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# Respiratory Disease Screening as an Adverse Effect and Associated Factors of COVID-19 Recovered Patients from Quiha Treatment Center in Mekelle, Tigray, Ethiopia, 2020: A Community Based Institutional Study

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**Abstract**

**Background:** Coronavirus (COVID-19) is an illness caused by a virus that can spread from person to person. The virus that causes COVID-19 is a new coronavirus that has spread throughout the world. COVID-19 symptoms can range from mild (or no symptoms) to severe illness. In late December 2019, investigation of a cluster of pneumonia cases of unknown origin in Wuhan, China resulted in identification of a novel coronavirus. The virus is distinct from both Severe Acute Respiratory Syndrome Coronavirus (SARS-CoV) and Middle East Respiratory Syndrome Coronavirus (MERS-CoV), although closely related.

**Objective:** To assess respiratory disease screening as an adverse effect and associated factors of COVID-19 recovered patients from a treatment center in Mekelle, Tigray, Ethiopia.

**Methods:** A community based quantitative study design was conducted among 600 samples in Mekelle town, Tigray, Ethiopia. Data were collected using a structured and semi-structured questionnaire. Associations between dependent and independent variables were tested using logistic regression with the assumptions of p-values < 0.05 and confidence interval 95% and considered to be statistically significant.

**Results:** The prevalence of respiratory disease after screening using CRQ was 24.3%. Variable like who read and wrote [AOR=2.859, 95% CI: 1.349-6.063, P=0.006]. COVID-19 symptoms such as those who had shortness of breathing [AOR=3.485, 95% CI: 1.776-6.838, P=0.001], sore throat [AOR=4.645, 95% CI: 2.107-10.242, P=0.001], and chest pain pressure was AOR=3.453, 95%CI: 1.484-8.037, P=0.04] were significant factor for respiratory disease.

**Conclusion:** The study found that the prevalence of respiratory disease after screening using CRQ was 24.3%. Variables such as read and write, shortness of breathing, sore throat, and pneumonia were significant factors for respiratory disease.

**Keywords:** Respiratory disease; COVID -19; Screening; CRQ; Treatment center; Ethiopia

## Abbreviations

ANOVA: One-way Analysis of Variance; AOR: Adjusted Odds Ratio; ARDS: Acute Respiratory Distress Syndrome; CDC: Disease Control and Prevention; CI: Confidence Interval; COR: Crude Odds Ratio; COVID-19: Coronavirus Disease; CRQ: Chronic Respiratory Questionnaires; FDA: Food and Drug Administration; HRERC: Health Research Ethics Review Committee; SARS: Severe Acute Respiratory Syndrome; SARS-CoV-2: Severe Acute Respiratory Syndrome Coronavirus 2; SPSS: Statistical Package for Social Sciences; WHO: World Health Organization

## Introduction

COVID-19 is a respiratory virus and disease. It is spread by small droplets from coughs and sneezes and from touching infected surfaces. At least 80% of people who are infected with the virus will have anywhere from no symptoms to mild to moderate flu-like symptoms, including a fever and cough and the remaining 20% may develop more severe cases of coronavirus that may develop pneumonia or severe acute respiratory syndrome.

The Centers for Disease Control and Prevention (CDC) estimate that 3-17 % of COVID-19 patients develop a complication known as Acute Respiratory Distress Syndrome (ARDS). ARDS patients lose the ability to breathe normally and this is known as a respiratory failure that results from severe inflammation in the lungs. Risk factors for developing pneumonia from COVID-19 include diabetes, hypertension, chronic heart, chronic lung disease, immune-suppressed conditions, being elderly (increasing age), and obesity.




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COVID-19 is a viral infection caused by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) that primarily targets the respiratory system, with initial symptoms often including shortness of breath and fever [1]. Emerging infectious diseases, such as Severe Acute Respiratory Syndrome (SARS) and Zika virus disease, present a major threat to public health [2]. In late December 2019, a cluster of patients was admitted to hospitals with an initial diagnosis of pneumonia of an unknown etiology. These patients were epidemiologically linked to the seafood and wet animal wholesale market in Wuhan, Hubei Province, China [3].

According to world meters info reported that globally, 41,169,789 cases and 1,131,329 deaths were encountered within 213 countries since last December 2019 due to COVID-19 until now there is no treatment or vaccination found.

The clinical manifestations of COVID-19 are protean, which include an asymptomatic carrier, ARD, and pneumonia of varying degrees of severity. First, asymptomatic cases were diagnosed based on positive viral nucleic acid test results, but without any COVID-19 symptoms, such as fever, gastrointestinal, or respiratory symptoms, and no significant abnormalities on chest radiograph [4].

There are currently no appropriate scientifically approved vaccines/drugs for COVID-19. Nonetheless, few broad-spectrum antiviral drugs, azithromycin were tested against COVID-19 in clinical trials, and finally, Food and Drug Administration (FDA) approved emergency use of remdesivir in hospitalized COVID-19 patients [5].

Convalescent plasma therapy is effective and specific for COVID-19 and this intervention has a special significance for eliminating SARS-CoV-2 and is believed to be a promising state-of-the-art therapy during the COVID-19 pandemic crisis [6].

Levels of potassium, albumin, and lymphocytes were increased persistently after treatment from sustained lopinavir use. Increasing eosinophils may be an indicator of COVID-19 improvement. Viral load of SARS-CoV-2, radiography, and eosinophil improved continuously not more than 9 days [7].

A study done in China reported that urea nitrogen concentration at admission was associated with the presence of CT abnormalities (P=0.046, AOR=7.149, 95% CI: 1.038 - 49.216). Lung function abnormalities were detected in 14 patients and the measurement of D-dimer levels at admission may be useful for prediction of impaired diffusion defect (P=0.031, AOR=1.06, 95% CI: 1.006-1.129). Radiological and physiological abnormalities were still found in a considerable proportion of COVID-19 survivors without critical cases 3 months after discharge. A higher level of D-dimer on admission could effectively predict impaired DLCO after 3 months of discharge [8].

Post-mortem studies have noted diffuse alveolar damage, leading some to postulate that long-term pulmonary sequelae are possible from COVID-19, such as interstitial pulmonary fibrosis [9]. Besides, based on the literature from other viral infections, reduced or abnormal pulmonary function may be expected in people with COVID-19 in the months after recovery, although there are limited studies to date evaluating pulmonary function [10].

The long-term effect of COVID-19 is still largely unknown. However, based on previous experiences with other viral pulmonary infections, long-term pulmonary consequences are indeed expected in some patients. A significant number of patients recovering from the acute viral illness may have significant impairment in overall functional capacity and specifically their pulmonary function in the first few months [11].

The predominant pattern of lung lesions in patients with COVID-19 patients is diffuse alveolar damage, as described in patients infected with severe acute respiratory syndrome and Middle East respiratory syndrome coronaviruses. Hyaline membrane formation and pneumocyte atypical hyperplasia are frequent. Importantly, the presence of platelet–fibrin thrombi in small arterial vessels is consistent with coagulopathy, which appears to be common in patients with COVID-19 and should be one of the main targets of therapy [12].

The pooled analysis revealed that common complications up to 6 months after discharge were: impaired diffusing capacity for carbon monoxide (prevalence 27%, 95% confidence interval (CI) 15–45 %); and reduced exercise capacity (mean 6-min walking distance 461 m, CI:450–473 m). Low scores on Short-Form 36 were identified beyond 6 months after discharge [13].

The study reported that 11.4% presented with at least one GI symptom (nausea, vomiting, or diarrhea), and 10.8% had pre-existing liver disease. Of patients with COVID-19 with GI symptoms, 17 (22.97%) had severe/critical types. Of patients with COVID-19 with GI symptoms, 29 (39.19%), 23 (31.08%), 8 (10.81%), and 16 (21.62%) had significantly higher rates of fever >38.5°C, fatigue, shortness of breath, and headache, respectively. Sputum production and increased lactate dehydrogenase/glucose levels were risk factors for severe/critical type [14].

A study was done revealed the prevalence of smell and taste of COVID-19 clients was 68% and 71% respectively. Smell and taste impairment [AOR=10.9, 95% CI: 5.08-23.15] was significant with COVID-19 [15]. The conceptual framework of the adopted literature review can see in (Figure 1).

To my knowledge so far, there is no research conducted that screening respiratory disease of recovered COVID-19 patients. So that the purpose of the study is to give an emphasis and base researchers to conduct a cohort study. Moreover, the study helps physicians to have foci on respiratory disease treatment to those who were recovered from the treatment center.

## Method and Materials

### Study area and period

The study was conducted in 2020 in the city of Mekelle Northern Ethiopia. Mekelle city which was founded in the 13th century is the capital city of the Tigray region. It is located 783 km north of Addis Ababa and its elevation is 2,084 meters above sea level with an area of 24.4 square kilometers. Administratively Mekelle is considered a special zone, which is divided into seven sub-cities namely: Hawelti, Adi Haki, Kedamay Weyane, Hadnet, Ayder, Semien, and Quia. The city has one specialized hospital (Ayder), three general hospitals (Mekelle, Quiha, and North command military hospital), nine

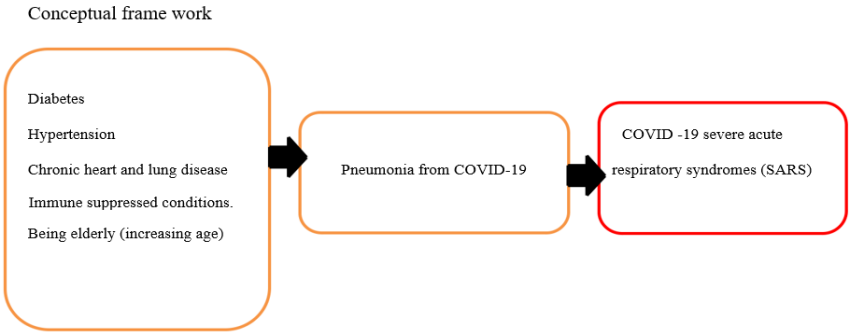


**Figure 1:** Conceptual framework of respiratory disease screening as an adverse effect and associated factors of COVID 19 recovered patients from treatment center in Mekelle, Tigray, Ethiopia, 2020 (n=600).

health centers (Mekelle, Semien, Kasech, Quiha, Aynalem, Hawelti, Felegado Adha and Adishimdihun) and several private clinics and private hospitals. According to the 2011 Census, the total population of the city is about 367,470 (186,045 males and 181,376 females); and approximately half of the inhabitants are younger than 20 years old. Tigrigna is spoken as a first language by (96.26%) and (2.98%) speak Amharic. The majority of the population (91.31%) practiced Ethiopian Orthodox Christianity, and 7.66% are Muslim and the remaining practiced other religions. There is 1 COVID-19 treatment center found in Quiha Sub-city. There are more than 6000 COVID-19 infected cases in Mekelle City, of those 5000 clients recovered and 50 deaths since the emerging pandemic disease to Ethiopia.

## Study design

A community-based cross-sectional survey was employed.

## Study population

**Source population:** The target population is all COVID-19 clients of the city of Mekelle.

**Study population:** All COVID-19 clients of Mekelle city were found in the randomly selected sub-cities.

**Sample population:** All COVID-19 sampled clients of Mekelle city who are found in the households (selected using systematic random sampling method).

## Eligibility criteria

**Inclusion criteria** All COVID-19 recovered clients who are greater than 18 years old and agreed to participate in the study were included.

**Exclusion criteria:** Respondents with incomplete information of the COVID-19 recovered clients and with any form of memory problem, psychiatric client, not volunteer to participate would not be included in the study.

## Sample size and sampling procedure

**Sample size determination:** The actual sample size for the study will be determined using the formula for a single population proportion by assuming 5% marginal error (d), 95% confidence interval (alpha=0.05), and taking the proportion of respiratory disease 50% because there was no study done in else area.

Based on the above information the total initial sample size was calculated by using the formula;

$$n = \frac{(z\alpha/2)^2 \times P(1-P)}{(d)^2} \cdot \frac{(1.96)^2 \times 0.304(1-0304)}{(0.05)^2}$$

Where; n= required an initial sample size

Zα/2=critical value for normal distribution at a 95% confidence interval which equals to 1.96 (Z value at alpha=0.05).

P= Proportion will be 50%.

d= marginal error (0.05).

This yield to n=384 Adding a 10% non-response rate and considering 1.5 design effect the total household required for this study will be 600 clients.

4 Sub cities will be selected randomly, from these selected sub-cities, 3 Kebeles will be selected randomly from each sub-cities. Then the 600 clients will be selected using a systematic random sampling method (Figure 2).

## Sampling technique and procedure

The systematic sampling technique was employed. The study participants were proportionally allocated in all kebeles and clients selected systematically from these kebeles (Figure 2).

## Data collection procedure

Face to face interview with keeping personal protective equipment's like sanitizer, facemask method using a structured questionnaire was used in this study to identify respiratory diseases screening such as (1) sociodemographic characteristics, (2) medical characteristics (3) coronavirus variables (4) SRQ-20, and (5) CRQ. Also, the chart was reviewed to check the psychiatric and other medical illness diagnoses and investigations. During the interview, pneumonic clients were referred to the hospital; and severe mentally distressed consulted for clinical psychological for further psychiatric evaluation.

Self-Reported Questionnaire 20 (SRQ-20) was developed by the World Health Organization (WHO) and is an instrument with 20 items to assess neurotic disorder. The tool is suitable for self-administer and interviewer-administered questionnaires. Each of the 20 items is scored 0 or 1. A score of 1 indicates the symptom was present during the past month, a score of 0 indicates that the symptom was absent. The maximum score, therefore, is 20. The tool was valid in WHO and Ethiopia as well. The Cronbach's alpha

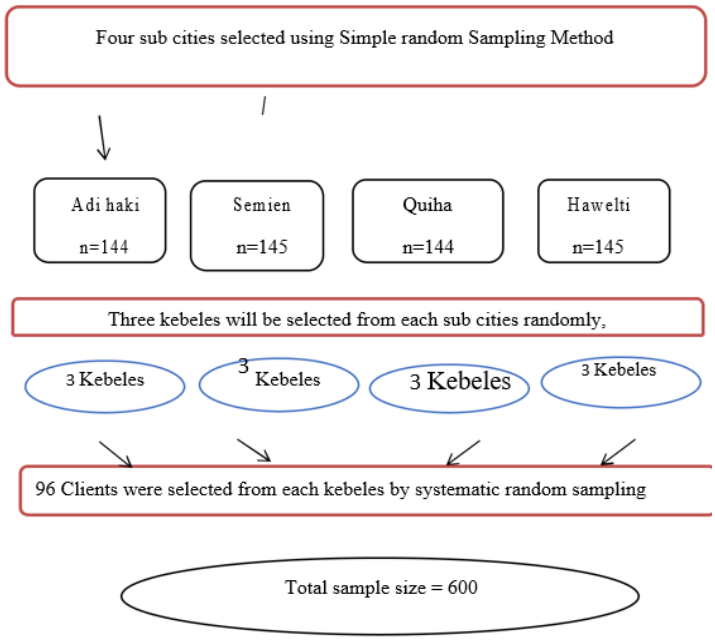


**Figure 2:** Sampling procedures for selecting clients, Mekelle town, Tigray, Ethiopia, 2020.

was 0.85.in addition to English, SRQ was used in Arabic, Eritrea (Tigrigna), Amharic (Ethiopia), Italian, Hindi, French, and Malaysia are some of the common [16].

The Chronic Respiratory Questionnaire (CRQ) is an established measure of health status, which had been widely used for research purposes. The CRQ-SR was found to be reproducible both in the short term and after a long period of 7 weeks. The CRQ is divided into four dimensions of dyspnea, fatigue, emotional function, and mastery (the patient's feeling of control over their disease). The patient is required to identify everyday activities which make them breathless and then select rank and score the five most important activities on a seven-point scale which spans from 1-'extremely short of breath' to 7- 'not at all short of breath'. Every patient will have a unique list of activities. In each dimension the lower the score, the greater the degree of dysfunction. Averagely classifying the scale into 4 main classes and those are dyspnea, fatigue, emotion, and mastery. The magnitude of respiratory disease was calculated as CRQ below mean had no respiratory disease and mean and above mean had the respiratory disease [17]. The tool was valid in Ethiopian settings, the reliability test was done and the Cronbach's alpha for CRQ was 0.87.

### Data Collection Instrument

A structured and pre-tested questionnaire was used for data collection. The questionnaire was first prepared in English and then translated into Tigrigna and back-translated into English by different qualified individuals to check the consistency. The training was given for data collectors and supervisors. COVID-19 Recovered participants were interviewed by six trained midwifery/nurses that deliver reproductive health service at the time of data collection, data collectors using face to face interview technique. Besides, trained supervisors who have a Master of Public Health (MPH) level professionals and principal investigators were supervised the work.

## Study Variables

### Dependent variable

- Respiratory Disease screening

### Independent variables

**Socio-demographic status:** Age, educational status, occupation, family perceived income status, marital status, number of children

### Operational definition

**Respiratory disease or lung diseases:** a type of disease that affects the lungs and other parts of the respiratory system.

**Chronic respiratory diseases (CRDs):** are diseases of the airways and other structures of the lung.

**CRQ screening:** a procedure that is performed to identify the presence of respiratory disease symptoms in the recovered participants in the short term and after a longer period of 7 weeks.

**Have CRQ:** those respondents who were scored mean and the above mean of the respiratory disease screening CRQ assessing questions.

**Have no CRQ:** those respondents who were scored below the mean of the respiratory disease screening CRQ assessing questions.

**Mental distress:** Mental distress (or psychological distress) is a term used to describe a range of symptoms and experiences of a person's internal life that are commonly held to be troubling, confusing, or out of the ordinary.

Have SRQ-20 (have mental distress): those respondents who were scored 6 and above from SRQ-20 items after assessing clients in the past 1 month.

**Have no SRQ-20 (have no mental distress):** Those respondents

who were scored 5 and below from SRQ-20 items after assessing clients in the past 1 month.

### Data collection tools and procedures

A structured and pre-tested questionnaire was used for data collection. The questionnaire was first prepared in English and then translated into Tigrigna and back-translated into English by different qualified individuals to check the consistency. The training was given for data collectors and supervisors. Clients were interviewed by six trained midwiferies/nurses that deliver reproductive health service at the time of data collection, data collectors using face to face interview technique. Also, trained supervisors who have MPH level professionals and principal investigators were supervised the work.

### Data collection tools and quality controls

**To achieve good data quality:**

- The questionnaire was prepared in English and translated into Tigrigna and back-translated to English to keep the consistency of the data.
- A structured questionnaire that is adapted from different literature is used.
- The training was provided to the selected data collectors and supervisors for three days about the objective and process of data collection, including pre-testing. If there were problems in the questionnaire explanation was provided.
- Pre-testing was done with 5% of the questionnaires, in a similar area that is not included in the study.

### Data analysis

- The collected data were entered, edited, and cleaned in Epidata Version 4.3 and then it was exported to SPSS Version 25 for analysis. After the data is preprocessed then descriptive statistics of the study variables were presented using frequencies and percentages for the categorical variables. The presence of an association between knowledge of cervical cancer, attitude, and practice to its screening and the independent variables was tested using cross-tabulation with the chi-square test at P-value<0.05 significance level.
- As the dependent variable cervical cancer is with two categories, binary logistic regression analysis was used. In the bivariate logistic regression, the level of significance of the association between the dependent and each independent variable was considered at P-value < 0.05, and the factors with this level of significance were made to pass on to the next level of analysis. In the multivariable logistic regression analysis, the Stepwise forward predictor inclusion method was used to develop the main-effect model for the dependent variable cervical cancer. The presence and significance of interaction terms and confounding effects on the main effect model were checked using the Log-likelihood ratio test and the percentage change in beta values of the independent variables.
- Multi-collinearity between independent variables also checked using variance inflation factors considering multi-co linearity at Variance Inflation Factor (VIF)>10. The presence and influence of outliers were checked using residuals cooks distance and influence statistic. A comparison between models was made using the log-likelihood ratio test. The goodness of fit of the model was checked using the Hosmer Lemeshow test of goodness of fit. The proportion of correctly classified observations was checked using the classification table, and the prediction power of the model was checked using the area under the Receiver Operating Characteristics (ROC) curve.

## Results

### Sociodemographic characteristics

The total study participants were 600 clients who recovered from COVID-19 treatment center. Of the total 307 (51.2%) males and 293 (48.8%) female; 116 (30%) who achieve the highest level of education was primary school; 463 (77.2) live with their family whereas 137 (22.8) live alone; 272 (45.3) single in marital status; 228 (38.0) unemployed and 115 (19.2) housewife in occupation participated. There were 272 (45.3) single, 230 (38.3) married, and 98(16.3) divorced participants clients in marital status. Participants their age ranges 145 (24.2) 25-31 years, 138 (23.0) 32-38 years, 46 years and above 114(19.0); mean=2.988, mode=2.00, and Std. Deviation=1.35 (Table 1).

### Medical characteristics

Regarding substance, 534 (89.0) had no smoking cigarette habit and the rest 66(11.0) had habit; 518(86.3) had a habit of alcohol drinking and 82 (13.7) had a habit. The current status of treatment

**Table 1:** Sociodemographic characteristics of respiratory disease screening as an adverse effect and associated factors of COVID 19 recovered patients from treatment center in Mekelle, Tigray, Ethiopia, 2020 (n=600).

| Variables | Categories | Respiratory Disease as an Adverse effect | |
|---|---|---|---|
| | | No | Yes |
| Age | 18-24 Year | 76 (16.7) | 22 (15.1) |
| | 25-31 Year | 116 (25.6) | 29 (19.9) |
| | 32-38 Year | 110 (24.2) | 28 (19.2) |
| | 38-45 Year | 69 (15.2) | 36 (24.7) |
| | ≥46 Year | 83 (18.3) | 31 (21.2) |
| Sex | Male | 228 (50.2) | 79 (54.1) |
| | Female | 226 (49.8) | 67 (45.9) |
| Live with | Alone | 103 (22.7) | 34 (23.3) |
| | With family | 351 (77.3) | 112 (76.7) |
| | Single | 4545.4) | 66 (45.2) |
| Marital status | Married | 172 (37.9) | 59 (39.7) |
| | Divorced/widowed/ | 76 (16.7) | 22 (15.1) |
| Occupation | Unemployed | 181 (39.9) | 47 (32.2) |
| | Housewife | 85 (18.7) | 30 (20.5) |
| | Daily laborer | 34 (7.5) | 13 (8.9) |
| | Government employee | 60 (13.2) | 24 (16.4) |
| | Farmer | 45 (9.9) | 14 (9.6) |
| | Merchant | 23 (5.1) | 8 (5.5) |
| | Student | 26 (5.7) | 10 (6.8) |
| | Illiterate | 109 (24.0) | 25 (17.1) |
| Educational status | Read and write | 37 (8.1) | 22 (15.1) |
| | Primary school | 88 (19.4) | 28 (19.2) |
| | Secondary school | 145 (29.7) | 45 (30.8) |
| | Tertiary school | 85 (18.7) | 26 (17.8) |

**Table 2:** Medical characteristics of respiratory disease screening as an adverse effect and associated factors of COVID 19 recovered patients from treatment center in Mekelle, Tigray, Ethiopia, 2020 (n=600).

| Variables | Categories | Respiratory Disease as an Adverse effect | |
|---|---|---|---|
| | | No | Yes |
| Current status treatment adverse effect of COVID-19 | No | 388 (85.5) | 126 (87.5) |
| | Yes | 66 (14.5) | 18 (12.5) |
| Diagnosis of comorbid physical illness | No | 359 (79.1) | 116 (79.5) |
| | Yes | 95 (20.9) | 30 (20.5) |
| Smoking Habit | No | 406 (89.4) | 128 (87.7) |
| | Yes | 48 (10.6) | 18 (12.3) |
| Drinking Habit | No | 398 (87.7) | 120 (82.2) |
| | Yes | 56 (12.3) | 26 (17.8) |
| Patient's comorbid disease with COVID-19 | No | 171 (37.7) | 68 (46.6) |
| | Gastrointestinal disease | 7 (7.0) | 11 (7.8) |
| | Cardiovascular disease | 57 (12.6) | 22 (15.1) |
| | Respiratory disease | 194 (42.7) | 42 (30.2) |

of adverse effects of COVID-19 clients, 514 (85.7) had no treatment whereas 84(14.3) were in the treatment. From the total participants, 475 (79.2) had no comorbid disease whereas the rest 125 (20.8) had a comorbid physical illness. Of the total participant clients, 237 (39.5) had no comorbid with the disease, 124 (20.7) had gastrointestinal and the rest 239(39.8) had both cardiovascular and respiratory diseases (Table 2).

Reporting the COVID stage during treatment, 70 (11.7) asymptomatic, 284 (47.3) experienced mild symptoms, 175 (29.2) serious/severe and 71 (11.8) were critical while in the treatment center. Results showed what happens after recovered of COVID-19, 107 (17.8) had no disease, 246 (41.0) had developed the respiratory disease, 247 (41.2) develop kidney and heart diseases.

Results showed that staying at the hospital and discharged from treatment institution, 290 (48.3) discharged after 3 weeks stay, 196 (32.7) 4-5 weeks stay, and 114 (19.0) 6-9 weeks stay. Of the total participants, almost all 571 (95.2) did not experience mental distress whereas only 29 (4.8) clients were distressed mentally and consulted for clinical psychological for further psychiatric evaluation.

Regarding the COVID-19 exposure, 349 (58.2) participants had travel history, 149 (24.8) had contact history from the confirmed case and 102 (17.0) had no travel history or no contact with the confirmed case. The study revealed regarding COVID-19 symptoms that 133 (22.2) had fever greater than 38 degree Celsius, 168 (28.0) had a dry cough, 106 (17.7) had shortness of breathing, 54 (9.0) had a sore throat, 93 (15.5) had fatigue and 46 (7.8) had chest pain or pressure (Table 3).

### Prevalence of Chronic Respiratory Questionnaires (CRQ)

The prevalence of respiratory disease after the screening was 146(24.3%) with 95%CI: 23.09-25.58; whereas those who had not respiratory disease symptoms after discharged from COVID-19 treatment were 75.7% (454) from 600 sampled participants. The study found that 298 (49.7) dyspnea, 171 (28.5) fatigue, 68 (11.3) emotion, and 63 (10.5) mastery responded to the CRQ tool (Figure 3).

**Table 3:** Corona virus characteristics of respiratory disease screening as an adverse effect and associated factors of COVID 19 recovered patients from treatment center in Mekelle, Tigray, Ethiopia, 2020 (n=600).

| Variables | Categories | Respiratory Disease as an Adverse effect | |
|---|---|---|---|
| | | No | Yes |
| COVID-19 stage during treatment | Asymptomatic | 51 (11.2) | 19 (13.0) |
| | Mild | 210 (46.3) | 74 (50.7) |
| | Serious/severe | 136 (30.0) | 39 (26.7) |
| | Critical | 57 (12.6) | 14 (9.6) |
| Experienced after of COVID-19 recovered | No disease | 74 (16.3) | 33 (22.6) |
| | Respiratory disease | 191 (42.1) | 55 (37.7) |
| | Kidney and heart disease | 189 (41.6) | 58 (39.7) |
| Respiratory disease Questionnaire | Dyspnea | 222 (48.9) | 76 (52.1) |
| | Fatigue | 141 (31.1) | 30 (20.5) |
| | Emotion | 50 (11.0) | 18 (12.3) |
| | Mastery | 41 (9.0) | 22 (15.1) |
| COVID-19 treatment duration | 3 weeks | 226 (49.8) | 64 (43.8) |
| | 4-5 weeks | 146 (32.2) | 50 (34.2) |
| | 6-9 weeks | 82 (18.1) | 32 (21.9) |
| Mental distress | No | 429 (94.5) | 142 (97.3) |
| | Yes | 25 (5.5) | 4 (2.7) |
| COVID-19 exposure | Travel history | 262 (57.7) | 87 (59.6) |
| | Contact history | 116 (25.6) | 32 (21.9) |
| | No known history of contact or travel | 76 (16.7%) | 27 (18.5) |
| | Fever (>38) | 114 (25.2) | 19 (13.0) |
| | Dry cough | 137 (30.2) | 31 (21.2) |
| COVID-19 symptoms | Shortness of breathing | 69 (15.2) | 37 (25.3) |
| | Sore throat | 33 (7.3) | 21 (14.4) |
| | Fatigue | 70 (15.5) | 23 (15.8) |
| | Chest pain or pressure | 6 (6.6) | 15 (10.3) |

### Associated factors of respiratory disease screening as an adverse effect

The study found that those who read and wrote were 2.859 times more likely to have the respiratory disease than those illiterate [AOR=2.859, 95% CI: 1.349-6.063, P=0.006]. COVID-19 symptoms such as those who had shortness of breathing during infection were 3.48 times more likely to have the respiratory disease than asymptomatic [AOR=3.485, 95% CI: 1.776-6.838, P=0.001], sore throat was 4.64 times likely to have the respiratory disease [AOR=4.645, 95% CI: 2.107-10.242, P=0.001], and chest pain pressure was 3.45 times more likely to have the respiratory disease [AOR=3.453, 95%CI: 1.484-8.037, P=0.04]. However, age, alcohol, developed the disease after COVID-19, CRQ, and mental distress were not significant factors in this study (Table 4).

## Discussion

COVID-19 is, emerged in china in December 2019; an infectious pandemic disease affects different people in different ways. Most

**Table 4:** Multiple logistic regression analysis of respiratory disease screening as an adverse effect and associated factors of COVID 19 recovered patients from treatment center in Mekelle, Tigray, Ethiopia, 2020 (n=600) Note: bolded indicates variables which show significant factors with respiratory disease at multivariate analysis.

| Variables | Categories | Yes | No | COR (95% CI) | AOR (95%CI) | P value |
|---|---|---|---|---|---|---|
| Age | 25-31 year | 31 (21.2) | 83 (18.3) | .864 [.462-1.614] | .818 [.419-1.596] | 0.556 |
| | 32-38 year | 36 (24.7) | 69 (15.2) | .879 [.468-1.652] | .831 [.420-1.646] | 0.596 |
| | 39-45 year | 28 (19.2) | 110 (24.2 | 1.802 [.967-3.359] | 1.749 [.883-3.467] | 0.109 |
| | ≥46 year | 29 (19.9) | 116 (25.6) | 1.290 [.688-2.420] | 1.234 [.618-2.462] | 0.551 |
| | 18-24 year | 22 (15.1) | 76 (16.7) | 1 | | |
| Education | Read and write | 22 (15.1) | 37 (8.1) | 2.592 [1.309-5.136] | 2.859 [1.349-6.063] | 0.006 |
| | Primary school | 88 (19.4) | 28 (19.2) | 1.387 [.755-2.548] | 1.194 [.618-2.306 | 0.597 |
| | Secondary school | 45 (30.8) | 145 (29.7) | 1.453 [.838-2.520] | 1.619 (.877-2.990) | 0.123 |
| | Tertiary school | 26 (17.8) | 85 (18.7) | 1.334 [.719-2.474] | 1.255 [.637-2.475] | 0.511 |
| | Illiterate | 25 (17.1) | 109 (24.0) | 1 | | |
| Alcohol | Yes | 26 (17.8) | 56 (12.3) | 1.540 [.927-2.559] | 1.604 [.914-2.815] | 0.1 |
| | No | 398 (87.7) | 120 (82.2) | 1 | | |
| Developed disease after COVID 19 | Respiratory Disease | 191 (42.1) | 55 (37.7) | .646 [.388-1.073] | .678 [.381-1.208] | 0.187 |
| | Kidney and Heart Disease | 189 (41.6) | 58 (39.7) | .688 [.415-1.140] | .721 [.401-1.295] | 0.273 |
| | No Disease | 33 (22.6) | 74 (16.3) | 1 | | |
| CRQ | Dyspnea | 76 (52.1) | 222 (48.9) | .638 [.357-1.139] | .673 [.403-1.124] | 0.13 |
| | Fatigue | 30 (20.5) | 141 (31.1) | .397 [.207-.760] | .998 [.514-1.937] | 0.995 |
| | Emotion | 18 (12.3) | 50 (11.0) | .671 [.318-1.417] | 1.325 [.700-2.509] | 0.387 |
| | Mastery | 41 (9.0) | 22 (15.1) | 1 | | |
| Mental distress | Yes | 4 (2.7) | 25 (5.5) | .483 [.165-1.413] | .439 [.141-1.373] | 0.157 |
| | No | 142 (97.3) | 429 (94.5) | 1 | | |
| COVID 19 symptoms | Cough | 31 (21.2) | 137 (30.2) | 1.358 [.728-2.531] | 1.480 [.764-2.870] | 0.245 |
| | Shortness of breathing | 37 (25.3) | 69 (15.2) | 3.217 [1.716-6.034] | 3.485 [1.776-6.838] | 0.0001 |
| | Sore throat | 21 (14.4) | 33 (7.3) | 3.818 [1.837-7.936] | 4.645 [2.107-10.242] | 0.0001 |
| | Fatigue | 23 (15.8) | 70 (15.5) | 1.971 [1.002-3.878] | 1.997 [.969-4.115] | 0.061 |
| | Pneumonia | 6 (6.6) | 15 (10.3) | 3.000 [1.365-6.593] | 3.453 [1.484-8.037] | 0.004 |
| | Fever | 19 (13.0) | 114 (25.2) | 1 | | |

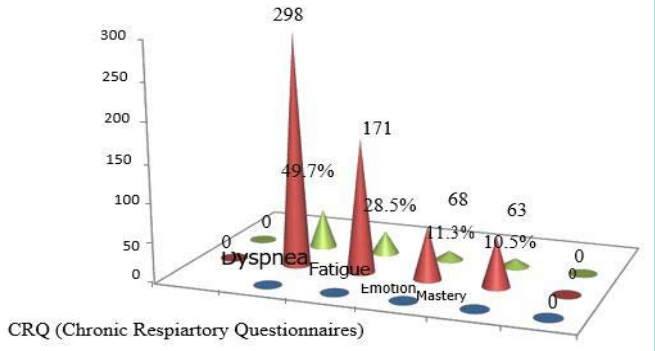


**Figure 3:** Chronic respiratory Questionnaires of respiratory disease screening as an adverse effect and associated factors of COVID 19 recovered patients from treatment center in Mekelle, Tigray, Ethiopia, 2020 (n=600).

infected people will develop mild to moderate illness and recover without hospitalization. The characterized by most common symptoms: fever, dry cough, tiredness; less common symptoms: aches and pains, sore throat, diarrhea, headache; and serious symptoms: shortness of breath, chest pain, or pressure.

The finding of the prevalence of respiratory disease after the screening was 24.3%. There is no study reported this instead other studies reported either the pathophysiology or effects after investigation or post-mortem.

The study showed that the prevalence of gastrointestinal symptoms was 7.8%, which is lower than with a study done by 11.4% in China. This could be due to sample size, the period, pandemic disease emerging. The prevalence of COVID-19 symptoms: was fever=13.0%. This very lower than a study done this is 39.19%. This might be due to herd immunity and illness status. The second COVID-19 symptom was shortness of breathing=25.3% prevalent. This result is very higher than in China which is 10.81%. This could be due to using modernized intervention in a developed country. The third COVID-19 symptoms were fatigue=15.8% and are contrasted lower than with study done in other which is 31.08%. This could be due to lifestyle modification, herd immunity, and illness status [18].

The study revealed that educational status (read and wrote) was

associated with respiratory disease. This might be due to the sample size of the COVID-19 infected participants. No study was done regarding this and cannot compare and contrast with studies because this study was only taken from client verbal than client and laboratory investigation, and imaging like other studies done reported that other viral infections, reduced or abnormal pulmonary function may be expected in people with COVID-19 in the months after recovery [19]; other viral pulmonary infections, long-term pulmonary consequences are indeed expected in some patients [20]; hyaline membrane formation and pneumocyte atypical hyperplasia are frequent; sputum production and increased lactate dehydrogenase/glucose levels were risk factors for severe/critical type [21].

Regarding the COVID-19 symptoms: dry cough; shortness of breathing; and chest pain and pressure were significant associated with respiratory disease. This is due to the pandemic disease symptoms had a dry cough, smothering so that almost all COVID-19 infected clients had such symptoms. This result compares with a study in another area that is the clinical manifestations of COVID-19 symptoms: fever which is not a significant factor for both studies; whereas gastrointestinal, or respiratory symptoms, and no significant abnormalities on chest radiograph [22].

## Conclusion

The study found that the prevalence of respiratory disease after screening using CRQ was 24.3%. Variables such as read and write, shortness of breathing, sore throat, and pneumonia were significant factors for respiratory disease.

## Recommendation

- For health professionals to examine, diagnose, and treat as early as possible to reduce complication to those who had developed respiratory disease
- It helps as a base for researchers to conduct cohort study, study design with investigations and imaging, qualitative as well.

## Limitation of the Study

- Study design: since the study design is cross-sectional, by nature, does not show the cause and for showing the temporal relationship.
- This study is original; first, study as far as our knowledge, it left many things
- The study didn't include physical examination, laboratory investigations, and imaging, it is only verbal information from the clients what happen during and after the treatment.

## Declarations

### Ethics approval and consent to participate

Ethical approval was obtained from the ethical review committee of Tigrain Health Institute and the Tigray Regional Health Bureau, which was confirmed to the principles embodied in the Declaration of Helsinki. Official permission was also obtained from the principals of the health facilities before approaching the study participants. The objective and purpose of the study were clearly explained to the study subjects to obtain written informed consent before data collection. Participants were also informed that they can discontinue or decline to participate in the study at any time. Confidentiality of the information was maintained and the data were recorded anonymously throughout the study. The potential subject must be informed of the right to refuse to participate in the study or to withdraw consent to participate at any time without reprisal.

### Consent for publication

Tigrain Health Institute, the Tigray Regional Health Bureau, and participants are for this section.

### Availability of data and material

All availability of data and material is attached to the manuscript.

### Competing interests

The authors declare that they have no competing interests regarding employment or voluntary involvement; collaborations with advocacy groups relating to the content of the article; grants from an entity paid to the author or organization; personal fees received by the author/s as honoraria, royalties, consulting fees, lecture fees, testimonies, etc.; patents held or pending by the authors, their institutions or funding organizations, or licensed to an entity whether earning royalties or not; involvement in legal action related to the work.

## Authors' Contributions

AT had made substantial contributions to the conception, design of the work; GM had the acquisition, analysis, interpretation of data; WM had a contribution to the creation of new software used in the work; have drafted the work or substantively revised it. The authors have approved the submitted version (and any substantially modified version that involves the author's contribution to the study); and to have agreed both be personally accountable for the author's contributions and to ensure that questions related to the accuracy or integrity of any part of the work, even ones in which the author was not personally involved, are appropriately investigated, resolved, and the resolution documented in the literature. All authors have read and approved the manuscript.

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