



Prevalence, Awareness, and the Response of the General Population Towards Covid-19 in 2023

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ABSTRACT

The COVID-19 pandemic, initiated by the SARS CoV-2 virus, originated in Wuhan, China, in December 2019 and swiftly transcended international borders, impacting nearly every nation. While Pakistan faced significant challenges due to the virus, the country effectively managed the crisis through stringent and well-regulated measures. This study aimed to assess the prevalence, awareness levels, and community response to COVID-19 among the residents of the Muzaffarabad district of Azad Jammu and Kashmir, Pakistan. Conducted as a cross-sectional survey, this research covered each union council within the Muzaffarabad district, utilizing both primary and secondary data sources. Primary data were collected through a comprehensive questionnaire (see Annexure I), complemented by secondary data obtained from the District Health Office Muzaffarabad and Abbas Institute of Medical Sciences. Data analysis employed GraphPad Prism software, utilizing multiple linear regression and the Chi-square test for quantitative data. The findings revealed an overall COVID-19 prevalence of 10.3% (from secondary data) and 11.3% (from primary data) in Muzaffarabad, with a notable prevalence of 18.2% observed in individuals aged 71 and above. Union council Domel exhibited the highest prevalence at 25.8%, with the Malik tribe reporting the highest prevalence (25%) among various tribes. Minor variations in prevalence were observed between male (10.6%) and female (10.2%) participants. Notably, the recovery rate was high at 98.66%, overshadowing the mortality rate of 1.34%. Regarding knowledge and attitudes, 78.2% of the study population demonstrated accurate knowledge about COVID-19, while 80.4% exhibited positive attitudes toward the pandemic. Despite the low incidence of COVID-19 in Muzaffarabad, the study underscores the importance of ongoing public outreach and education efforts. Additionally, the community's response to the pandemic varies, with some implementing preventive strategies like mask-wearing and social distancing, while others face challenges due to socioeconomic constraints. It is recommended that health authorities continue their efforts to enhance awareness and ensure equitable access to resources, with the ultimate goal of completely eliminating COVID-19 from the region. This study contributes valuable insights into the dynamics of the pandemic in Muzaffarabad and emphasizes the need for sustained public health interventions.

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AR, SF, and SAK played key roles in the study design, sampling, experimentation, results analyses, and manuscript writing. ARA contributed to the study design, methods setting, and manuscript writing. MZL actively participated in the study design, sampling, experimentation, results analyses, and manuscript writing. GD contributed to the methodology setting, manuscript drafting, and reviewing. BS contributed in results analysis, manuscript writing, and manuscript reviewing. MMA and AAA were involved in methods development and manuscript writing. NEALH contributed to results analysis and manuscript writing, while ZI and ZUR participated in results analysis and manuscript review writing. ZA and MT contributed to manuscript writing and reviewing. All authors have read and approved the final version of the manuscript.

Key words

Covid-19, Corona virus, Covid-19 in 2023, Community response about Covid-19, Prevalence of Covid-19 in AJ and K, Awareness about Covid-19

INTRODUCTION

Public health faces severe threats from pandemics, causing widespread political and social upheavals. COVID-19, denoted by CO for corona, VI for virus, D for disease, and 19 for the year of emergence, has emerged as a global risk, impacting nations irrespective of their development status (Huang *et al.*, 2020). Respiratory viruses, identified as CoVs, were initially discovered in

1962 in patients with respiratory tract infections (Sahin *et al.*, 2019). The WHO reported the SARS-CoV pandemic in 2002–2003, causing over 8000 infections and 774 fatalities. In 2012, MERS-CoV struck, infecting 2494 and resulting in 858 deaths worldwide (World Health Organization, 2004, 2013).

COVID-19, also known as the novel CoV sickness and SARS-CoV-2, poses a significant global health risk (Fisher and Heymann, 2020). From the common cold to severe respiratory distress syndrome, it induces various respiratory diseases (Heymann and Shindo, 2020). The virus's crown-like appearance, from which it gets its name Corona, is due to proteinic spikes protruding from its periphery (Kang *et al.*, 2020). In December 2019, China discovered a new coronavirus, SARS-CoV-2, swiftly spreading globally (Lai *et al.*, 2020). Termed COVID-19 by the WHO, it is distinct from SARS-CoV and MERS-CoV (Wu *et al.*, 2020; Zhou *et al.*, 2020). SARS-CoV-2, with a high fatality rate, affects more people than its predecessors (Guarner, 2020; Wu and McGoogan, 2020).

The Nidovirales order, housing Coronaviridae, Arteriviridae, and Roniviridae families, contains the most viruses, including corona viruses (Chen *et al.*, 2020). Coronaviridae has two subfamilies, Torovirinae and Coronavirinae, genetically classified into Alpha coronaviruses, Beta coronaviruses, Gamma coronaviruses, and Delta coronaviruses (Weiss and Leibowitz, 2020; Li, 2016; Schwartz and Graham, 2020). SARS-CoV-2 belongs to the Betacoronavirus cluster, sharing lineage with SARS-CoV and MERS-CoV (Zhu *et al.*, 2020; Altaf *et al.*, 2022). Coronaviruses, causing respiratory, enteric, and neurological diseases, are zoonotic viruses (Weiss and Martin, 2005; World Health Organization, 2020). SARS-CoV-2, genetically identical to SARS-CoV, enters cells through ACE 2, similar to its precursor (Zhou *et al.*, 2020).

The origins of SARS-CoV-2 remain unknown, with genetic analyses indicating its connection to bat-derived SARS-CoV-like variants (World Health Organization, 2020; Zhu *et al.*, 2020; Rehman *et al.*, 2023). The virus shares lineage B in the subgenus Sarbecovirus (Chen *et al.*, 2020). As a pandemic, COVID-19 affects all age groups, with a 10% mortality rate (Aghdam *et al.*, 2020). Ongoing research seeks to unveil the virus's mysteries, providing insights into its transmission and prevention strategies.

SARS-CoV-2 variants undergo classification into clades and lineages (Koyama *et al.*, 2020; Rambaut *et al.*, 2020). The World Health Organization (WHO), in collaboration with GISAID, Nextstrain, and Pango, has established naming systems for identification and monitoring. A WHO convened specialist panel recommends utilizing Greek Alphabetic characters like Alpha (α), Beta (β), Delta (δ), and Gamma (γ) to designate

variants. This decision aims to enhance recognition and facilitate discussions among non-scientific audiences (World Health Organization, 2021).

While the exact transmission processes remain unclear, airborne diffusion and human-to-human transmission are likely (ECDC, 2020; Wax and Christian, 2020). Similar to SARS-CoV, which spreads from bats to humans via palm civets or dromedary camels (Cui *et al.*, 2019; Wu *et al.*, 2020), the revival of an infected animal or exposure to laboratory strains can result in human infections and subsequent human-to-human spread (Poon *et al.*, 2004). SARS transmission occurs through infecting mucous membranes (eyes, nose, and mouth) via direct or indirect contact with infected respiratory droplets or fomites. The risk increases with proximity and duration of contact with infected individuals (Lau *et al.*, 2004). The survival duration of SARS-CoV-2 remains uncertain. Studies suggest maximum survival times of about two weeks in dehydrated conditions and five days at 22–25 °C with 40–50 percent moisture content for SARS-CoV, with viability declining afterward. Viability is notably reduced after a day at 38 °C with 80–90 percent moisture content (Chan *et al.*, 2011). The pathogen remains present for two days at 20°C with 40% moisture content, decreasing to 480 minutes at 30°C with 80 percent moisture content (ECDC, 2020; Doremalen *et al.*, 2013).

As of May 6, 2022, COVID-19, has affected 226 states and territories, as reported by Worldometer (2022). On a global scale, the World Health Organization (WHO) has documented 513,955,910 confirmed cases and 6,249,700 fatalities due to COVID-19 (World Health Organization, 2022). To combat the pandemic, Pakistan, constrained by limited financial and resource capabilities, has implemented stringent limitations. The country's overall recovery rate stands at 92%, with Punjab province exhibiting an even higher recovery rate of 91% (Nawaz *et al.*, 2020). Despite the availability of vaccines, Pakistan faces challenges in immunization acceptance, with a 67% acceptance rate according to the Center for Communication Program at John Hopkins University's study on COVID-19 knowledge, attitudes, and practices. The Vaccine Confidence Project attributes the rise in anti-vaccination sentiments in Pakistan, from 2% to 4%, to unrest and anti-vaccine religious leadership (MacPherson, 2020). Pakistan reports a COVID-19 fatality rate of 1.3% and a recovery rate of 4.8% (Government of Pakistan, 2020).

In India, Singh *et al.* (2022) observed that over half of the study population demonstrated a high level of knowledge (58.6%) and a positive attitude (62.1%). Notably, educational attainment exhibited a significant impact on both knowledge and attitude dimensions.

The study indicates a moderate level of COVID-related knowledge, attitudes, and practices among the Indian population. In Afghanistan, [Sirat et al. \(2023\)](#) found that university students exhibited desirable levels of overall knowledge and attitudes regarding COVID-19. Factors such as higher university year, younger age, male gender, and urban residency were significantly associated with favorable knowledge, attitudes, and practices concerning COVID-19. They recommend increasing good practices through awareness programs. Turning to Bangladesh, [Banik et al. \(2020\)](#) emphasized the urgent need for a comprehensive awareness-raising program via mass media, the Internet, and social media. This program aims to actively engage the general population in understanding the gravity of the COVID-19 outbreak and their role and responsibility in alleviating its severity.

To date, no study has explored the prevalence of COVID-19 in the general population of Azad Jammu and Kashmir or the public's response to the virus. However, [Khan et al. \(2021\)](#) conducted a cross-sectional study in Azad Kashmir, Pakistan, revealing that a majority of healthcare professionals (HCPs) perceive COVID-19 as a serious health concern. Despite this, most HCPs lack adequate training for the current pandemic and express dissatisfaction with personal protection, workload, and wages. Similarly, [Ehsan et al. \(2022\)](#) conducted a multicentre survey in Azad Kashmir, identifying 4,776 healthcare workers in AJK. Among them, 2,219 individuals tested positive for COVID-19, with 118 being healthcare workers. The risk of contracting the disease was notably higher among frontline healthcare workers compared to the general population. Additionally, the severity of infection was more pronounced in patients with co-morbidities, and among healthcare workers, physicians comprised the highest number of COVID-19 cases.

As of July 23, 2022, Pakistan's population is 229,688,733, as per the latest United Nations data analyzed by [Worldometer \(2022\)](#). WHO reports 1,547,795 confirmed cases of COVID-19 in Pakistan with 30,452 fatalities, as of July 22, 2022. The country has administered a total of 315,115,088 vaccine doses by July 18, 2022 ([World Health Organization, 2022](#)). Vaccination coverage stands at 66.7% for persons fully vaccinated with the last dose of the primary series per 100 populations, and boosted individuals per 100 populations are at 14.2% ([WHO, 2022](#)).

The objective of this study was to assess the geographic distribution, lethality, and prevalence of COVID-19 among residents of Muzaffarabad district. Additionally, the research aimed to gauge the community's response and awareness regarding COVID-19, including their knowledge, perceptions, and attitudes toward the

disease in the population of district Muzaffarabad, Azad Jammu and Kashmir. This study is a crucial step towards contributing to the control of the pandemic in the region.

MATERIALS AND METHODS

Study area

The study was conducted in district Muzaffarabad, Azad Kashmir. The district Muzaffarabad is divided into two tehsils, (1) Muzaffarabad Tehsil, and (2) Pattika Tehsil. Muzaffarabad district is 1,642 square kilometres (634 square miles) in area and 737m above sea level. The district is bordered by the Neelum District in the north, the Kupwara and Baramulla districts of Indian-occupied Jammu and Kashmir in the east, and the Khyber Pakhtunkhwa (Province of Pakistan) in the west.

Study design

By keeping in view, the time constraints and availability of data, a cross-sectional, analytical, and observational research investigation was carried out in district Muzaffarabad, Azad Jammu and Kashmir from February 2023 to July 2023.

Inclusion and exclusion criteria

The data of population subjected to COVID-19 test was collected from District Health office and Abbas Institute of Medical Sciences. The primary data were collected from general population of district Muzaffarabad, Azad Kashmir. Population under the age of 12 were not included in this study.

Data type, sources, and sequence of questions

A well-structured questionnaire was designed for gathering the required data. The questionnaire comprised of closed ended questions. Quantitative data were used in this study. Both primary as well as secondary data were used in the study. Primary data were collected through questionnaire while secondary data were obtained from District Health Office Muzaffarabad and Abbas Institute of Medical Sciences. In this study, questions were written simply to prevent respondents from being puzzled and were presented in a clear order to make it easy for participants to select the appropriate response.

Sample size

The sample size was calculated using Rao-Soft software. The power was maintained at 80%, the response distribution was 50%, although the 95% confidence interval was chosen, and the error margin was 5%. The total population of the district of Muzaffarabad, according to the 2017 population census, was 650,370. Through

calculation, the recommended minimum population size was found to be 384 by using Rao-Soft software. The individuals below age 12 were excluded from the study.

Method of sampling and statistical analysis

In this study, data was collected through random sampling within the time period of study. The data obtained from the sources was analyzed quantitatively. The data was analyzed by using GraphPad Prism (version 7.4) software. The significance of data was checked by using appropriate statistical tests. The log normality tests were used for age and sex. Multiple linear regression analysis of COVID-19 with age, sex, and marital status was also used. The parametric covariance analysis was also used for different variables such as age, gender and marital status. The Chi-square test was also used to check union council wise correlation between sex and COVID-19 prevalence, and caste wise correlation between sex and COVID-19 prevalence.

RESULTS

Age distribution of the participants and prevalence of Covid-19

In the current study, there were 775 participants overall, the minimum age in the study population was 12, the maximum age was 85, the range was 73.00 and the mean age was found 35.82. The standard deviation was 16.17, the standard error of the mean was calculated 0.5808, the lower limit was 34.68, the upper limit was 36.96 and the coefficient of variation was 45.13%. In the present study, the prevalence of COVID-19 among the participants was also calculated on the basis of age groups. Highest COVID-19 prevalence was found in the age group above 71 which was 18.2%. However 12.5% COVID-19 positive individuals were found in 32-51 years age group and 9% COVID-19 prevalence was found in both the age group 12-31 Years and 52-71 Years given in Table I.

Table I. Age wise COVID-19 prevalence among the participants.

Age groups	Total participants	COVID-19 positive individuals
12-31 years	376	34(9%)
32-51 years	255	32(12.5%)
52-71 years	133	12(9%)
Above 71 years	11	2(18.2%)

Knowledge assessment of the participants about Covid-19

In the present study, the evaluation of participants' knowledge of COVID-19 was one of the goals. Each candidate completed a thorough knowledge assessment form with numerous questions. Table II shows the percentages of responses given by candidates. According to the data, 82.6% of candidates believe that the cause of COVID-19 is a virus, 2.9% of respondents say that it is bacteria, 0.4% say that it is fungi, and 14.1% of people have no information about the cause of COVID-19. Among the study population, 99.48% of participants were aware of the word COVID-19, while 0.26% were unaware and 0.26% had no idea about it. From the data, we have found that 93.935% of participants believe that the COVID-19 virus spreads through respiratory droplets, but 2.84% of participants in a study population were not sure about it. 88.9% of respondents say that COVID-19 is an airborne disease, 4.8% say that it is not an airborne disease, and 6.3% were not sure. Out of 775 participants, 84.26% believe that COVID-19 is a contagious disease, 6.58% don't believe it, and 9.16% of the study population were sure about it. 71.61% of individuals respond that the coronavirus can be transmitted by blood transfusion from a person infected with COVID-19 disease. 13.29% of respondents do not agree with the statement, while 15.1% have no idea about it. 98.19% of participants agree that the main symptoms of the coronavirus are fever, cough, flu, and body pain. 0.51% do not agree with it, while 1.3% of respondents have no information. 49.16% of participants believe that people with COVID-19 cannot pass on the virus if they don't have symptoms, while 25.03% of respondents disagree with the statement and 25.93% have no idea.

According to 78.70% of the study population, currently there is no effective treatment for COVID-19, 12.13% said there is treatment for COVID-19, and 9.61% of the participants have no information about it. About 27.48% of the study population believes that Not every person infected with the coronavirus develops into a severe condition. 64.52% do not believe it, and 8% have no information. 8.26% of participants said that it is not essential for children and young people to take protective measures to prevent the COVID-19 infection, and 88% said that it is not true, while 3.74% of participants were unaware of it. 37.16% of individuals respond that direct contact with animals causes COVID-19 disease. 34.97% of participants rejected the statement, and 27.87% had no information. 94.97% of the study population believes that COVID-19 is a preventable disease, 2.45% say that it is not preventable, and 2.58% don't know. COVID-19 is completely curable, according to 15.7% of participants, 72.8% believe it is not curable, and 11.5% have no idea.

Table II. The percentage estimate of knowledge of study population about Covid-19.

Statement	Virus	Bacteria	Fungi	No information
Cause of COVID-19 is?	640(82.6%)	23(2.9%)	3(0.4%)	109(14.1%)
Statement		Yes	No	Not sure
Have you ever heard the word COVID-19?		771(99.48%)	2(0.26%)	2(0.26%)
COVID-19 virus spreads through respiratory droplets.		728(93.935%)	22(2.84%)	25(3.225%)
COVID-19 virus is an airborne disease.		689(88.9%)	37(4.8%)	49(6.3%)
Is COVID-19 virus a contagious disease?		653(84.26%)	51(6.58%)	71(9.16%)
Do you think that coronavirus could be transmitted via blood transfusion from a person with COVID-19 disease?		555(71.61%)	103(13.29%)	117(15.1%)
Main symptoms of coronavirus are fever, cough, flu and body pain.		761(98.19%)	4(0.51%)	10(1.3%)
Person with COVID-19 cannot pass on the virus to others if they don't have symptoms?		381(49.16%)	193(25.03%)	201(25.93%)
Currently, there's no effective treatment for COVID-19 virus.		610(78.70%)	94(12.13%)	71(9.16%)
Not every person infected with coronavirus develops into severe condition. Only those who are old and chronically ill can have serious problems?		213(27.48%)	500(64.52%)	62(8%)
It is not essential for children and young person to take protective measures to prevent the COVID-19 infection.		64(8.26%)	682(88%)	29(3.74%)
Direct contact with animals causes COVID-19 disease.		288(37.16%)	271(34.97%)	216(27.87%)
Do you think COVID-19 is a preventable disease?		736(94.97%)	19(2.45%)	20(2.58%)
Do you think COVID-19 is completely curable?		122(15.7%)	564(72.8%)	89(11.5%)
Do you think that wearing face mask and washing hands with soap can completely protect you from COVID-19 disease?		666(85.935%)	56(7.225%)	53(6.84%)
Do you follow SOP's for COVID-19 recommended by health department?		745(96.13%)	19(2.45%)	11(1.42%)
Do you think COVID-19 disease can be detected by a laboratory test?		409(52.8%)	108(13.9%)	258(33.3%)
Do you think COVID-19 can be prevented by COVID-19 vaccine?		654(84.4%)	46(5.9%)	75(9.7%)
Do you think COVID-19 vaccines increase the risk of COVID-19?		36(4.6%)	664(85.7%)	75(9.7%)
Have you been tested for COVID-19 disease?		241(31.1%)	532(68.6%)	2(0.3%)
Did you have positive result for COVID-19?		80(10.3%)	692(89.3%)	3(0.4%)

Wearing a face mask and washing your hands with soap can completely protect you from COVID-19 disease, according to 85.935% of participants, while 7.225% believe it is not true and 6.84% have no information. 96.13% of the study population follows the SOP's for COVID-19 recommended by the health department, 2.45% don't follow the SOP's, and 1.42% of participants have no information. 52.8% of the study population thinks COVID-19 disease can be detected by a laboratory test. 13.9% of the participants gave the opposite response, and the remaining 33.3% were not sure. 84.4% of individuals think COVID-19 can be prevented by the COVID-19 vaccine, 5.9% think that it cannot be prevented by the COVID-19 vaccine, and 9.7% of the participants have no information. 4.6% of participants think COVID-19 vaccines increase the risk of COVID-19, while 85.7% believe that it is not true, and 9.7% of individuals have no

idea about the statement. 31.1% of the study population have been tested for COVID-19, 68.6% have not been tested, and 0.3% of the individuals are not sure. 10.3% of the study population gets a positive result for COVID-19, while 89.3% don't get a positive result, and 0.4% of the participants are not sure.

According to our findings, the general population of Muzaffarabad has a high level of knowledge. The study shows that, out of a total of 775 participants, 78.2% had more accurate knowledge about COVID-19, while 11.3% were found to have false knowledge, and 10.5% had no knowledge about the disease. According to the results, only 31.1% of the study population has been tested against COVID-19 which was quite low. The research shows that the spread of COVID-19 in the district of Muzaffarabad is very low. According to our assessment, only 10.3% of the study population became ill with COVID-19.

Table III. Assessment of attitude/perception toward Covid-19 of the participants which shows the mentality level of respondents towards Covid-19.

Statement	Agree	Disagree	Not sure
The coronavirus is a manmade scam.	44(5.7%)	648(83.6%)	83(10.7%)
COVID-19 is not deadly; it is just a normal flu.	51(6.6%)	682(88%)	42(5.4%)
The Coronavirus is made to reduce the global population.	45(5.8%)	617(79.6%)	113(14.6%)
COVID-19 virus is a bioweapon manufactured by United Nation.	29(3.7%)	598(77.2%)	148(19.1%)
Some power made the Coronavirus to take the global control.	33(4.26%)	593(76.52%)	149(19.22%)
Pharma industries created COVID-19 to get profit from vaccines.	55(7.1%)	547(70.6%)	173(22.3%)
COVID-19 is not a real disease.	43(5.5%)	684(88.3%)	48(6.2%)
Coronavirus is not a dangerous disease.	37(4.8%)	689(88.9%)	49(6.3%)
Corona is a myth spread to stop the Tawaaf.	65(8.4%)	615(79.35%)	95(12.25%)
Technology companies created Coronavirus to make money out of the pandemic?	48(6.2%)	555(71.6%)	172(22.2%)

Attitude/perception towards Covid-19

Attitude and perception toward COVID-19 were evaluated using questionnaires that were filled out by each participant. Data regarding attitude/perception toward COVID-19 was obtained from each participant and is shown in Table III. Out of a total of 750 participants, 5.7% of the participants said that COVID-19 is a man-made scam. 83.6% of the participants believe that COVID-19 is not a man-made scam, and 10.7% were unaware. 6.6% of the participants perceive that coronavirus is the normal flu; it is not deadly. 88% responded that this is not true about COVID-19, while 5.4% of the participants were not sure about the statement. 5.8% of the study population thinks that the coronavirus is made to reduce the world's population. 79.6% of the respondents disagreed with the statement, and 14.6% of the participants were not sure. 3.7% of the participants think that the COVID-19 virus is a bioweapon manufactured by the United Nations. 77.2% of the respondents don't believe that statement, and 19.1% of the participants have no idea about this statement. 4.26% of individuals in a study population think that the coronavirus was made to take global control and 76.52% of the study population refuses the statement.

However, 19.22% of participants have no certainty about the statement. 7.1% of the study population was found with the mentality that medicinal companies created the coronavirus to get money from the vaccines, and 70.6% of the participants believed that this statement was only a misconception, while 22.3% of the population was found to be not sure about the statement. Out of 775 participants in a study population, 5.5% believed that COVID-19 was not a real disease. However, 88.3% of the participants believe that it is a real disease, and 6.2% of the individuals are not sure. 4.8% of the study population thinks that COVID-19 is not a dangerous disease, while

88.9% of the study population was found with the mindset that COVID-19 is a dangerous disease, and 6.3% of respondents said that they are not sure about the statement. 8.4% of the individuals were found to believe that Corona is a myth which was spread by some non-Muslims to stop the religious ritual of the Tawaaf, while 79.35% of the participants disagreed with the statement, and 12.25% of the participants were found to be not sure. 6.2% of those who believed that coronavirus was a money-making scheme devised by technology companies, but 71.6% of those who were disagreed, and 22.2% were unsure.

According to the whole assessment, we conclude that the people of District Muzaffarabad do not believe in rumors and show more positive attitudes and perceptions towards COVID-19 disease. We have found that out of a total of 775 participants in our study population, 80.4% of the participants have a positive attitude and perceptions towards COVID-19 disease. However, 5.8% of the participants believed these rumors and showed more negative attitudes and perceptions towards COVID-19 disease, while 13.8% of the participants had no idea about the disease and all these rumors.

Union council wise correlation between sex and Covid-19 prevalence

One of the targets of the present study was to document the prevalence of COVID-19 in all the union councils of the district of Muzaffarabad. The information was gathered from all of the union councils in the Muzaffarabad district. From each of the union councils that took part in the study, 31 volunteers were chosen. In the present study, Union Council Domel was found with the highest number of COVID-19 infected individuals, which was 25.8%. After union council Domel, union council Bheri, and union council Katkair were found with 22.6% infected

individuals. In union council Sarli Sacha, 19.4% of people were found infected with COVID-19. The prevalence of COVID-19 was found to be similar in the union councils of Jhandgran, Gojra, Dana, Talgran, and Machiara, and the estimated COVID-19 prevalence rate in these union councils was 16.1%. Union Council Muzaffarabad and Union Council Ghorli both had 12.9% of the affected people. Union Council Panjgran, Kumikot, Kai Manja, and Saidpur were found with a 9.7% prevalence rate of COVID-19.

In union council Heerkotli, 6.5% of people had a positive result for COVID-19. 3.2% COVID-19 prevalence was found in union councils in Balgran, Therian, Langarpura, Hattian Dopata, and Chattar Klass. The prevalence of COVID-19 was found to be zero in union councils Panjkot, Maira Kalan, Charakpura, and

Nora Seri among the 31 participants from each of the union councils who participated in the study. There were 775 participants in total, 376 of whom were men and 399 of whom were women. The data of our work revealed that out of 376 male participants, only 40 got infected, which is 10.6% of the male participants, and out of 399 female participants, only 40 got the disease, which is 10.2% of the total female participants. This data shows that there is a minor difference in the prevalence of COVID-19 among male and female participants.

The two-tailed chi-square test at $p < 0.05$ with 95% CI was calculated to find out the correlation between gender and COVID-19 prevalence in various union councils of district Muzaffarabad. The results show that there is no significant relationship between sex and COVID-19 prevalence. Complete details are given in [Table IV](#).

Table IV. UC- wise correlation between sex and Covid-19 prevalence.

Names of UCs	Total participants	Overall Covid-19 prevalence (%)	Gender distribution		COVID-19 Positive		COVID-19 Negative		Two tailed chi-square test at $p < 0.05$ with 95% CI		
			M	F	M	F	M	F	P value	Odds ratio	Relationship b/w sex and COVID-19 prevalence
Domel	31	8(25.8%)	13	18	5	3	8	15	1.16	2.50	Not significant
Bheri	31	7(22.6%)	17	14	4	3	13	11	0.88	1.12	Not significant
Katkair	31	7(22.6%)	17	14	5	2	12	12	1.00	0.31	Not significant
Sarli sachha	31	6(19.4%)	20	11	4	2	16	9	0.90	1.12	Not significant
Jhandgran	31	5(16.1%)	11	20	1	4	10	16	0.62	0.40	Not significant
Gojra	31	5(16.1%)	14	17	3	2	11	15	0.46	2.04	Not significant
Dana	31	5(16.1%)	15	16	1	4	14	12	0.16	0.21	Not significant
Talgran	31	5(16.1%)	18	13	2	3	16	10	0.37	0.41	Not significant
Machiara	31	5(16.1%)	9	22	1	4	8	18	0.62	0.56	Not significant
Muzaffarabad	31	4(12.9%)	13	18	1	3	11	16	0.54	0.48	Not significant
Ghorli	31	4(12.9%)	8	23	2	2	6	21	0.23	3.50	Not significant
Panjgran	31	3(9.7%)	15	16	1	2	14	14	0.58	0.50	Not significant
Kumikot	31	3(9.7%)	16	15	2	1	14	14	1.00	1.00	Not significant
Kai manja	31	3(9.7%)	15	16	3	0	12	16	0.05	9.24	Not significant
Saidpur	31	3(9.7%)	15	16	2	1	13	15	0.50	2.30	Not significant
Heerkotli	31	2(6.5%)	17	14	0	2	17	12	0.10	0.14	Not significant
Balgran	31	1(3.2%)	19	12	1	0	18	12	0.41	2.02	Not significant
Therian	31	1(3.2%)	13	18	0	1	13	17	0.38	0.43	Not significant
Langarpura	31	1(3.2%)	15	16	1	0	14	16	0.29	3.41	Not significant
Hattian Dopata	31	1(3.2%)	15	16	0	1	15	15	0.32	0.33	Not significant
Chattar Klass	31	1(3.2%)	23	8	1	0	22	8	0.54	1.13	Not significant
Panjkot	31	0	21	10	0	0	21	10	--	--	N/A
Maira Kalan	31	0	17	14	0	0	17	14	--	--	N/A
Charakpura	31	0	9	22	0	0	9	22	--	--	N/A
Nora seri	31	0	11	20	0	0	11	20	--	--	N/A
Total	775	80 (10.3%)	376	399	40 (10.6%)	40 (10.2%)	336 (90.4%)	359 (90.8%)	0.77	1.06	Not significant

Caste wise correlation between sex and Covid-19 prevalence

There were 775 participants in the current study, and they came from 16 different tribes. Out of 16 total people in the Malik caste, 4 or 25% were found to be COVID-19 positive, which is the highest percentage among caste given in Table V. There are total 18 participants who belongs to Butt caste, 4(22.22%) participants were COVID-19 positive individuals out of 18. The Jaghwal caste ranked third with 1(20%) COVID-19 positive participant out of a total of 5 participants. 4(14.81%) were found positive for COVID-19 in the Qureshi caste out of 27 total individuals. Out of 211 total participants, Rajpoot caste had a COVID-19 prevalence of 19 (9.004%). We also discovered 1 (14.28%) COVID-19 prevalence in Khokhar caste out of 7 respondents, 7 (14%) in Mir caste out of 82 participants, and 11 (13.41%) in Awan caste out of 82 participants, 10.2% and 10. COVID-19 prevalence was found in Abbassi and Syed castes respectively, 8.6% in Sheikh caste, 8.47% in Mughal caste, 8.33% in Chaudary caste, 8% in Khawaja caste, 4.16% in Khan caste, and found no prevalence in Kayani caste. Some of the tribes (Minhas, Usmani, Hashmi, Sardar, Khiljee, Chishti, Satti, Rana, and Mogry) had a very low number of participants

included collectively in the special cluster mentioned as others. However, further details about COVID-19 prevalence are given in Table V. The two-tailed chi-square test at $p < 0.05$ with 95% CI was calculated to find out the correlation between gender and COVID-19 prevalence in various tribes of Muzaffarabad. The results show that there is no significant relationship between sex and COVID-19 prevalence.

Overall Covid-19 prevalence among the population of district Muzaffarabad AJ and K

The secondary data collected from the District Health Office, Muzaffarabad in and the Abbas Institute of Medical Sciences revealed an overall COVID-19 prevalence among the population of district Muzaffarabad AJ and K as shown in Table VI. According to the data, 92740 individuals were being tested for COVID-19 viral RNA through real-time PCR. Of these, 11.3% of individuals were found positive for the COVID-19 RNA. Of all the infected participants, 1.34% were not able to tolerate the disease burden and they died. 98.66% of participants were found to have successfully recovered from the COVID-19 infection with the help of available treatment at different treatment centres in Muzaffarabad.

Table V. Caste wise correlation between sex and Covid-19 prevalence.

Names of caste	Total participants	Overall Covid-19 prevalence (%)	Gender distribution		COVID-19 positive		COVID-19 negative		Two tailed chi-square test at $p < 0.05$ with 95% CI		
			M	F	M	F	M	F	P Value	Odds Ratio	Relationship b/w sex COVID-19 prevalence
Abbassi	59	6(10.2%)	27	32	4	2	23	30	0.39	2.60	Not Significant
Awan	82	11(13.41%)	43	39	5	6	38	33	0.74	0.72	Not Significant
Butt	18	4(22.22%)	10	8	3	1	7	7	0.58	3.00	Not Significant
Chaudary	72	6(8.33%)	42	30	2	4	40	26	0.22	0.32	Not Significant
Jaghwal	5	1(20%)	4	1	1	0	3	1	1.00	1.28	Not Significant
Kayani	8	0(0.0%)	6	2	0	0	6	2	--	--	N/A
Khan	24	1(4.16%)	15	9	1	0	14	9	1.00	1.96	Not Significant
Khawaja	25	2(8%)	6	19	0	2	6	17	1.00	0.53	Not Significant
Khokhar	7	1(14.28%)	3	4	0	1	3	3	1.00	0.33	Not Significant
Malik	16	4(25%)	10	6	4	0	6	0	--	--	N/A
Mir	50	7(14%)	24	26	5	2	19	24	0.23	3.15	Not Significant
Mughal	59	5(8.47%)	25	34	2	3	23	31	1.00	0.89	Not Significant
Qureshi	27	4(14.81%)	13	14	2	2	11	12	1.00	1.09	Not Significant
Rajpoot	211	19(9.00%)	103	108	5	14	98	94	0.08	0.37	Not Significant
Sheikh	35	3(8.6%)	20	15	3	0	17	15	0.11	6.20	Not Significant
Syed	60	6(10%)	18	42	2	4	16	38	0.85	1.18	Not Significant
Others	17	0	7	10	0	0	7	10	--	--	N/A

Table VI. Overall COVID-19 prevalence among the population of district Muzaffarabad.

Total tests through real-time PCR	Number of COVID-19 positive	Total deaths due to COVID-19	Recovered patients from COVID-19 infection
92740	10438(11.3%)	140 (1.34%)	10298 (98.66%)

DISCUSSION

[Khattak et al. \(2021\)](#) carried out an online cross-sectional study and revealed that 734 out of 1,000 respondents who were asked to take part in the research. The number of responses was 734/1,000, or 73.4%. There was a strong correlation between the mean knowledge and the gender, marital status, education, and place of living. 94.5% (n= 700) of the study participants, as well as 96.7% (n= 710) of those with chronic illnesses or serious consequences, believed that COVID-19 would be more risky in elderly people (p = 0.00). 52.5% (n = 385) of the participants expressed anxiety about getting the infection for themselves or a member of their family. More than 98% of the participants (n = 703), with a P-value of 0.00, believed that COVID-19 will be successfully controlled in by following governmental guidelines. [Kasemy et al. \(2020\)](#) conducted a study in Egyptian population to assess their knowledge attitude and practice toward Covid-19, the results show that in Egyptians 70.2% showed good knowledge, 75.9% positive attitude and 49.2% had practices towards Covid-19 to protect themselves from disease. These studies show results contrary to our results because we conducted our work in very small population size and demographic location where the time period for research was also limited were also the reason for contradiction.

The participants attitudes and perspectives towards COVID-19 were assessed through a questionnaire. Each participant's attitudes and perceptions of COVID-19 were recorded. According to the whole assessment we assess that the peoples of district Muzaffarabad does not believe on rumors and show more positive attitude and perceptions towards COVID-19 disease. We have found that out of total 775 participants in our study population, the responses of 80.4% participants shows that they have positive attitude and perceptions towards COVID-19 disease. However, 5.8% of the participants believed on rumors and show more negative attitude and perceptions towards COVID-19 disease, while 13.8% participants have no idea about the disease and all these rumors. As compared to this, a study was conducted by [Ladiwala et al. \(2021\)](#), and they stated that 1200 individuals from a variety of backgrounds, including age and education, took part in the survey. The majority of respondents (93.3%) had adequate

knowledge (mean: 6.59 1.35) and good perception (mean: 4.29, 0.82). Considerable disparities in knowledge and perception were seen between students and employees in the healthcare and non-healthcare departments, as well as between genders, age groups, and educational levels. A greater level of education and being a woman were found to be important predictors of having enough knowledge and perception in a multivariate analysis. Similarly, another study was conducted by [Tomar et al. \(2020\)](#) with regard to 7978 participants, the total knowledge, attitude, and practice rating was subsequently 80.64%, 97.33%, and 93.8%. A large portion of the Indian populace showed prior good understanding, a positive attitude, and good practices about the COVID-19 epidemic. Bangladeshi citizens aged 12-64 who were invited through social media participated in an internet cross-sectional study from March 29 to April 19, 2020 conducted by [Ferdous et al. \(2020\)](#). The results of the study showed that, 48.3% of respondents had more precise information, 62.3% had more positive attitudes, and 55.1% had more regular acts in terms of COVID-19 prevention. The difference in results are due lack of education and demographic changes.

One of the targets of the present study was to document the prevalence of COVID-19 in all the Union councils of district Muzaffarabad. In district Muzaffarabad there are 25 union councils and the Data were taken from all the union councils. 31 volunteer participants were taken from each of the union council. In the present study, Union council Domel was found with a highest number of COVID-19 infected individuals, which were 25.8%. After union council Domel, union council Bheri and union council Katkair were found with 22.6% infected individuals. In union council Sarli Sacha 19.4% persons were found infected with COVID-19. The COVID-19 prevalence rate was found similar in union council Jhandgran, Gojra, Dana, Talgran, and Machiara. And the estimated COVID-19 prevalence rate in this union council was 16.1%. 12.9% infected individuals were found in union council Muzaffarabad and union council Ghori. Union council Panjgran, Kumikot, Kai manja, and Saidpur were found with 9.7% prevalence rate of COVID-19. In union council Heerkotli 6.5% persons have positive result for COVID-19. 3.2% COVID-19 prevalence was found in union council Balgran, Therian, Langarpura, Hattian Dopata, and Chattar Klass. Prevalence of COVID-19

were found 0% in union council Panjkot, Maira Kalan, Charakpura, and Nora seri among the 31 participants from each of the union council, who participate in the study. In contrast to our work none of the study explains UC- wise correlation between sex and Covid-19 prevalence, because these union councils were not found elsewhere.

Out of total 775 participants 376 are male and 399 are female participants. The data of our work revealed that out of 376 male participants only 40 get infected which is 10.6% of the male participants and out 399 female participants only 40 gets the disease which is 10.2% of the total female participants. The data shows that there are total 80(10.3%) of the study population was infected with the disease, out of which 40(50%) are male and 40(50%) are females. This data shows that there is a minor difference in prevalence of COVID-19 among male and female participants. According to [Ejaz *et al.* \(2021\)](#) COVID-19 was more common in males than females among confirmed samples, with a prevalence rate of 61.7% in men and 38.2% in women. This difference in prevalence of COVID-19 in male and female is due difference in geography, occupation and education level. However, the research done by [Habib *et al.* \(2020\)](#) produced results that were similar to our work. According to a survey done in Basrah Province in Southern Iraq, the average age there was 46 (median: 45), with a range of 13 to 98 years. Sex had no impact on the COVID-19 chance at all. These two investigations produce comparable findings.

In the current study the population size was 775 which were composed of the participants from 16 Tribes. Among tribes, 4(25%) individuals were found Covid-19 positive out 16 total individuals in Malik caste which is highest among all castes. Similarly, the second highest prevalence was found in Butt caste, where we found 4(22.22%) COVID-19 positive individuals out of 18 total individuals and in Jaghwal caste we found 1(20%) individual positive for COVID-19 out of 5 total individuals. According to prevalence rate of COVID-19 the Jaghwal caste was found with third highest prevalence among all other castes. 4(14.81%) were found positive for COVID-19 in Qureshi caste out of 27 total individuals. We were found Rajpoot caste with 19(9.004%) prevalence of COVID-19 out of 211 total participants. We also found 1(14.28%) COVID-19 prevalence in Khokhar caste out of total 7 respondents, 7(14%) in Mir caste out of, 11(13.41%) in Awan caste out of total 82 participants, 10.2% and 10% COVID-19 prevalence was found in Abbassi and Syed castes respectively, 8.6% in Sheikh caste, 8.47% in Mughal caste, 8.33% in Chaudary caste, 8% in Khawaja caste, 4.16% in Khan caste and found no prevalence in Kayani caste. Some of the tribes (Minhas, Usmani, Hashmi, Sardar, Khiljee, Chishti, Satti, Rana and Mogry) were having very

low number of participants included collectively in the special cluster mentioned as others. Two tailed chi-square test at $p < 0.05$ with 95% CI was calculated to find out the correlation between gender and COVID-19 prevalence in various tribes of district Muzaffarabad. The results show that there is no significant relationship between sex COVID-19 prevalence. However, in contrary to our study we found none of the study which explains the caste wise correlation between sex and Covid-19 prevalence. One of the reasons for it is that the castes found in Azad Jammu and Kashmir and Pakistan were never found in other countries.

Overall Covid-19 prevalence among the population of district Muzaffarabad AJ and K was found out from the secondary data collected from District Health Office, Muzaffarabad and Abbas Institute of Medical sciences. According the data, 92740 individuals were being tested for Covid-19 viral RNA through real-time PCR. Of these, 11.3% individuals were found positive for the Covid-19 RNA. From all the infected participants 1.34% was not able to tolerate the disease burden and they died. 98.66% participants were found successfully recovered from the Covid-19 infection with the help of available treatment at different treatment centers of Muzaffarabad. However, contrary to our work [Chatterjee \(2020\)](#) conducted a study in India, according to the Indian government; the country's overall recovery rate has increased to 77%, while the case fatality rate has decreased to 1.8%. However, in our country the recovery rate was high because of regular medication, proper isolation and Pakistan is less populated country then India that were the main reasons due to which the difference in results were found.

Comparing findings from various studies across different regions reveals distinct patterns and characteristics. In India, [Singh *et al.* \(2022\)](#) identified a moderate level of COVID-related knowledge, attitudes, and practices, with educational attainment significantly influencing these dimensions. Afghanistan, as reported by [Sirat *et al.* \(2023\)](#), demonstrated desirable levels of overall knowledge and attitudes among university students, linking factors like higher university year, younger age, male gender, and urban residency to positive outcomes. The call for increasing good practices through awareness programs aligns with the proactive approach suggested in India.

[Banik *et al.* \(2020\)](#) underscored Bangladesh's urgent need for a comprehensive awareness-raising program, emphasizing mass media, the Internet, and social media to engage the general population. This recommendation mirrors the proactive measures advocated in India and corresponds to the overarching theme of heightened awareness. Turning to Azad Jammu and Kashmir,

Pakistan, the perspectives of healthcare professionals, as highlighted by [Khan et al. \(2021\)](#) and [Ehsan et al. \(2022\)](#), emphasize the perceived seriousness of COVID-19. However, challenges in training, personal protection, workload, and wages were evident, showcasing common concerns shared across different regions. The study in Azad Jammu and Kashmir adds a granular view of the local prevalence, revealing a noteworthy 10.3% to 11.3% prevalence in Muzaffarabad. This data complements existing knowledge by providing a regional perspective. The recovery rate of 98.66% is encouraging, but the mortality rate of 1.34% highlights the persistent threat. Insights into knowledge and attitudes within the population (78.2% accurate knowledge and 80.4% positive attitudes) offer a nuanced understanding, emphasizing the need for ongoing public outreach.

Overall, these findings collectively contribute to a broader understanding of the varied impacts of COVID-19 across different regions, reflecting both common challenges and unique contextual factors. The recommendations for sustained public health interventions, awareness programs, and equitable resource distribution resonate across these diverse settings, highlighting the universality of the efforts needed to combat the pandemic effectively.

CONCLUSIONS AND RECOMMENDATIONS

In this cross-sectional study among the general population of district Muzaffarabad, COVID-19 prevalence was found to be 11.3% (according to secondary data) and 10.3% (according to primary data). The low prevalence is attributed to the predominantly rural nature of Muzaffarabad, where houses are spaced apart. Individuals aged 71 and above showed a higher susceptibility (18.2%), given compromised immune systems in the elderly. Union council Domel exhibited the highest prevalence at 25.8%, linked to overcrowded transportation and congested living conditions. The Malik tribe had the highest prevalence (25%). Minimal gender-based variation was observed (10.6% in males, 10.2% in females), indicating an even impact on both sexes. The death rate stood at 1.34%, with a recovery rate of 98.6%. Knowledge levels were at 78.2%, and positive attitudes were noted in 80.4% of participants. Despite increasing public awareness, the study suggests a need for ongoing outreach and education. The community's response varies, with some adopting preventive measures while others face challenges due to socioeconomic constraints. Continuous efforts by health authorities are crucial to ensuring awareness and equitable resource access for complete COVID-19 elimination.

DECLARATIONS

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IRB approval

This research was approved by Board of Advanced Studies and Research at University of Azad Jammu and Kashmir, Muzaffarabad under the approval number F-BASR/(82nd M)/41-48/1657-58/2022.

Ethical approval

Approval for ethical issues was obtained from Advanced-Studies and Research, Board at the University of Azad Jammu and Kashmir, Muzaffarabad.

Consent to participate

A filled and signed consent form was obtained from each participant prior to the commencement of the actual data collection, in accordance with their willingness to participate.

Data availability

The data in excel sheet are available and will be provided to the journal on demand.

Conflicts of interest

The authors have declared no conflict of interest.

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