

The crisis, disasters and catastrophes afflicting Yemen and its people

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Abstract: It would be inaccurate to state that Yemen's difficulties began with the current civil war in September of 2014. While the war brought about its own list of insurmountable tribulations, it also exacerbated already present disasters. This article explores the many dynamics that have led to what has been referred to as the world's worst humanitarian crisis. These include war, internal displacement, economic disaster, healthcare collapse, outbreaks in refugee camps, vaccination concerns, malnutrition, food insecurity, water sparsity, and infectious disease catastrophes. Along with accurate depictions of what is happening on the ground, this article suggests a few potential solutions worth investigating further, ranging from national and international efforts. With an ever-changing climate, this article serves to provide the most up to date impression of the current crisis and disasters.

Keywords: Communicable Diseases; Crisis; Disaster; Food Insecurity; Malnutrition; War; Yemen

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1. Background

The country of Yemen is located on the tip of the Arabian Peninsula. and is the 12th largest out of Asia's 48 countries. The total area is (527,970 sq km). It is also the 18th largest in population (34 million) (1, 2). Over the centuries, Yemen has been known for its language, tradition, agriculture, spices, honey, coffee, and rare plant and animal species. In short, Yemen was known for its beauty, hospitality, and unique views and experiences for all welcomed visitors. However, much has changed over the years. The Republic of Yemen became official on May 22, 1990 (3), unifying the two regions previously referred to as North Yemen and South Yemen. Nevertheless, the two regions remained separate in their function. Northern Yemen's became the capital and served as the governing and political arm of the Republic of Yemen, while Southern Yemen served as the economic arm. Over the years, difficulties have accumulated, and the current conflict began with the Arab Spring in 2011. The previous administration stepped down, rebel groups became rampant, and international involvement began. Yemen's already existing disasters only became worse. The war is still ongoing, however it has already led to death and destruction. With the introduction of the COVID-19 pandemic, Yemen served no chance as it was already in shambles without a properly functioning health infrastructure. As disasters strike one after the other, the Yemeni people are left to fend for themselves. This paper aims to shed light on the multifactorial factors contributing

to the current crisis, disasters and catastrophes, and offers solutions going forward.

2. Crisis, disasters and catastrophes

2.1. War and displacement

Since 2015, the World Health Organization (WHO) has recorded more than 140 attacks and airstrikes on hospitals and healthcare facilities, resulting in only half of medical facilities and hospitals functional since the beginning of the war (4). The United Nations has already estimated close to a quarter million deaths as a result of the ongoing war (5). The population has been internally displaced with limited mobility to seek refuge elsewhere as the blockade by air, land, and sea is ongoing (6). The violations of international humanitarian laws had been addressed by the UN Security Council, in resolutions 2140 (2014) and 2216 (2015). These resolutions have sanctioned parties deemed responsible with travel bans and asset freezes (7). As with any unstable region, militias and rebels continue to wreak havoc and grow in the midst of chaos. As Yemen continues to suffer, groups who do not have Yemen's best interest at heart continue to grow stronger. This feeds a continuously vicious cycle that does not cease to exist.

2.2. Economic disaster

Yemen's economy has gradually declined over the years. In recent years, Yemen's Rial has been uncontrollably depreciating, as indicated in a recent briefing to the UN Security Council (8). Since 2015, the Yemeni Rial has lost more than 75% of its value (9). Within the health sector, medical staff have not received compensation for their work for at least two years and depend on limited incentives by the WHO (10). The reliance on such measures is not realistically applicable for much longer. Yemen is in dire need of economic interventions and drastic changes.

2.3. Healthcare collapse

Although only half of Yemen's medical facilities are fully functional, there is still a lack of medical professionals. Yemen consists of over 300 districts. About 18% of these districts lack a physician (11). Doctors have been leaving the region and country due to the unsafe and unstable climate. Unfortunately, some physicians have lost their lives due to the ongoing conflict. This has not only made treating patients difficult, but it has also hindered the training of the next generation of Yemeni health professionals. The COVID-19 pandemic has only exacerbated and exposed the already deteriorating healthcare system. Due to the blockade, Yemen was one of the later countries afflicted by COVID-19. Early on, the absolute lack of personal protective equipment (PPE) and non-existent safety protocols facilitated the spread of the virus, taking the lives of medical professionals and communities. Medical professionals took care of patients without proper protection and were also under increased attacks and threats by family and relatives of COVID-19 patients due to their lack of understanding of the disease process (12). The extent of healthcare collapse also reached outpatient services, such as pharmacies and their staff (10).

2.4. Outbreaks in refugee camps

Combating the highly contagious SARS-CoV-2 is a difficult process. The virus is mostly transmitted through respiratory droplets or close contact with infected persons. However, there has been evidence of COVID-19 being found in the feces of infected individuals leaving open the possibility of fecal-oral transmission. These transmissible factors pose a great deal of concern when anticipating outbreaks of the virus in refugee camps. In these camps, there is a lack of personal space, making social distancing nearly impossible (13). On top of this, refugee camps are often multicultural, with people of varying religions and ethnicities, which can pose a threat to social distancing through religious gatherings. There is also an overall lack of personal protective equipment and proper hygiene in most refugee camps, further fostering an environment prone to disease spread (14). Yemenis who are allocated to these refugee camps often face dim circumstances as they carry myriad health risks along with them. These health risks are highlighted by the fact that nearly all citizens of Yemen are facing acute malnutrition. Due to the

conflict of the war, food prices have increased by more than 150% in some instances, causing more than 20 million people to be affected by this inhuman situation. Malnutrition and overall immune health are tightly correlated, as a person with poor nutrition who is undernourished is most often going to have a compromised immune system (15). This does not bode well for fighting off a viral infection such as the coronavirus, especially given the fact that most displaced Yemeni citizens are living in refugee camps that offer a breeding ground for viral illnesses.

2.5. Infectious diseases

2.5.1. COVID-19 pandemic

COVID-19 afflicted Yemen later and well into the pandemic when compared to the global community due to limited movement in and out of the country. Epidemiologist estimations were unfortunately accurate as the spread and infection rates soared (16). Yemen's current conditions very easily explains why such infections can run rampant, as shown with other infectious diseases (17). More than a quarter of all confirmed COVID-19 patients have lost their lives. This is five times higher than the global average (11). The COVID-19 pandemic has truly unearthed the depths and extent of the healthcare insufficiencies that have directly led to the death of patients and medical professionals alike.

2.5.2. Diphtheria outbreak

Diphtheria, an acute disease caused by *Corynebacterium diphtheriae*. Diphtheria is contracted via respiratory droplets, often from being in direct contact with another person, and is most common in children who are not immunized. The disease has been eradicated from most countries through vaccine administration. However, due to poor vaccine availability, coupled with the conflicts of war, Yemen has seen a resurgence of Diphtheria. During the period of October 2017 to August 2018, there were 2,203 Diphtheria cases with 116 deaths being reported (18).

2.5.3. Cholera outbreak

Amongst all difficulties, hurdles, and shortages Yemen is facing, another catastrophe hits the country in the form of another contagious disease: cholera outbreak. The cholera epidemic is the worst in modern times (19). The epidemic was augmented by the lack of medical supplies, facilities, and chronic malnutrition (19). The first wave started in October 2016 up to April 2017 (20). The second wave started 27 April 2017 up to December 2020 (21). The outbreak reached the 1 million milestone in late 2017, just before the spread started to become under control in early 2018 (22). By the end of 2020, the cumulative number of suspected cholera cases counted 2,510,806 cases (23). The total number of deaths related to Cholera was 3,981 deaths (23). Between the start of 2021 and the 6th of March 2021, a total of 5,676 cases of acute watery diarrhea/cholera were reported according to the humanitarian situation report by UNICEF's Yemen country office report which was published in April 2021 (23). Vaccination was initiated after the total count of cases neared the one

million mark (24).

Eighteen million Yemenis still in urgent need of water, sanitation and hygiene (WaSH) assistance, access to clean and safe drinking water (25). Multiple humanitarian relief organizations are aiding in the restoration of WaSH and improving infrastructure to prevent repeat of such epidemic (24-26). Essentially, WHO intervention included: 139 oral rehydration corners, trained 900 health workers in the management of cholera, delivered 1 million bags of IV fluids, distributed 158 cholera kits, and sent 1,450 cholera cots (24).

2.5.4. Polio outbreak

In June and July 2020, 15 cases were reported declaring an outbreak in Yemen. These cases were mainly in the country's northwest governorate of Sa'adah (27). This marked a setback in the global polio eradication initiative, as well as in the national level. In 2016, the initiative - which began in 1988 - recorded the fewest ever number of new cases in a year worldwide with only 37 cases reported (28).

Yemen last endured a spread in 2020 with over 28 children suffering from paralysis due to Polio (29).

2.6. Vaccination shortages

When vaccinations are limited, the potential for wide-spread disease is increased exponentially, often creating outbreaks that are difficult to contain. One such outbreak listed above is Diphtheria, which has been eradicated from most countries through vaccine administration. However, due to poor vaccine availability, coupled with the conflicts of war, Yemen has seen a resurgence of Diphtheria (18). A study conducted found that there was a strong correlation between conflict and Diphtheria, as well as not being vaccinated and contracting the disease. In areas experiencing conflict, the chances of an outbreak occurring were increased 11-fold, and the risk of an outbreak happening if there was proper immunization coverage saw the risk of an outbreak decrease by 0.98% (18). Many other vaccination rates have declined over the years.

2.7. Malnutrition, food insecurities, and water sparsity

Malnutrition in Yemen is quite alarming as 10 out of 22 governorates in the country are on the edge of famine. Upwards of 14 million individuals have been affected as they are unable to access adequate nutrition. Malnutrition has been so severe because imports of food have been interrupted by the blockade of the War. The cost of food has increased 55%, while the country's GDP has fallen by approximately 33%, leading to an economic inability to secure food. At the same time, the War has rendered 142 malnutrition treatment centers inoperable (30). The primary targets of malnutrition have been young children and women of reproductive age (31). There has also been a statistically significant inverse association between childhood malnutrition and prenatal care, maternal education, and socioeconomic status (32). Contaminated water is a prime example of how malnutrition has manifested in disease. More than 70% of the country's pop-

ulation lack clean water. Yemen has reported 205,662 cases of cholera between January and October 2020. There has also been an uptick in cases and deaths due to diphtheria, dengue, and measles (33). The extent of malnutrition in Yemen is complicated to ascertain and is referred to as an invisible crisis because data has been difficult to gather.

3. Discussion

The current humanitarian crisis in Yemen is multi-faceted and the points mentioned are only a portion of all that afflict Yemen and its people. A long-term solution to the crisis in Yemen is increased education and training to create a robust healthcare community of skilled physicians and mid-level providers, such as nurse practitioners. Mid-level providers require less training and financial compensation than physicians but can provide adequate healthcare especially in settings of need. For example, in terms of the COVID-19 crisis, there are few laboratories in Yemen capable of running RT-PCR tests and a very limited number of professionals able to interpret the results.

Increasing the supply of medical equipment and the number of fully functional hospitals is important but will only be used to their full potential when there are enough providers. Also, emergency and disaster preparedness must be taught to all health care providers on both an individual and organization level to help strengthen existing facilities in the face of ongoing crises. People should have access to pre-hospital emergency services and transportation. Increasing the number of skilled health professionals and robust healthcare facilities will not only help overcome COVID-19, but will also support Yemen's gradual recovery by ensuring increased accessibility to adequate health care. Current studies have illustrated this void (34).

Malnutrition, food insecurity, and water scarcity all continue to afflict the population of Yemen. As described earlier, Yemen is dependent on imports for 90% of its food and food prices have increased by more than 150%. Yemen's infrastructure including all sea, land, and airports must be rehabilitated and restored to full capacity to ensure unhindered import and transportation of commercial food. Water scarcity must be combated with aggressive measures such as improved irrigation techniques, use of rainfall water for harvesting, and possibly water desalination. Yemen is dependent upon humanitarian aid from international organizations and will continue to require such support until essential infrastructure is reconstructed.

A group of researchers and physicians shed light on their own techniques to help treat patients who are confined to refugee camps, both offering tips and eliciting challenges faced. For instance, they ask all people to wear a mask, and recognize that if a person is sleeping, wearing a mask can be difficult, so they instead provide plastic to act as a barrier and ask that each person sleep head to foot. Each person is given multivitamins containing vitamin D and zinc which helps decrease respiratory tract infections. Testing for COVID-19 in refugee

camps can be challenging given the vast number of people and poor working conditions. To help solve this issue they use a handheld ultrasound to monitor lung pleura and offer rapid flu tests to help rule out influenza which can aid in the diagnosis of COVID-19 by exclusion (35). These techniques are not perfect, but they do offer alternative methods to help try and keep everyone safe.

4. Conclusion

Education and development of skilled health care professionals, increased disaster management training, and improved vaccination outreach and knowledge are all important for Yemen's gradual long-term recovery. Further, proper infrastructure must be restored to ensure full access to food and water. Until political unrest subsides and such facilities and infrastructure can be restored, international aid organizations are essential to providing the resources Yemen is in dire need of. Recovery from decades of internal strife and conflict is dependent on concerted efforts between both international and local communities. Shedding light on the topics discussed above is an initial step to short- and long-term solutions. Further interventions and continued assessment will be expected in the near future.

5. Declarations

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None.

5.2. Authors' contribution

AA, SA, and SA contributed to the conception and the drafting of the paper. MA participated and supervised the elaboration and every step of the paper writing process and as a corresponding author, will handle correspondence at all stages of the refereeing, publication, and post publication. All the authors contributed to drafting the manuscript and approving the final manuscript.

5.3. Conflict of interest

The authors declare no conflict of interest statements.

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References

- World Population Review (n.d.). Largest Countries in Asia 2023. Largest countries in Asia 2023. [Retrieved February 5, 2023]. Available from: <https://worldpopulationreview.com/country-rankings/largest-countries-in-asia>.
- World Population Review (n.d.). Asia Population 2023. Asia population 2023. [Retrieved February 5, 2023]. Available from: <https://worldpopulationreview.com/continents/asia-population>.
- Rabi U. Yemen: revolution, civil war and unification. Bloomsbury Publishing; 2014 Dec 17.
- Yemen: UN Humanitarian Coordinator condemns hospital attack [Internet]. OCHA (United Nations Office for the Coordination of Humanitarian Affairs). 2020 [cited 2021 Jan 16]. Available from: <https://www.unocha.org/story/yemen-un-humanitarian-coordinator-condemns-hospital-attack>.
- UN humanitarian office puts Yemen war dead at 233,000, mostly from 'indirect causes' UN News [Internet]. United Nations. United Nations; [cited 2021 Jan 16]. Available from: <https://news.un.org/en/story/2020/12/1078972>.
- Alsabri M, Nightingale B, Amin M, Cole J. When COVID-19 hit Yemen: dealing with the pandemic in a country under pressure from the world's worst humanitarian crisis. *Glob J Med Public Health*. 2020;9(2):1-6..
- World Report 2019: Rights Trends in Yemen [Internet]. Human Rights Watch. 2019 [cited 2021 Jan 16]. Available from: <https://www.hrw.org/world-report/2019/country-chapters/yemen#>.
- Under Secretary-General for Humanitarian Affairs and Emergency Relief Coordinator, Mark Lowcock, Briefing to the Security Council on the humanitarian situation in Yemen, 24 June 2020 - Yemen [Internet]. ReliefWeb. [cited 2021 Jun 19]. Available from: <https://reliefweb.int/report/yemen/under-secretary-general-humanitarian-affairs-and-emergency-relief-coordinator-mark-28>.
- Joplin T. Yemen's Escalating Currency Collapse and the Slow Death of Its People [Internet]. Al Bawaba. [cited 2021 Jun 19]. Available from: <https://www.albawaba.com/news/yemen%E2%80%99s-escalating-currency-collapse-and-slow-death-its-people-1194832>.
- MedGlobal. A tipping point for Yemen's health system: the impact of COVID-19 in a fragile state. 22 Jul 2020..
- Looi MK. Covid-19: Deaths in Yemen are five times the global average as healthcare collapses. *BMJ*. 2020;370:m2997.
- Gharib M. 'I Will Kill You': Health Care Workers Face Rising Attacks Amid COVID-19 Outbreak [Internet]. WAMU. WAMU 88.5 - American University Radio; 2020 [cited 2021 Jan 16]. Available from: <https://wamu.org/story/20/06/29/i-will-kill-you-health-care-workers-face-rising-attacks-amid-covid-19/>.
- Nott D. The COVID-19 response for vulnerable people in places affected by conflict and humanitarian crises. *Lancet*. 2020;395(10236):1532-3.
- Baloch Z, Ma Z, Ji Y, Ghanbari M, Pan Q, Aljabr W. Unique challenges to control the spread of COVID-19 in the Middle East. *J Infect Public Health*. 2020;13(9):1247-50.
- Pritchard J, Collier A, Mundenga M, Bartels SA. COVID in

- crisis: The impact of COVID-19 in complex humanitarian emergencies. *J Mil Veteran Fam Health*. 2020;6(S2):70-82.
16. COVID-19: Yemen faces 'deadlier consequences' than many [Internet]. *Anadolu Ajansı*. [cited 2021 Jan 16]. Available from: <https://www.aa.com.tr/en/middle-east/covid-19-yemen-faces-deadlier-consequences-than-many/1850873>.
 17. Mousavi SM, Anjomshoa M. COVID-19 in Yemen: A Crisis within Crises. *Int J Equity Health*. 2020;19:120.
 18. Dureab F, Al-Sakkaf M, Ismail O, Kuunibe N, Krisam J, Müller O, et al. Diphtheria outbreak in Yemen: the impact of conflict on a fragile health system. *Confl Health*. 2019;13:19.
 19. Ng QX, De Deyn ML, Loke W, Yeo WS. Yemen's cholera epidemic is a one health issue. *J Prev Med Public Health*. 2020;53(4):289.
 20. World Health Organization. Epidemic and pandemic-prone diseases: Cholera update in Yemen, 23 October 2016. [Retrieved February 8, 2023]. Available from: <https://web.archive.org/web/20181201193005/http://www.emro.who.int/pandemic-epidemic-diseases/cholera/cholera-update-in-yemen-23-october-2016.html>
 21. World Health Organization. Cholera situation in Yemen, December 2020. 2020 [Accessed February 8, 2023]. Available from: <https://reliefweb.int/report/yemen/cholera-situation-yemen-december-2020>
 22. Potter C. Largest cholera outbreak on record continues. *Outbreak Observatory*. 2020 [Retrieved February 8, 2023]. Available from: <https://www.outbreakobservatory.org/outbreakthursday-1/1/16/2020/large-cholera-outbreak-on-record-continues-in-yemen>.
 23. UNICEF. UNICEF Yemen Humanitarian Situation Report - reporting period 1 – 28 February 2021 [EN/AR]. 2021 [Retrieved February 8, 2023]. Available from: <https://reliefweb.int/report/yemen/unicef-yemen-humanitarian-situation-report-reporting-period-1-28-february-2021-enar>
 24. Federspiel F, Ali M. The cholera outbreak in Yemen: lessons learned and way forward. *BMC Public Health*. 2018;18(1):1338.
 25. UNICEF. Water, sanitation and hygiene. 2022 [Retrieved February 8, 2023]. Available from: <https://www.unicef.org/yemen/water-sanitation-and-hygiene>
 26. Joint Cholera Response Plan - Yemen - July 2017 - ReliefWeb. 2017 [Retrieved February 8, 2023]. Available from: <https://reliefweb.int/report/yemen/joint-cholera-response-plan-yemen-july-2017>
 27. REACH Initiative. Yemen: Research terms of reference: Situation overview of polio outbreak and wash needs Yem2103 (March 2021, version 1). 2021 [Retrieved February 8, 2023]. Available from: <https://reliefweb.int/report/yemen/yemen-research-terms-reference-situation-overview-polio-outbreak-and-wash-needs-yem2103>
 28. World Health Organization. Global Polio Eradication Initiative: annual report 2016: eradication within reach. 2017 [Retrieved February 8, 2023]. Available from: <https://www.who.int/publications/i/item/WHO-POLIO-17.03>
 29. World Health Organization. Polio. [Retrieved February 8, 2023]. Available from: <https://www.emro.who.int/yemen/priority-areas/polio.html>
 30. Eshaq AM, Fothan AM, Jensen EC, Khan TA, AlAmodi AA. Malnutrition in Yemen: an invisible crisis. *Lancet*. 2017;389(10064):31-2.
 31. El Bcheraoui C, Jumaan AO, Collison ML, Daoud F, Mokdad AH. Health in Yemen: losing ground in war time. *Global Health*. 2018;14(1):42.
 32. Al-Zangabila K, Adhikari SP, Wang Q, Sunil TS, Rozelle S, Zhou H. Alarming high malnutrition in childhood and its associated factors: A study among children under 5 in Yemen. *Medicine*. 2021;100(5):e24419.
 33. Alsabri M, Alhadheri A, Alsakkaf LM, Cole J. Conflict and COVID-19 in Yemen: beyond the humanitarian crisis. *Global Health*. 2021;17:83.
 34. Naser WN, Saleem HB. Emergency and disaster management training; knowledge and attitude of Yemeni health professionals- a cross-sectional study. *BMC Emerg Med*. 2018;18:23.
 35. Leiner A, Sammon M, Perry H, Dunavant S. Facing COVID-19 and Refugee Camps on the US Border. *J Emerg Med*. 2020;59(1):143-5.