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Coronavirus Pandemic

COVID-19 pandemic in Yemen: A questionnaire based survey, what do we know?

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Abstract

Introduction: Coronavirus infectious disease 2019 (COVID-19) is currently one of the most important public health crises affecting the global human population. It continues to spread widely, as the world still lacks specific treatments and a vaccine for the virus. The scenario of COVID-19 in Yemen seems obscure due to the lack of adequate data, therefore, we developed an electronic questionnaire and distributed it online among Yemeni people. The aim of this study was to understand the COVID-19 epidemiological situation in Yemen better since there is currently limited published data and limited availability of COVID-19 testing.

Methodology: A 34-question web-based survey was distributed on social media outlets targeting people in Yemen. Data aggregation, analysis, and visualization were performed using Tableau and Microsoft Excel.

Results: 2,341 individuals reported symptoms concerning for COVID-19 infection, with 25.4% reporting a chronic medical condition. Diabetes, hypertension, asthma, and immune deficiency were associated with increased severity of the disease, while obesity, cardiovascular disease, kidney disease, and liver disease were not. Only 37 individuals (1.6%) had a confirmatory COVID-19 PCR test. The presence of high fever, dyspnea, chest pain, and dysphagia were symptoms that tended to be correlated to worse clinical outcomes.

Conclusions: This study provides some important information about the early overspread of COVID-19 within the Yemeni community in May, June, and July of 2020. It shows that online questionnaires may help in collecting data about pandemics in resource-limited countries where testing availability is limited.

Key words: COVID-19; Yemen; Coronavirus; Covid-19; pandemic.

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Introduction

The novel Coronavirus disease 2019 (COVID-19) is currently one of the most public health threats facing humans globally. It is caused by the novel severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), which was first reported in December 2019 in Wuhan, China. The World Health Organization (WHO) declared COVID-19 a pandemic disease on March 11, 2020. At that time 118,320 confirmed cases were reported in 114 countries [1]. The COVID-19 pandemic has since continued to increase, with 18,443,484 cases and 697,189 deaths reported in 213 countries and territories as of May 22, 2020 [2]. Several countries have been able to control or slow down the spread of the disease by implementing very strict national infection control measures, including locking down whole cities, social distancing, imposing wearing masks, and other hygiene practices [3].

The infection and fatality rates vary among different countries depending on patient population and healthcare system readiness. It is more likely that COVID-19 will continue to spread widely, as the world is still lacking specific antiviral therapy or effective vaccination against the virus. This might lead to more deaths and tremendously affect the world economy [4].

When COVID-19 started to affect the Middle East, it began to surge rapidly in Iran, which became the epicentre of the pandemic in the region. Initial slow response to the pandemic in that region with resource-limited countries like Yemen can be explained by the lack of essential resources and the regional political conflicts, which definitely weakened the healthcare infrastructure. On the other hand, Gulf countries with

adequate resources and political stability showed a good preparedness plan [5,6].

COVID-19 is transmitted from person-to-person mainly through coughing, sneezing, and touching a surface that was contaminated with the virus [7]. Common clinical features of COVID-19 include fever, fatigue, cough, shortness of breath, and pneumonia [8]. The majority of COVID-19 patients develop mild symptoms, according to the WHO report, and recover without specific treatment. Severe disease was observed in 20% of infected people, and the mortality rate was about 2% [9]. Complicated disease was mostly observed in patients with cardiovascular diseases, diabetes, and hypertension, according to the systemic review reported by Yang *et al*. [10].

The first confirmed case of COVID-19 pandemic in Yemen was announced on April 10, 2020 in Hadhramaut. On April 29, Yemen health authorities in Aden officially recorded five new cases of COVID 19. In Sana'a, and despite the lack of adequate data, it is believed that a few cases of COVID-19 were detected at the same time. It is not well known if COVID-19 has particularly spread to Yemen from other neighbour countries such as Saudi Arabia and the other states on the borders. The whole countries in the region has closed their borders and shutdown international flights during the first weeks of reporting COVID-19 cases. However, in the same time, Yemeni passengers were travelling from many different countries back to Yemen. True data about the situation of COVID-19 in Yemen is largely scarce [5,11,12].

In this paper, we report the results of an electronic questionnaire that was developed and distributed online among Yemeni people. We aimed to understand the COVID-19 epidemiological situation better in Yemen in view of limited published data and limited availability of COVID-19 testing.

Methodology

A web-based questionnaire with 34 questions and 56 data points was designed using Google forms. The questionnaire form was distributed to the public using social media outlets, in particular, Facebook/WhatsApp platforms. No selection was made to the participants, aside from being in Yemen or from Yemen. Response from 4,059 participants was collected over 1 week. This questionnaire was developed according to medical guidelines and relevant publications, our questionnaire evaluated the risk of COVID-19 in the general population from the following aspects; History of living, people travelling and contact, Clinical symptoms, Comorbidities, other basic information such as gender and age. The data was cleaned, and some collected variables were transformed using OpenRefine. Data aggregation, analysis, and visualization were performed using Tableau and Microsoft Excel.

Table 1. General demographic characteristics of the respondents.

Demographic characteristic	***n (%)***
Male gender	1,210 (51.7)
Age group (Mode)	21-30 (31.9)
Live in the Capital	1,349 (57.6)
Chronic diseases	650 (27.8)
Diabetes Mellitus	151 (6.5)
Hypertension	180 (7.7)
Obesity	233 (10.0)
Asthma	54 (2.3)
Active smoking	512 (21.9)
Active gat use	1,347 (57.5)

Results

Of our 4,059 respondents, 2,341 individuals reported symptoms concerning for COVID-19 infection. In Table 1, we list some of the major characteristics of the population we surveyed. The most prevalent age group was 21–30 years old, and 51.7% were male. More than half of the respondents live in the capital city of Sana'a, with Ibb coming second, and Dhamar coming third in terms of number of respondents. As for substance use, we observed that 21.9% of the respondents reported tobacco usage, compared to 57.5% Gat usage.

Five hundred and ninety five individuals reported having a chronic medical illness (25.4%). Obesity was the most reported chronic medical condition (233 respondents, 10%), followed by hypertension (7.7%) and diabetes (6.5%). Asthma was reported as a chronic illness by 54 (2.3%) respondents.

In the sample we collected, 217 correspondents sought medical help (9.3%) and were told by their physicians that they most likely have a COVID-19

Table 2. Clinical features of the respondents' illness.

Clinical features	**n** (%)
Had symptoms but did not seek medical help	1,960 (83.7)
Seen a doctor who made the diagnosis clinically	217 (9.3)
Hospitalized	147 (6.3)
Required supplemental O2	71 (3.0)
Required mechanical ventilation	24 (1.0)
Death	15 (0.6)
Had laboratory testing (COVID-19 not included)	334 (14.3)
COVID-19 tested	37 (1.6)
Hydroxychloroquine use prior to diagnosis	128 (5.5)
BCG vaccination	1,469 (62.8)
Azithromycin use	789 (33.7)

Table 3. Clinical severity of PUIs by chronic medical illness.

Comorbidity	Clinical severity of COVID-19 illness					
	All (%)	Medical attention (%)	Hospitalization (%)	Increased O_2 requirement (%)	Mechanical ventilation (%)	Death (%)
Asthma	54 (2.3%)	10 (4.6%)	9 9 (6.1%)	9 (12.7%)	3 (12.5%)	3 (20.0%)
Cardiovascular disease	61 (2.6%)	11 (5.1%)	2 (1.4%)	9 (12.7%)	2 (8.3%)	1(6.7%)
Diabetes	151 (6.5%)	33 (15.2%)	17 (11.6%)	20 (28.2%)	5 (20.8%)	4 (26.7%)
Hepatitis	19 (0.8%)	1 (0.5%)	3 (2.0%)	0 (0%)	0 (0%)	0 (0%)
Hypertension	180 (7.7%)	34 (15.7%)	17 (11.6%)	17 (23.9%)	5 (20.8%)	5 (33.3%)
Immunocompromisation	36 (1.5%)	7 (3.2%)	4 (2.7%)	4 (5.6%)	4 (16.7%)	3 (20.0%)
Kidney diseases	65 (2.8%)	11 (5.1%)	2 (1.4%)	4 (5.6%)	1 (4.2%)	0 (0%)
No chronic illnesses	1,691 (72.2%)	125 (57.6%)	89 (60.5%)	26 (36.6%)	11 (45.8%)	5 (33.3%)
Obesity	233 (10.0%)	34 (15.7%)	21 (14.3%)	9 (12.7%)	1 (4.2%)	0 (0%)

infection. Table 2 outlines the major clinical outcomes reported in this sample. A total of 147 respondents reported being hospitalized because of their illness (6.3%). Because we allowed correspondents to report on their family members, we captured some of the patients who were extremely sick. In our database, 71 patients required supplemental O_2 therapy, 24 patients were reported to have required mechanical ventilation, and 15 patients were reported to have not survived the illness. There were only 37 individuals (1.6%) who had the opportunity to have COVID-19 PCR testing and were confirmed to have the infection. The rest of the diagnoses were made medically. There were 334 individuals (14.3%) who reported having tests other than COVID-19 PCR to help diagnose what infection they had.

When asked, 789 and 128 individuals reported taking azithromycin and hydroxychloroquine prior to having the infection (5.5% and 33.7%), respectively. We did not inquire about the reason they were on that medication. Despite being a mandatory vaccination in Yemen, only 62.8% of the respondents reported receiving the Bacillus Calmette–Guérin vaccine (BCG).

When looking at comorbidities in the different outcomes, we noticed that the presence of diabetes, hypertension, obesity, asthma, and immune deficiency was increasing with the increased severity of their clinical condition (Table 3). Cardiovascular disease, kidney disease, and liver disease were not associated with worsening clinical outcomes.

As for symptoms associated with their illness, fever was the most commonly reported symptom (Table 4). In our cohort, myalgia and headache were reported by a significantly higher percentage of the patients, compared to what has been reported in the current literature. Low-grade fever was reported by 1,141

Table 4. Symptoms prevalence with various levels of severity.

Symptom	Clinical severity of COVID-19 illness					
	All (%)	Medical attention (%)	Hospitalization (%)	O_2 (%)	Ventilation (%)	Death (%)
Myalgia	1,639 (70.0%)	202 (93.2%)	125 (85.0%)	67 (94.4%	17 (70.8%)	14 (93.3%)
Headache	1,302 (55.6%)	154 (71.0%)	91 (61.9%)	36 (50.7%)	12 (50.0%)	7 (46.7%)
Low-grade fever	1,141 (48.7%)	88 (40.6%)	54 (36.7%)	19 (26.8%)	7 (29.2%)	2 (13.3%)
Sore throat	1,108 (47.3%)	122 (56.2%)	73 (49.7%)	32 (45.1%)	13 (54.2%)	8 (53.3%)
Loss of taste or smell	955 (40.8%)	115 (53.0%)	48 (32.7%)	26 (36.6%)	4 (16.7%)	6 (40.0%)
Joint pain	753 (32.2%)	99 (45.6%)	63 (42.9%)	28 (39.4%)	8 (33.3%)	6 (40.0%)
Dry cough	723 (30.9%)	130 (59.8%)	67 (43.6%)	54 (76.1%)	14 (58.4%)	10 (66.7%)
High fever	613 (26.2%)	114 (52.5%)	71 (48.3%)	46 (64.8%)	13 (54.2%)	10 (66.7%)
Chills	609 (26.0%)	97 (44.7%)	55 (37.4%)	30 (42.3%)	10 (41.7%)	6 (40.0%)
Runny nose	552 (23.6%)	38 (17.5%)	30 (20.4%)	10 (14.1%)	3 (12.5%)	1 (6.7%)
Dyspnea	443 (18.9%)	103 (47.5%)	55 (37.4%)	50 (70.4%)	16 (66.7%)	14 (93.3%)
GI symptoms	411 (17.6%)	61 (28.1%)	45 (30.6%)	22 (31.0%)	9 (37.5%)	3 (20.0%)
Productive cough	395 (16.9%)	41 (18.9%)	25 (17.0%)	16 (22.5%)	3 (12.5%)	1 (6.7%)
Chest pain	351 (15.0%)	77 (35.5%)	60 (40.8%)	43 (60.6%)	16 (66.7%)	11(73.3%)
Dysphagia	325 (13.9%)	39 (18.0%)	36 (24.5%)	18 (25.4%)	6 (25.0%)	5 (33.3%)
Conjunctivitis	73 (3.1%)	12 (5.5%)	3 (2.0%)	4 (5.6%)	1 (4.2%)	0 (0%)
Skin rash	54 (2.3%)	9 (4.1%)	4 (2.7%)	4 (5.6%)	0 (0%)	0 (0%)
Epistaxis	51 (2.2%)	10 (4.6%)	1 (0.7%)	2 (2.8%)	1 (4.2%)	0 (0%)

(48.7%) of the respondents, and high fever was reported by 613 (26.2%). Unlike low-grade fever, the presence of high fever was associated with severe clinical condition, as demonstrated by Figure 1. Dyspnea, chest pain, and dysphagia were symptoms that tended to be correlated to worse clinical outcomes in this sample.

When looking at age groups, almost half of the respondents were under the age of 30 (Figure 2). However, the population with worse clinical outcomes were patients 50 years of age or older. Table 4 shows each clinical outcome and the percentage of each age group that was affected by it. We can see that the small subgroup of the sample (286, 12.2%) accounted for 28.6% of the cases seeking medical attention, 21.1% of the hospitalized cases, 46.5% of cases requiring supplemental oxygen, 37.5% of all ventilated cases, and two-thirds of the mortalities (66.7%).

Figure 1. The Prevalence of symptoms with various clinical severity markers.

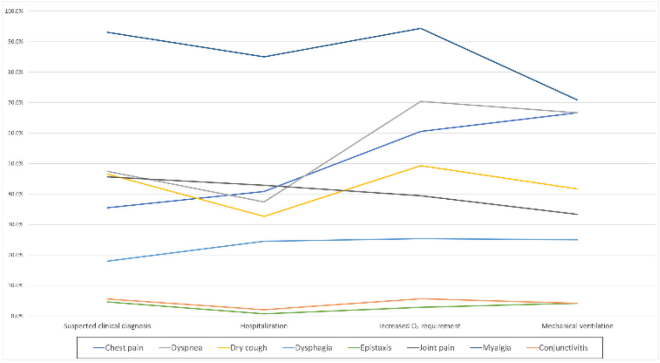
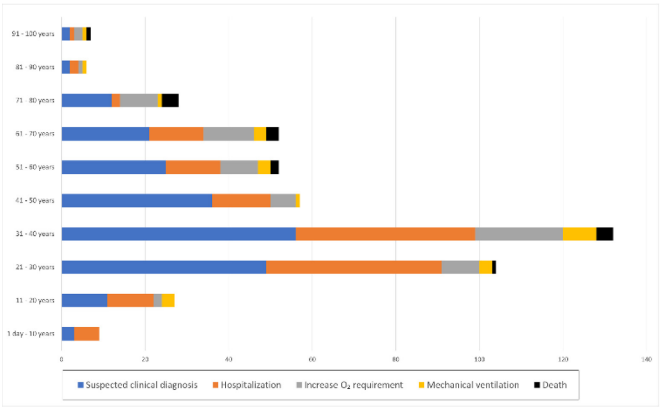


Figure 2. The Clinical Outcomes by age group.



Discussion

To the best of our knowledge, this is the first large-sample online questionnaire surveillance of the COVID-19 outbreak in the general population in Yemen. The ratio of sample to population varied between different provinces, mostly due to internet availability in different regions. Given the conflict-related situation on the field in Yemen with the additional restrictions that COVID-19 imposed on travel and work [13], as well as the limited collected data by the government, a remotely administered online surveillance questionnaire was developed to overcome some of those limitations.

The online questionnaire that we developed was designed according to most recent medical guidelines and can provide a more contemporary way of conducting surveillance in these limiting circumstances. The median age group was 21 years, compared to the international published average age of 47–62 years [14,15]. This might be attributed to the fact that the younger age groups have more internet and social media access than older groups. Nevertheless, we allowed family members to fill questionnaires for their younger and older family members, explaining the presence of younger than 1 year and older than 90 years old among the data collected. Males were affected slightly more often than females (were 51.7% of the cases), and that was similar to previous studies [14,16]. Furthermore, 6.3% of our patients were admitted to the hospital and 1% of them received ICU care. This was similar to the international estimated percentages [15]. In agreement with previous reports [7,14], the most common symptoms in our patients were fever (74.9%), myalgia (70.0%), headache (55.6%), cough (47.8%), and loss of taste and smell (40.8%). Fever and cough were the most reported symptoms, according to a meta-analysis by Fu *et al*. [17]; however, conjunctivitis and skin rash were uncommon. High fevers were only reported in 26.2% of cases and seemed to positively correlate with more severe disease and worse outcomes. Our study did not report any other major vital sign abnormalities that matched those of a recent retrospective study from Wuhan, China [16]. Furthermore, no laboratory blood testing was recorded, and asymptomatic patients were not revealed in this questionnaire. Comorbidities were reported in 27.8% of patients in our report, with hypertension and diabetes mellitus being the most common, matching the rates reported by a study from Nanjing, China [18]. We observed a clear burden of COVID-19 infection in healthcare workers, which was also described in a recent report from Yemen [19].

Our study highlighted that around 37.7% and 5.5% of the patients received azithromycin and antimalarial

(hydroxychloroquine) treatment, respectively, and around 9.0% received antiviral treatment. These medications have been suggested to have some beneficial effect in reducing the viral load and eliminating the disease; however, there are also uncertainties regarding their safety [20].

The hospitalization rate in our sample was 6.3%, which is about 40 times what the CDC has reported in the United States (161 per 100,000 of population) [21]. This could be due to the tendency of those who suffered most from this disease to fill out the questionnaire. The case fatality rate in our study is 0.6%, which is similar to the previously published reports [22]. This is somewhat limited by the reporting, as the patients who were reported dead had to have a family member who would take the questionnaire and fill it out on behalf of those who passed away.

The COVID-19 pandemic is another hit to a country that has been fragmented by war, devastated by a 5-year blockade, and has not yet recovered from deadly cholera and diphtheria epidemics that started in 2016 [23]. COVID-19 was likely spread in Yemen through Yemeni business workers or merchants who were traveling to China, Wuhan, before the lockdown. This is why it is believed that COVID-19 was spreading in Yemen earlier than it was announced [19,24].

Yemen is located at the southern end of the Arabian Peninsula in Western Asia. It is the second-largest Arab sovereign state in the peninsula, occupying 527,970 square kilometres. It is bordered by Saudi Arabia to the north, the Red Sea to the west, the Gulf of Aden to the south, and Oman to the east. Yemen Population according to 2018 estimation is 28,498,683 [25].

The number of COVID-19 cases in Yemen is expected to be more than what was announced due to many factors including war conflicts which devastated the health infrastructure and displaced millions of people without proper shelters and essential nutrition. This led to aggravated poor hygiene measures and limited the access to healthcare centers. It rendered people in Yemen more vulnerable to disease, as well as caused a shortage of ventilators and intensive care unit beds, as well as a very low capacity of testing to identify suspected cases, which likely added to the disease burden [26]. As of May 2020, WHO has only provided Yemeni laboratories with 6,700 RT-PCR tests, which have been distributed to five laboratories across the country [27]. Therefore, these tests were only used for testing a small number of suspected cases presenting to hospitals.

One limitation of this study was that the online questionnaire did not include diagnostic tests such as real-time polymerase chain reaction or lung computed tomography results. Therefore, evaluating the respondents' risk of viral infection from the history of contact, body temperature, symptoms, and comorbidities may have the risk of underestimating some patients who are asymptomatic or presymptomatic, which are not uncommon [28,29].

Conclusions

In conclusion, this study provides some important information about the early overspread of COVID-19 within the Yemeni community in May, June, and July 2020. It shows that online questionnaires may help in collecting data about pandemics in resource-limited countries where testing availability is limited.

Authors' Contributions

All authors contributed equally to this work.

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