to Healthcare. *The RUSI Journal*. 2014 Sep 3;159(5):14-8.
14. Federspiel F, Ali M. The cholera outbreak in Yemen: lessons learned and way forward. *BMC public health*. 2018 Dec 1;18(1):1338.
15. WHO. Outbreak update – Cholera in Yemen, 25 October 2018 [Available from: [http://www.emro.who.int/ar/pandemic-epidemic-diseases/cholera/outbreak-update-cholera-in-yemen-25-october-2018.html%22%20%5Ct%22\\_blank](http://www.emro.who.int/ar/pandemic-epidemic-diseases/cholera/outbreak-update-cholera-in-yemen-25-october-2018.html%22%20%5Ct%22_blank). Last Accessed 2020 October 12].
16. Human Development Report 2019 Inequalities in Human Development in the 21st Century Briefing note for countries on the 2019 Human Development Report. Available from: <http://hdr.undp.org/sites/default/files/hdr2019.pdf> [last accessed 15 December 2020]
17. World Health Organization. Children: Improving Survival and Well-Being. World Health Organization, Sept. 2020. Available from [www.who.int/news-room/fact-sheets/detail/children-reducing-mortality](http://www.who.int/news-room/fact-sheets/detail/children-reducing-mortality) [Last accessed 15 December 2020]
18. UNICEF. Yemen Country Office Humanitarian Situation Report July 2020 Available from <https://www.unicef.org/documents/yemen-humanitarian-situation-report-july-2020> [Last accessed 15 December 2020]
19. Looi MK. Covid-19: Deaths in Yemen are five times global average as healthcare collapses. *BMJ*. 2020 Jul 27;370:m2997.
20. Devi, S. Fears of "highly catastrophic" COVID-19 spread in Yemen. *The Lancet*. 2020;395(10238), 1683. doi:10.1016/s0140-6736(20)3123
21. Blackburn, C. C., Lenze, P. E., & Casey, R. P. Conflict and Cholera: Yemen's Man-Made Public Health Crisis and the Global Implications of Weaponizing Health. *Health Security*. 2020;18(2), 125-131
22. Boley J, Kent E, Grassie S, Romeih S. A conflict overlooked: Yemen in crisis. 2017.
23. Torbosh, A., Al Amad, M. A., Al Serouri, A., & Khader, Y. The Impact of War in Yemen on Immunization Coverage of Children Under One Year of Age: Descriptive Study. *JMIR Public Health and Surveillance*. 2019; 5(4), e14461.
24. Ng QX, De Deyn MLZO, Loke W, Yeo WS. Yemen's Cholera Epidemic is a One Health Issue. *Journal of Preventive Medicine and Public Health*. 2020 Jul;53(4):289.