

# Epidemiological Features of COVID - 19 in Hodeidah, Yemen

## ABSTRACT

**Background:** Acute respiratory infection namely coronavirus disease 2019 (COVID -19) is a great public health problem in the world and causes leading to morbidity and mortality in developing and developed countries.

**Objectives:** The research aims to study the epidemiological features of COVID-19 in Hodeidah , Yemen.

**Methodology :** 505 patients were diagnosed clinically according to case definition with COVID-19 (from 3 to 80 years old ) and triaged into suspected, probable and confirmed in COVID- 19 Isolation Department , Center of Tropical Medicine and Infectious Diseases (CTMID) , AL Thawara Public Hospital Authority ,Hodeidah, Yemen from 1<sup>st</sup> June 2020 to 31<sup>st</sup> December 2020. Nasopharyngeal swabs for severe and critical cases were collected from patients and detected by Real Time - Polymerase Chain Reaction (RT-PCR) and admitted according severity of disease.

**Results:** The results showed that 386/505 (76.43 %) of suspected cases and 70/505 (13.86 %) of probable cases were isolated and treated at home while a total of 49/505 (9.70 %) were confirmed and admitted in COVID-19 isolation department, where the males were more exposed to COVID-19 with (81.6%),33 cases (67.3%) of old age, 65.3 % were chronic diseases where the most prevalent diabetic mellitus and diabetic mellitus associated with other chronic diseases were 18.36% and 16.32 % respectively, followed by 12.24 % of cardiac disorder and hypertension , 12.24 of respiratory disorders, 4.08 % of cardiac diseases associated with respiratory disorder and 4.08 % of renal failure. On the other hand, 4.08 % of coinfection. In addition, COVID -19 was not found through the whole year; however, higher frequency during the spring season 69.4% and lower frequency during the summer season 24.5% and autumn 6.1%.The case fatality rate (CFR %) of confirmed cases was 23 /49 (46.9 %) namely 30.6 % of death cases had chronic diseases,12.2 % had not any chronic diseases, and 2 % had coinfection. However 19/49 (82.6 %) of deaths was over the age of 50 years. **Conclusion:**The research concluded that, old age and chronic diseases may be contributing factors to excess morbidity and mortality among COVID-19 patients. Coinfections with other infections are concern.

**Keywords:** Epidemiological , COVID-19, Morbidity , Mortality , Risk Factor , Hodeidah, Yemen

## 1. INTRODUCTION

Coronavirus disease 2019 (COVID-19) is a respiratory disease that is caused by novel single-stranded positive sense RNA virus (nCoV-19) that was firstly isolated in December 2019 when emerged in Wuhan, China <sup>(1,2)</sup>, the resulting diseases so called COVID 19 which then emerged worldwide and caused mortality globally at the rate of 3.7% till the 12<sup>th</sup> of March 2020 when declared by WHO as a pandemic <sup>(3)</sup>. The emergence of COVID-19 expanded to 216 country causing 1,153,176 deaths and 42,838,516 confirmed cases all over the world till October 24 , 2020 <sup>(4)</sup>. However, chronic pulmonary diseases and lower respiratory infections are two of the top ten global causes of morbidity and mortality<sup>5</sup>. Disease severity is ranging from mild non-fatal respiratory illness to more serious complications that may lead to death while associated with social determinants , risk factors , chronic diseases or other communicable diseases <sup>(6,7)</sup>.

Mainly the most susceptible patients for mortality were those who experienced COVID-19 and a co-morbidity, with hypertension being the most common co-morbid followed by diabetes and coronary heart disease and older aged patients <sup>(8-12)</sup>. Clinical features of COVID-19 include lower respiratory tract infection related symptoms mainly fever, dry cough and dyspnea as reported in the initial case series from Wuhan, China.

In addition, headache, dizziness, weakness, vomiting and diarrhea were also observed. <sup>13-15</sup> In Yemen the first case was registered in April 10,2020 in Hadramout then emerged to other parts of the country. A lot of morbidity and mortality were reported in Yemen, the question about what epidemiological features of COVID -19 in Hodeidah , Yemen ? Hodeidah governorate at the Western part of Yemen was exposed to COVID-19 pandemic like other governorates in Yemen, adding to the current chronic problems. Hodeidah is facing complex spectrum of determinants of health; including poverty, illiteracy, food insecurity, malnutrition and multiple epidemics as well as humanitarian crises resulting from the ongoing armed conflicts since 2015. No study till now documented the COVID-19 pandemic process in Hodeidah especially morbidity and mortality. The aim of this research is to describe the epidemiological features of COVID – 19 in Hodeidah , 2020.

## 2. METHODOLOGY

### 2.1. Study area

Hodeidah Governorate is located on the western ,flat and narrow coastal plain between the foothills of the highlands and the red sea. Hodeidah is the fourth largest Governorate in Yemen in the term of population which reaches to about (2157552) .The area is 13500 km<sup>2</sup> involves 26 Districts, and a lot of islands in the red sea. The weather is typically hot and humid and the temperatures sometimes exceeding 38 to 40° C. During the rest of the year temperature range between 27-35° C. This region is known to have high conflict area

since the 26<sup>th</sup> of March 2015. Hodeidah also is considered as an endemic zone for numerous infectious diseases<sup>(16-18)</sup>.

## 2.2. Study Design

This study is a cross sectional study. The patients who were admitted in the COVID-19 Isolation Department, Center of Tropical Medicine and Infectious Diseases (CTMID), AL Thawara Public Hospital Authority, Hodeidah, Yemen from 1<sup>st</sup> June to 31<sup>st</sup> December 2020.

## 2.3. Screening and triage process for patients

There were 505 cases (age range from 3 years to 80 years), diagnosed in COVID-19 emergency department according to case definition. The cases were triaged into suspected, probable and confirmed. The severity of patients were assessed based on radiological and hematological findings. mild and moderate cases were isolated and treated at home. Severe and critical cases were admitted to COVID -19 Isolation Department, Center of Tropical Medicine and Infectious Diseases (CTMID), AL Thawara Public Hospital Authority of Hodeidah, Yemen. Nasopharyngeal swabs were collected from severe and critical patients only and detected by Real Time - Polymerase Chain Reaction (RT-PCR)<sup>(19-22)</sup>.

## 2.4. Data collection and analysis

This study was conducted on the epidemiological features of COVID - 19 patients where the COVID-19 was the major cause of morbidity and mortality. The independent variables studied were age, gender, co-morbidity, co-infection, seasons, and residence. Data was collected, checked and displayed in an Excel format. Then the data was analyzed using tables, graphs, median, range, frequency and percentages were the main descriptive tools.

## 3. RESULTS

### 3.1. Suspected – probable and confirmed cases

On the other hand, a total of 49 confirmed cases (9.70%) of 505 patients were admitted as inpatients for intravenous support therapy in isolation department, while 386 suspected cases and 70 probable cases (76.43% ; and 13.86 %) respectively were isolated as outpatient for receiving oral support therapy at home (Table 1).

**Table 1.** Suspected – probable and confirmed cases according to screening, triage and admitted criteria (N :505)

Suspected cases <sup>*</sup>		Probable cases <sup>**</sup>		Confirmed cases <sup>***</sup>		Total		
Male	Female	Male	Female	Male	Female	Male	Female	Total

<15	4	5	2	3	3	0	9	8	17
15-29	55	82	6	4	1	1	62	86	148
30 -49	47	60	10	7	8	2	65	69	134
50-59	19	35	13	3	12	3	44	41	85
60+	41	38	16	7	15	4	72	49	121
Total	166	220	47	23	39	10	252	253	505
Total	386	70	49	505					

- \*: Suspected cases were diagnosed according to case definition and treated at home
- \*\*: Probable cases were diagnosed according to case definition, radiological and hematological finding . 16 cases were received and died in triage department namely 11 cases of males and 5 cases of females ., all cases were over 50 years old .
- \*\*\*: Confirmed cases were confirmed according to molecular biological method namely RT-PCR and radiological and hematological finding assessed the severity of cases and admitted in isolation center of COVID-19 , AL Thawara Public Hospital Authority , Hodeidah, Yemen

### 3.2. Socio - demographic features

COVID – 19 infection was detected in 9.70 % using RT-PCR technique. The general characteristics of patients were shown in Table 1 and 2. COVID – 19 infection was represented in the males as 79.59 .5% while in the females it was represented as 20.41 %. However, this difference was statistically significant ( $P = 0.00$ ). The age range of patients was from 3 to 80 years old and the median age of subjects was 51 year. The higher frequency of COVID – 19 infection was in elderly between 50 and 80 years (67.34 % % ( $P = 0.00$ ) and the lower frequency was in children and young between 0 and 15 years old and 16 – 29 years old respectively (6.12 %; 10.40 %) (Table 2). The relationship between the COVID – 19 infection and area of residence was not found, regarding the area of residence, only 44.89 % of COVID – 19 infection was from the urban whereas 55.10 % were from rural area. However, this difference was not statistically significant ( $P = 0.47$ ) (Table 2).

**Table 2.** General socio-demographic data of COVID-19 patients in Hodeidah , Yemen (N = 49)

Variables	Number(n)	Ratio (%)	$X^2$	P – value
<b>Gender</b>				
Male	39	79.59		
Female	10	20.41	17.16	0.00
Total	49	100		
<b>Age</b>				
<15	3	6.12		
15-29	2	4.10		
30 -49	11	22.44	0.19	0.00079
50-59	17	34.69		
60+	16	32.65		
Total	49	100		
<b>Residency</b>				
Urban	22	44.89	0.51	0.47
Rural	27	55.10		
Total	49	100		

### 3.3. Clinical symptoms

In addition, the clinical findings were diagnosed and recorded. 30 cases of fever , 14 cases of pharyngitis , 20 cases of cough , 3 cases of headache , 13 cases of chest pain , 16 cases of arthritis , and 42 cases of difficult breathing . Those were the main symptoms (Table 3). All cases had Acute Respiratory Distress Syndrome (ARDS) for a period of a week before hospitalization.

**Table 3.** Clinical symptoms data of COVID-19 patients in Hodeidah , Yemen (N = 49)

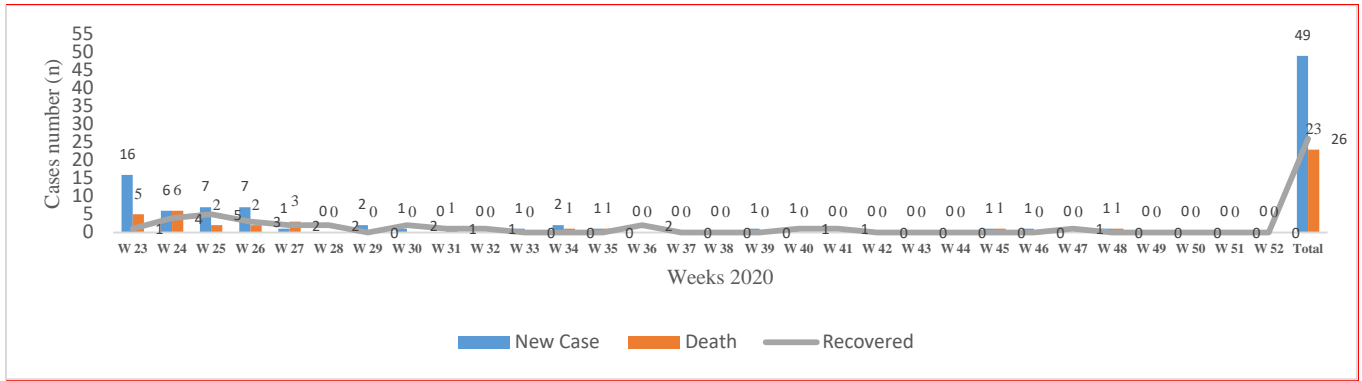
Variables	Number(n)	Ratio (%)
Fever	30	61.2
Pharyngitis	14	28.6
Cough	20	40.8
Headache	3	6.12
Chest pain	13	26.5
Difficult in breath	42	85.7

### 3.4. Effect of co-morbidity and co-infection on COVID 19 morbidity

Morbidity rate was high in patients that experienced COVID-19 in comorbidity, namely 32 cases (65.30 %), 9 cases (18.36%) of diabetic mellitus and 8 cases (16.32 % ) of diabetic mellitus with chronic diseases ,followed by cardiac disorder and hypertension 6 cases (12.24 %) . Also 6 cases (12.24 %) of respiratory disorder (bronchial asthma). 2 cases (4.08 %) of heart disease with respiratory disorder (bronchial asthma), and 2 cases (4.08 %) of renal failure . In addition , 2 cases (4.08 %) of co- infection namely hepatitis C and tuberculosis . On the other hand , 14 cases (28.57 %) were infected without any chronic diseases .

### 3.5. Effect of co-morbidity and co-infection on COVID 19 mortality

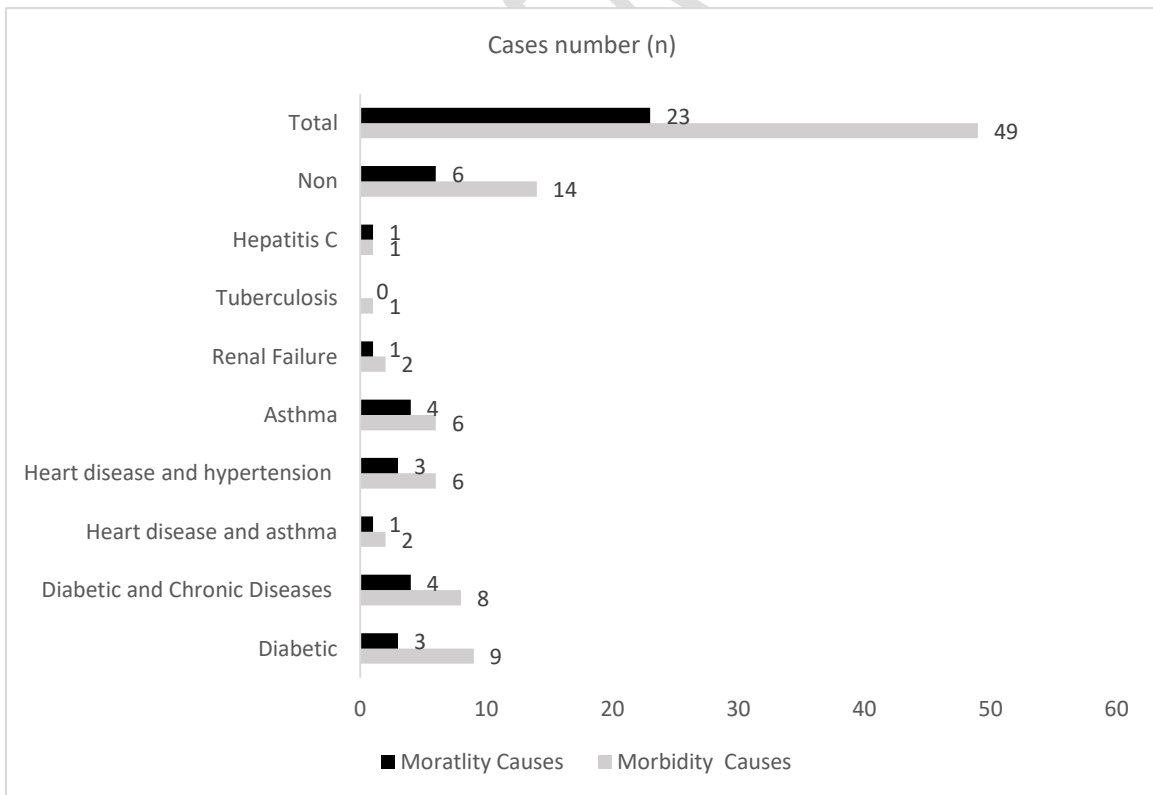
Mortality rate was high in patients that experienced COVID-19 in comorbidity namely 16 cases (69.56 %) , 3 cases (13.04 %) of diabetic mellitus , 4 cases (17.39 % ) of diabetic mellitus with cardiovascular diseases ,followed by cardiac disorder and hypertension 3 cases (13.04 % ). Also , 4 cases (17.39 %) of asthma disorder. 1 case (4.34 %) of heart disease with asthma , and 1 case (4.34%) of renal failure . In addition , 1 case (4.34 %) of co- infection namely hepatitis C. On the other hand , 6 cases (26.08 %) died without having any chronic diseases .



**Figure 1.** Epidemiological surveillance of COVID -19 in Hodeidah , Yemen

**Table 4 .** Effect of co-morbidity and co-infection on COVID 19 morbidity and mortality (N:49)

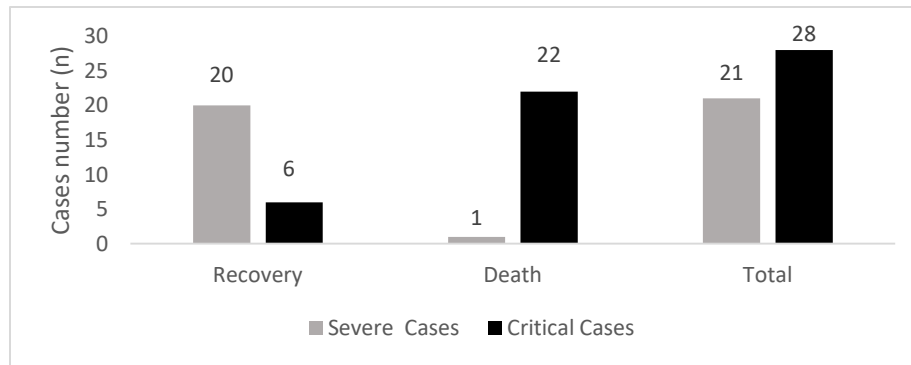
Risk factors	Recovery		Death		Total	
	n	%	n	%	N	%
Comorbidity	18	36.73	16	32.65	32	65.30
Co- infection	1	2.04	1	2.04	2	4.08
Non	8	16.32	6	12.24	14	28.57
Total	26	53.06	23	46.93	49	100



**Figure 2.** Risk factors associated with COVID – 19 morbidity and mortality (N:49)

### 3.6. Recovery and death of severe case versus critical cases

Mortality rate was very high in critical cases namely 22 /27 Cases (81.48 %) while the mortality rate of severe cases was 1 case /20 case (5 %) (Figure 3).



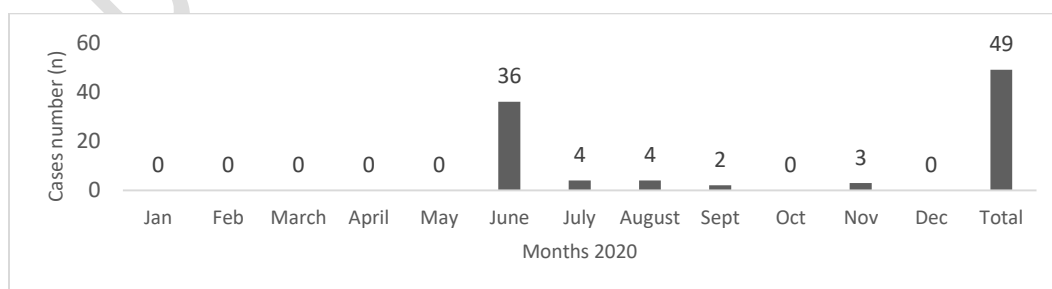
**Figure 3.** Morality and recovery of COVID-19 namely severe and critical cases in Hodeidah , Yemen (N:49)

### 3.7. Seasonality of COVID -19

As for seasonal distribution, COVID -19 infection was not found through the whole year. However, spring season was significantly associated with COVID -19 infection (  $P = 0.0001$  ); however, higher frequency during the spring season (40 cases, 81.16%, and  $P = 0.0001$ ) and lower frequency during the summer , autumn and winter seasons respectively (4 cases , 8.15 ; 5 cases , 10.20 % ; and 0 cases, 0%) (Table 5). In addition, COVID -19 infection exhibited peaks in June month (Figure 4).

**Table 5. :** Seasonality data of COVID-19 patients in Hodeidah , Yemen , 2020 (N = 49)

Variables	Number(n)	Ratio (%)	$\chi^2$	$P$ – value
Spring	40	81.16	84.95	0.0001
Summer	4	08.16		
Autumn	5	10.20		
Winter	0	0		
Total	49	100		



**Figure 4.** Monthly seasonality of COVID-19 among people of Hodeidah , Yemen (N:49)

#### 4. DISCUSSION

Since COVID-19 pandemic accelerates, governments are warning people at high risk to be particularly stringent in observing social distancing measures because if they become ill they are more likely to need critical care including ventilation, to recovery or die<sup>(24)</sup>. However, in this study, patients access late to hospital with a serious critical condition. Males were more susceptible to develop morbidity and mortality and this is inconsistency with other studies in China and Italy<sup>(25-27)</sup> and it may be due to sex-based immunological or gendered differences, such as patterns and prevalence of smoking<sup>(24, 28-30)</sup>.

The elderly patients are at greater risk developing COVID-19 certainly over 60 years old, this was according to their underlying health condition with immune response. Infection co-morbidities with COVID-19 increase the risk of mortality five times in older subjects<sup>(24,29)</sup>. Most commonly reported co-morbidities with COVID-19 and poses a life threat are diabetes, hypertension, cardiovascular disease and chronic obstructive pulmonary disease, this was similar to what was found in this study due to underlying immunodeficiency, which may have made those patients more susceptible to COVID-19 complications and fatality<sup>(31-33,12)</sup>.

On the other hand, beyond the pathogenesis of COVID-19, microbial coinfection plays an important role in the occurrence and development of SARS-CoV-2 infection by raising the difficulties of diagnosis, treatment, prognosis of COVID-19, and even increasing the disease symptom and mortality, on other means, the coinfection between different microorganisms and COVID-19 is a serious problem in the COVID-19 pandemic. However, there are few reports about COVID-19 coinfects with bacteria, fungus, and other viruses<sup>(34)</sup>.

Our study reported TB – COVID-19 coinfection namely 1 case (1/49) 2.04%, European respiratory journal reported “in the absence of previous cohorts and scientific information on TB - COVID-19 co-infection, they have described the timing of diagnosis of the two diseases, observing that one third had COVID-19 diagnosed prior to TB and 18% were diagnosed simultaneously<sup>(35)</sup> “. There is limited literature on the occurrence of COVID-19 in patients with TB. 8 studies reported a total of 80 patients with this coinfection. These patients were reported from ten different countries, with Italy reporting the largest number of cases. In all 8 studies, COVID-19 was treated as per the local protocol. Mortality was reported in more than 10% of patients. Mortality was higher in elderly patients (> 70 years) and amongst patients with multiple medical comorbidities<sup>(36)</sup>. Our study reported 1 case hepatitis C (1/49) 2.04% and in Iran, death proportion was 6% among COVID-19-HBV and 13% among COVID-19-HCV co-infected patients. Also,

among COVID-19 patients, 34.1% and 76.2% reported at least one comorbidity besides HBV and HCV infections, mainly hypertension and diabetes mellitus type 2<sup>(37)</sup>. Other study, chronic HBV infection did not predispose COVID-19 patients to more severe outcomes, their data suggest COVID-19 and HBV coinfection poses a higher extent of dysregulation of host functions at the onset of COVID-19. Thus, caution needs to be taken with the management of SARS-CoV-2 and HBV coinfecting patients<sup>(38)</sup>.

Finally, our study reported the maximum peak of infection in spring, in Italy, the coronavirus (COVID-19) pandemic was particularly invasive in Italy during the period between March and late April 2020, then decreased in both the number of infections and in the seriousness of the illness throughout the summer of 2020<sup>(39)</sup>. Other previous studies reported that most viral respiratory infections tend to follow seasonal patterns with high incidence during winter<sup>(40)</sup>. Also previous study found the largest global peak of COVID-19 during the winter season, with the highest rate of positivity among children<sup>(41)</sup>.

## 5. CONCLUSION

Old age and co-morbidity with non-communicable diseases mainly diabetes mellitus, hypertension, and heart diseases may be contributing factors to excess illness and deaths among COVID-19 patients. Co-infections with other viral infections like tuberculosis and hepatitis is of high concern in Hodeidah, Yemen.

## ETHICAL APPROVAL

The studies involving human participants were reviewed and approved by Ethics Committee of CTMID, Al-Thawara Public Hospital Authority, Hodeidah, Yemen.

## CONSENT

Written informed consent for participation was required for this study.

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