

Research Article

Epidemiological and Clinical Profile of Deaths due to COVID-19 among Hospitalized Patients in Sidama Region, Ethiopia

Kibruyisfaw Weldeab Abore^{1,*}, Ashagre Beyene Barasa², Amsalu Midaso Titole³¹ Department of pediatrics, yirgalem medical college, yirgalem, Sidama, Ethiopia² Data management center, Sidama public health institute, Hawassa, Sidama, Ethiopia³ Department of Internal medicine, yirgalem medical college, yirgalem, Sidama, Ethiopia

*Correspondence: Kibruyisfaw Weldeab Abore (kibruyisfaww@gmail.com)

Abstract: Novel corona virus disease (COVID-19) pandemic, which started in China's Hubei province in 2019, has caused a significant loss of human lives globally. This study describes the epidemiologic and clinical profiles of COVID-19 related deaths among patients admitted to treatment centers in Sidama region, Ethiopia. A cross-sectional study of 186 in hospital COVID-19 related deaths that occurred from July 2020 to December 2021 in Sidama region were analyzed. Data was extracted from regional emergency operation center death report. Data was entered using Epidata v3.1 and analysis was done using SPSS v.20. Categorical data was summarized using frequency and percentage while continuous data was summarized using median and interquartile range. Association between variables was assessed using chi-square test. More than two-third of the deceased patients were male (135; 72.6%) and median age at death was 60. The majority of deaths (151; 81.1%) occurred in 2021, while April 2021 had the highest death records. Cough and shortness of breath were the main presenting symptoms occurring in 89.2% and 85.5% of deceased patients respectively. Most of the COVID-19 related deaths (64.5%) had associated comorbidities. Diabetes (50%) and Hypertension (39.2%) were the most prevalent comorbidities. Significant proportion of patients (74.73%) presented on severe end of disease spectrum (critical/ severe). Of the deceased patients, around two-third required Intensive care unit (ICU) admission and 111 of them were put on mechanical ventilator. Moreover, the median ICU stay was 4 days. Around half of the death (48.4%) occurred in the first 5 days. The median survival time from symptom onset was 11.5 days with most (43.5%) of the deaths occurring within the first 14 days of symptom onset. Age category was significantly associated with the number of days from onset to death ($p=0.006$). The case fatality rate was 1.87% which is lower than national and global reports. Unlike previous studies, the prevalence of asthma among deceased patients was low and there were no patients with documented COPD.

Keywords: COVID-19, Sidama, Ethiopia**How to cite this paper:**

Abore, K. W., Berasa, A. B., & Titole, A. M. (2022). Epidemiological and Clinical Profile of Deaths due to COVID-19 among Hospitalized Patients in Sidama Region, Ethiopia. *Global Journal of Epidemiology and Infectious Disease*, 2(2), 69–77.

Retrieved from

<https://www.scipublications.com/journal/index.php/gjeid/article/view/402>

Received: July 05, 2022

Accepted: August 22, 2022

Published: August 24, 2022

**Copyright:** © 2022 by the authors.

Submitted for possible open access publication under the terms and conditions of the Creative Commons Attribution (CC BY) license (<http://creativecommons.org/licenses/by/4.0/>).

1. Introduction

Corona virus disease 2019 (COVID-19) is an RNA virus infectious disease that was first detected in Wuhan, China in 2019 [1]. It was identified after a cluster of cases presented with pneumonia like symptoms in Hubei province [2].

Presentation of COVID-19 Patients can range from asymptomatic/mild flue like symptom including cough, fever, myalgia, and sore throat to critical patients with signs of organ failure [1, 3]. More than 489 million confirmed cases with 6 million deaths were reported globally as of April 2022. According to World health organization (WHO), there were a total of more than 8.5 million confirmed cases and 171,115 deaths in Africa in April

2022 [4]. The first confirmed case in Ethiopia was identified on 13-March-2020 [5]. As of 5-April -2022 , there were a total of reported 469,879 confirmed cases and 7508 deaths [6].

Death due to COVID-19 is defined as a death of a confirmed COVID-19 case from a disease process compatible with COVID-19 with no identifiable alternative cause of death that is not related to COVID-19 such as trauma [7]. The prevalence of in hospital mortality varies from study to study with a reported range of 1% to 50% [8]. Mortality also varies across different regions of the globe with Europe recording the highest (32%) and Africa recording the lowest mortality rate (3%) [4].

Studies had shown that male patients, those with comorbidities such as diabetes, hypertension, HIV/AIDS, older aged patients, and those with deranged laboratory results were at high risk of mortality from COVID-19 [9-11]. Studies done in other parts of Ethiopia also support this evidence [12, 13]. To the best of the author's knowledge, there is no prior study done in Sidama region either to describe patients with unfavorable outcome or to identify its predictors.

2. Methods and materials

2.1. Study area and setting

Sidama region is one of the 11 regions of Ethiopia which is home to 3 million people. There are 12 COVID-19 treatment centers in the region with a cumulative bed capacity of 111 patients with 17 Intensive care unit (ICU) beds and 9 mechanical ventilators. The first case was detected in the region in July-06-2020. Community based surveillances and facility based surveillance conducted through contact tracing and symptom based screening were used to identify cases. Diagnosis was confirmed using polymerase chain reaction (PCR). There were a total of 11,820 confirmed COVID-19 cases up to December - 31-2021.

2.2. Data extraction

From May 08 to May 15 a review of Sidama region emergency operation center (EOC) COVID-19 treatment facility reports was conducted. The region's EOC has a predefined reporting format for patients diagnosed with COVID-19 and for reporting COVID-19 related deaths. A cross-sectional study reviewing all recorded in-hospital COVID-19 related deaths that occurred from July 2020 to December 2021 was performed. There were 221 recorded deaths among patients admitted with PCR confirmed COVID-19. Patients with incomplete data and deaths which are not directly related to COVID-19 were excluded from the study and a final population of 186 was achieved.

2.3. Data analysis

The extracted data was coded, entered, and cleaned using epi data3.1. Data analysis was done using SPSS v.16. Categorical variables were analyzed and presented using frequency tables. After assessing for normality, continuous variables were summarized using median and interquartile range. Subgroup analysis was done to determine differences within categorical variables. Associations between variables were assessed using chi-square test and p-value <0.05 was considered statistically significant.

2.4. Definitions of terms

Survival time was defined as the number of days from symptom onset to death. Meanwhile, Clinical severity was classified based on presenting sign and symptoms upon admission.[1] Individuals who have any of the signs and symptoms of COVID-19 (fever, cough, sore throat, malaise, headache, muscle pain, nausea, vomiting, diarrhea, loss of taste and smell) but who do not have shortness of breath, dyspnea, or abnormal chest imaging were labeled as mild illness. Moderate illness was classified as individuals who

show evidence of lower respiratory disease during clinical assessment or imaging and who have oxygen saturation (SpO₂) $\geq 94\%$ on room air.

Severe illness was defined as individuals with clinical signs of pneumonia (fever, cough, dyspnea, fast breathing) plus SpO₂ $< 94\%$ on room air, respiratory rate > 30 breaths/min, or lung infiltrates $> 50\%$. Those individuals who have respiratory failure, septic shock, and/or multiple organ dysfunctions on presentation were classified as critical. Those patients presenting with mild and moderate sign and symptoms of COVID-19 were labeled as having non-severe manifestation.

A patient who in the past 14 days had close contact with RDT-PCR confirmed COVID-19 patient is said to have close contact while a patient who visited a health facility in the past 14 days was said to have facility visits [14]. Case fatality was calculated as ratio of the number of deaths among COVID-19 cases to the total number of confirmed cases.

2.5. Ethical statement

Ethical clearance for the study was obtained from Sidama region public health institute review board. Obtaining informed consent was not applicable as the study was based on a previously collected data and it was waived by ethics committee. Identifiers were also removed from the dataset during data entry.

3. Result

Of the 186 deaths, male patients (135; 72.6%) and those aged more than 60 (86; 46.3%) accounted for the highest proportion. Patient's age ranged from 18 to 100 with a median age of 60 (IQR=45-70). Nearly half of the deceased patients (87; 46.8%) were unemployed. Among the recorded deaths, 106 (57%) of the patients were from urban areas and majority (80.6%) of the diagnosis was made in a governmental health institution. Moreover, 151 (81.1%) of the recorded death occurred in 2021 while 18.3% of deaths occurred in 2020 (Table 1). The highest number of death in Sidama region was recorded in April 2021 which corresponds to the second wave COVID-19 in Ethiopia (Figure 1).

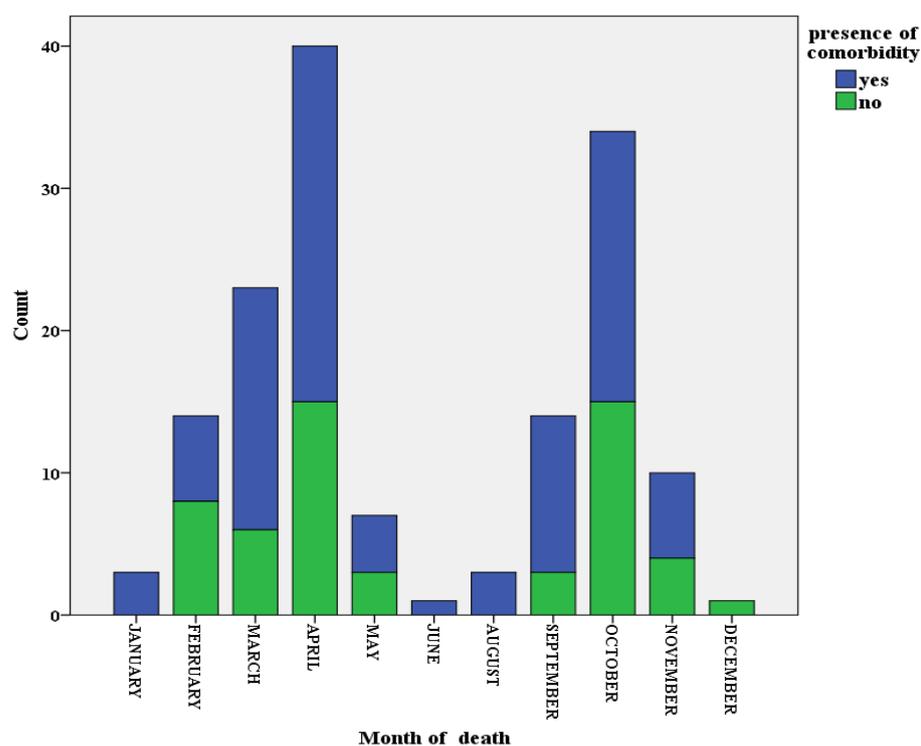


Figure 1. The number of deaths due to COVID-19 by month of death and comorbidity status in Sidama region, 2021

Table 1. Sociodemographic and epidemiologic profile of dead adult COVID-19 patients admitted in treatment facilities of Sidama region

Variables	Frequency(all patients=186)	Percentage (%)
Median age	60	
18 to 39 years	33	17.7
40 to 60 years	67	36
≥ 61 years	86	46.3
Sex		
Male	135	72.6
Female	51	27.4
Occupation		
Government employee	38	20.4
Private employee	4	2.2
Unemployed	87	46.8
Private business	26	14
Housewife	31	16.1
Place of residence		
Urban	106	57
Rural	80	43
Site of detection		
Community	12	6.5
Government	150	80.6
Private	24	12.9
Treatment facility		
Health facility visit	17	9.1
Contact	54	29

Of the recorded symptoms, Cough (89.2%) and shortness of breath (85.5%) were the commonest, while sore throat was the least common presentation. Meanwhile, only 9.1 % of patients presented with high grade fever (Table 2). Around two-third (64.5%) of the deceased patients had associated comorbidity and of those patients with comorbidity more than a third of the patients had two or more comorbidity (35.4%). Diabetes mellitus (50%) and hypertension (39.2%) were the most commonly presenting comorbidities (Table 3). Most of the patients (71%) had no recent health facility visit and no identified close contact with confirmed COVID-19 patients (90.9%). Majority of the patients (92; 49.5%) presented with severe COVID-19 symptoms. Male patients, old age patients, and those with comorbidities make up a higher proportion of those on the severe end of the disease spectrum.

Of all the deceased patients, 122 (65.6%) patients had admission to an intensive care unit and 111 (91%) of them required mechanical ventilation. Around two-third (69.7 %) of the patients admitted to ICU had associated comorbidity. Male patients (71.3%), age group ≥ 61(45.9%), and those with comorbidities (69.7%) make up a higher proportion of ICU admission. The minimum and maximum duration of stay in the ICU was 1 and 26 days respectively with the median duration of stay in the ICU of 4 days. Only 4.1 % of patients stayed in the ICU for more than two weeks. The median duration of stay in ICU based on age group was shorter for those aged 40-60 (3 days).

There was no difference in the median stay in ICU based on sex and comorbidity status. 84.4% of the patient were admitted and treated in governmental health facilities. The median number of days from current admission to death was 7 days, IQR (3, 11 days) with nearly half of the death (48.4 %) occurring in the first week of admission. The median number of days from symptom onset to current admission was 5 days, IQR (3, 7 days). Around two-third of the patients died in the first two weeks of symptom onset (65.5%). The case fatality rate was 1.87%.

Table 2. Clinical profile of dead adult COVID-19 patients admitted in treatment facilities of Sidama region

Variables	All patients=186 (100%)	
	Frequency	Percentage (%)
Symptoms		
Fever	125	67.2
Cough	166	89.2
Shortness of breath	159	85.5
Sore throat	66	35.5
Headache	101	54.3
Generalized body weakness	135	72.6
Myalgia	100	53.8
T⁰ on presentation		
36-37.5°C	120	64.5
37.6-38.1°C	49	26.3
≥ 38.2°C	17	9.1
ICU admission	122	65.6
Median ICU stay , IQR	4 days	(2, 8)
1-4days	65	53.3
5-8days	32	26.2
9-12 days	20	16.4
≥ 13 days	5	4.1
MV	111	91
Severity status		
Mild	3	1.6
Moderate	44	23.7
Severe	92	49.5
Critical	47	25.3
days from admission to death (median, IQR)	7	(3,11)
Days from admission to death		
1-6 days	90	48.4
7-12 days	68	36.6
≥13 days	28	15.1
Days from symptom onset to admission (median, IQR)	5	(3,7)
≤ 7 days	149	80.1
>7days	37	19.9
survival time (median, IQR)	11.5	(8, 17)
1-7 days	41	22
8-14 days	81	43.5
>14 days	64	34.4

IQR, Interquartile range

Table 3. Comorbidity profile of dead adult COVID-19 patients admitted in treatment facilities of Sidama region

Variables	Frequency	Percentage
Comorbidity	120	64.5
No. of comorbidity		
One comorbidity	77	64.2
Two or more comorbidity	43	35.8
Comorbidity type		
DM	60	50
Hypertension	47	39.2
HIV/AIDS	7	5.8
Malignancy	5	4.2
Asthma	8	6.7
Renal disease	15	12.5
Stroke	4	3.3
Cardiac disease	13	10.8
Congestive heart failure	10	
Myocardial infraction	3	
Others	14	11.7

Others =Tuberculosis, Anemia, chronic liver disease, severe malnutrition

There was a statistically significant association between comorbidity status and disease severity (p-value=0.045), ICU admission (p value=0.042), and mechanical ventilation (p value= 0.033). There was also a statistically significant association between the number of comorbidity and disease severity (p-value= 0.014) (Table 4). Age category had a statistically significant association with survival time in the first two weeks and beyond (p-value=0.006). Meanwhile, comorbidity status and mechanical ventilation had a statistically significant association among COVID-19 related death patients. (Table 5)

Table 4. Summary of ICU admission status and disease severity among COVID-19 related deaths

Variables	Severity status			Intensive care unit admission		
	Yes	No	p-value	Yes	No	p-value
Age group						
18-39	8(24.2%)	25(75.8%)	0.73	19(57.6%)	14(42.4%)	0.457
40-60	15(22.4%)	52(77.6%)		47(70.1%)	20(29.9%)	
≥61	24(27.9%)	62(72.1%)		56(65.1%)	30(34.9%)	
Sex						
Male	34(25.2%)	101(74.8%)	0.966	87(64.4%)	48(35.6%)	0.592
Female	13(25.5%)	38(74.5%)		35(68.6%)	16(31.4%)	
Comorbidity						
Yes	36(30%)	84(70%)	0.045	85(70.8%)	35(29.2%)	0.042
No	11(16.7%)	55(83.3%)		37(56.1%)	29(43.9%)	
Comorbidity number						
One	29(37.7%)	48(62.3%)	0.014	54(70.1%)	23(29.9%)	0.821
Two or more	7(16.3%)	36(83.7%)		31(72.1%)	12(27.9%)	
Comorbidity type						
Diabetes	15(25%)	45(75%)	0.232	47(78.1%)	13(21.7%)	0.07

HTN	11(23.4%)	36(76.6%)	0.206	34(72.3%)	13(27.7%)	0.771
HIV/AIDS	2(28.6%)	5(71.2%)	1.00 ^f	3(42.9%)	4(57.1%)	0.19 ^f
Cancer	1(20%)	4(80%)	1.00 ^f	1(20%)	4(80%)	0.25 ^f
Asthma	1(12.5%)	7(87.5%)	0.433 ^f	7(87.5%)	1(12.5%)	0.43 ^f
Renal disease	2(14.3%)	12(85.7%)	0.225	9(64.3%)	5(35.7%)	0.54 ^f
Stroke	1(25%)	3(75%)	1.00 ^f	3(75%)	1(25%)	1.0 ^f
Cardiac disease	4(30.8%)	9(69.2%)	1.00 ^f	9(69.2%)	4(30.8%)	1.0 ^f

f; fisher exact test

Table 5. Summary of adverse events of mechanical ventilation and survival time among COVID-19 related deaths

Variables	Mechanical ventilation (n=111)			Survival time (n=186)		
	Yes	No	p-value	Yes	No	p-value
Age group						
18-39	18(94.7%)	1(5.3%)	0.46	25(75.8%)	8(24.2%)	0.006
40-60	44(93.6%)	3(6.4%)		34(50.7%)	33(49.3%)	
≥61	49(87.5%)	7(12.5%)		63(73.3%)	23(26.7%)	
Sex						
Male	78(89.7%)	9(10.3%)	0.509 ^f	86(63.7%)	49(36.3%)	0.489
Female	33(94.3%)	2(5.7%)		36(70.6%)	15(29.4%)	
Comorbidity						
Yes	74(87.1%)	11(22.9%)	0.033^f	77(64.2%)	43(35.8%)	0.631
No	37(100%)	0		45(68.2%)	21(31.8%)	
Number of comorbidity						
One	50(92.6%)	4(7.4%)	0.089 ^f	50(64.9%)	27(35.1%)	0.814
Two or more	24(77.4%)	7(22.6%)		27(62.8%)	16(37.8%)	
Type of comorbidity						
Diabetes	40(85.1%)	7(14.9%)	0.747 ^f	39(65%)	21(35%)	0.849
Hypertension	29(85.3%)	5(14.7%)	0.748 ^f	33(70.2%)	14(29.8%)	0.268
HIV/AIDS	2(66.7%)	1(33.3%)	0.344 ^f	4(57.1%)	3(42.9%)	0.7
Cancer	1	0	1.00	3(60%)	2(40%)	1.00
Asthma	6(85.7%)	1(14.3%)	1.00	4(50%)	4(50%)	0.455
Renal disease	7(77.8%)	2(22.2%)	0.329 ^f	11(78.6%)	3(21.4%)	0.232
Stroke	2(66.7%)	1(33.3%)	0.344	4	0	0.295
Cardiac disease	7(77.8%)	2(22.2%)	0.329 ^f	7(53.8%)	6(46.2%)	0.541

f; fisher exact test

4. Discussion

Similar to previous studies, in this study we found out that the majority of patients who had unfavorable outcomes were old aged and male patients [10, 15-17]. Most of the deceased patients were from an urban area, which could correspond to the availability of health facilities capable of COVID-19 testing and advanced cares. It was also noted that most of the patients were diagnosed and died in government facilities. This could be explained by the availability of COVID-19 related services only in government health facilities during the earlier waves of the pandemic.

Similar to a study done in southern Ethiopia [18] and Nigeria [9], most deceased patients presented on the severe end of the disease spectrum. The time from symptom onset to admission was significantly shorter than reported in previous studies done in

China and Ethiopia [13, 16]. The first week of admission was found out to be a high risk period, as nearly half of the patients died within this period. The median day from admission to death was also shorter than reported in northern Ethiopia [13].

Around two-third of the deceased patients had ICU admission and most of them required mechanical ventilation. Moreover, more than half of the patients died within the first four days of ICU admission. The length of ICU stay was significantly shorter than two previous studies done in the USA, which reported a median length of ICU stay of 13 days [19] and 9.5 days [20]. This could be due to better ICU setup and care in USA which could have led to prolonged survival after admission. It was also found that the median survival time from symptom onset to death was 11.5 days with most of the patients dying within the first two weeks of symptom onset. This was shorter than those reported in china [21, 22].

Around two-third of the patients had comorbidities and most of them had at least one comorbidity. Based on recorded history, the most prevalent comorbidities among deceased COVID-19 patients were diabetes mellitus and hypertension which is also consistent with previous studies [9, 23, 24]. Unlike previous studies done in south-central Ethiopia, the prevalence of asthma among deceased patients was low and there were no patients with documented COPD [18]. Consistent with previous studies, our study has shown that comorbidity status was significantly associated with severity status, ICU admission, and mechanical ventilation [1, 9, 25]. The case fatality rate in the region is higher than national reports (1.87 vs 1.59%) [6] but lower than those reported globally [4, 17]. This low result could be due to lower testing capacity coupled with poor health care seeking behavior in developing countries in general and Sidama region in particular.

5. Conclusion

Overall, it was found that male, age group more than 60, patients with comorbidity constituted a higher proportion of deceased patients. Larger numbers of deceased patients were admitted to ICU and were put on mechanical ventilators. The first week of admission was a high risk period for death. Moreover, age group had a statistically significant association with survival to 14 days and beyond while comorbidity is associated with severity, ICU admission, and mechanical ventilation.

We recommend further study to be done to identify predictors of adverse events among COVID-19 patients in the region.

Limitation

The study was based on secondary data and it did not include all relevant variables. The study was also not able to identify the predictors of adverse outcomes as it did not include survivors.

Author Contributions: Conceptualization, A.B. and K.A.; methodology, A.B., K.A, A.T.; software, A.B., K.A.; validation, A.B., K.A, A.T.; formal analysis A.B., K.A, A.T.; resources A.B. and K.A.; writing—original draft preparation K.A.; writing—review and editing, A.B. and K.A.; visualization, A.T. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding

Data Availability Statement: Data supporting the study would be available upon request from the authors

Conflicts of Interest: The authors declare no conflict of interest.

References

- [1] Organization WH. Clinical management of COVID-19: interim guidance, 27 May 2020. World Health Organization; 2020.
- [2] Lupia T, Scabini S, Pinna SM, Di Perri G, De Rosa FG, Corcione S. 2019 novel coronavirus (2019-nCoV) outbreak: A new challenge. *Journal of global antimicrobial resistance*. 2020; 21:22-7.
- [3] Du R-H, Liang L-R, Yang C-Q, Wang W, Cao T-Z, Li M, et al. Predictors of mortality for patients with COVID-19 pneumonia caused by SARS-CoV-2: a prospective cohort study. *European Respiratory Journal*. 2020;55(5).
- [4] Organization WH. COVID-19 weekly epidemiological update, edition 86, 5 April 2022. 2022.
- [5] Gebretensae YA, Asmelash D. Trend Analysis and Forecasting the Spread of COVID-19 Pandemic in Ethiopia Using Box-Jenkins Modeling Procedure. *International journal of general medicine*. 2021; 14:1485.
- [6] EPHI. Ethiopian public health institute COVID-19 situational update [Available from: <https://www.ephi.gov.et>].
- [7] Organization WH. Medical certification, ICD mortality coding, and reporting mortality associated with COVID-19, 7 June 2020. 2020.
- [8] Abate SM, Checkol YA, Mantedafro B, Basu B, Ethiopia D. Prevalence and risk factors of mortality among hospitalized patients with COVID-19: A systematic review and Meta-analysis. *Bull World Health Organ*. 2020; 10.
- [9] Osibogun A, Balogun M, Abayomi A, Idris J, Kuyinu Y, Odukoya O, et al. Outcomes of COVID-19 patients with comorbidities in southwest Nigeria. *PloS one*. 2021; 16(3):e0248281.
- [10] Williamson EJ, Walker AJ, Bhaskaran K, Bacon S, Bates C, Morton CE, et al. Factors associated with COVID-19-related death using OpenSAFELY. *Nature*. 2020; 584(7821):430-6.
- [11] Tian W, Jiang W, Yao J, Nicholson CJ, Li RH, Sigurslid HH, et al. Predictors of mortality in hospitalized COVID-19 patients: a systematic review and meta-analysis. *Journal of medical virology*. 2020; 92(10):1875-83.
- [12] Abraha HE, Gessesse Z, Gebrecherkos T, Kebede Y, Weldegiargis AW, Tequare MH, et al. Clinical features and risk factors associated with morbidity and mortality among patients with COVID-19 in northern Ethiopia. *International Journal of Infectious Diseases*. 2021; 105: 776-83.
- [13] Kebede F, Kebede T, Gizaw T. Predictors for adult COVID-19 hospitalized inpatient mortality rate in North West Ethiopia. *SAGE Open Medicine*. 2022; 10:20503121221081756.
- [14] FMOH. NATIONAL COMPREHENSIVE COVID19 MANAGEMENT HANDBOOK. Addis Ababa, Ethiopia2020.
- [15] Eskandarian R, Sani ZA, Behjati M, Zahmatkesh M, Haddadi A, Kakhi K, et al. Identification of clinical features associated with mortality in COVID-19 patients. *medRxiv*. 2021.
- [16] Du Y, Tu L, Zhu P, Mu M, Wang R, Yang P, et al. Clinical features of 85 fatal cases of COVID-19 from Wuhan. A retrospective observational study. *American journal of respiratory and critical care medicine*. 2020; 201(11):1372-9.
- [17] Dorjee K, Kim H, Bonomo E, Dolma R. Prevalence and predictors of death and severe disease in patients hospitalized due to COVID-19: A comprehensive systematic review and meta-analysis of 77 studies and 38,000 patients. *PloS one*. 2020; 15(12):e0243191.
- [18] Kaso AW, Hareru HE, Kaso T, Agero G. Factors Associated with Poor Treatment Outcome among Hospitalized COVID-19 Patients in South Central, Ethiopia. *BioMed Research International*. 2022; 2022.
- [19] Krishnan S, Patel K, Desai R, Sule A, Paik P, Miller A, et al. Clinical comorbidities, characteristics, and outcomes of mechanically ventilated patients in the State of Michigan with SARS-CoV-2 pneumonia. *Journal of clinical anesthesia*. 2020; 67: 110005.
- [20] Oliveira E, Parikh A, Lopez-Ruiz A, Carrilo M, Goldberg J, Cearras M, et al. ICU outcomes and survival in patients with severe COVID-19 in the largest health care system in central Florida. *PLoS One*. 2021; 16(3):e0249038.
- [21] Wang K, Qiu Z, Liu J, Fan T, Liu C, Tian P, et al. Analysis of the clinical characteristics of 77 COVID-19 deaths. *Scientific reports*. 2020; 10(1):1-11.
- [22] Zhang B, Zhou X, Qiu Y, Song Y, Feng F, Feng J, et al. Clinical characteristics of 82 cases of death from COVID-19. *PloS one*. 2020; 15(7):e0235458.
- [23] Leulseged TW, Maru EH, Hassen IS, Zewde WC, Chamiso NW, Abebe DS, et al. Predictors of death in severe COVID-19 patients at millennium COVID-19 care center in Ethiopia: a case-control study. *The Pan African Medical Journal*. 2021; 38.
- [24] Xie J, Tong Z, Guan X, Du B, Qiu H. Clinical Characteristics of Patients Who Died of Coronavirus Disease 2019 in China. *JAMA Network Open*. 2020; 3(4):e205619-e.
- [25] Li W, Lin F, Dai M, Chen L, Han D, Cui Y, et al. Early predictors for mechanical ventilation in COVID-19 patients. *Therapeutic advances in respiratory disease*. 2020; 14:1753466620963017.