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Review Article

Unveiling the Landscape of COVID-19 in Khyber Pakhtunkhwa: A Review on Comprehensive Regional Analysis from March 2020 to October 2022

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A B S T R A C T

Background: This comprehensive study explores the prevalence of COVID-19 patients in Khyber Pakhtunkhwa, Pakistan, spanning from March 2020 to October 2022.

Methodology: The research adopts a meticulous methodology, incorporating defined inclusion criteria and data collection from reputed sources such as government health agencies. A thorough quality assessment is applied to ensure the reliability of the included studies, and ethical considerations are upheld by using de-identified data from publicly available sources. The study provides a detailed analysis of COVID-19 cases, deaths, recoveries, and active cases in different divisions of Khyber Pakhtunkhwa, namely Peshawar, Mardan, Malakand, Hazara, Kohat, Bannu, and Dera Ismail Khan.

Results: Analysis of COVID-19 data in Khyber Pakhtunkhwa (March 2020 to October 2022) revealed localized patterns. Peshawar Division, with 104,496 cases, showcased effective control measures (3.2% fatality, 96.7% recovery). With 24,772 patients, the Mardan Division showed lower death rates but similar recovery rates (3.5%, 96.5%). Malakand Division (38,832 cases) displayed varied fatality rates (2.1%) and recovery rates (97.9%). Hazara Division (26,986 cases) recorded lower fatality rates (2.1%) and generally higher recovery rates (97.9%). Kohat Division (15,090 cases) indicated moderate fatality rates (2.1%) and high recovery rates (97.9%). Bannu Division (6,250 cases) demonstrated a moderate impact with district-wise variations. Dera Ismail Khan Division (5,820 cases) faced challenges, notably a higher fatality rate (4.8%).

Conclusion: This study underscores the necessity of region-specific data for tailoring effective pandemic responses, providing valuable insights for researchers, policymakers, and healthcare professionals engaged in managing and mitigating the impact of COVID-19 in Khyber Pakhtunkhwa. It highlights the ongoing importance of research efforts to continually refine public health strategies in response to the dynamic nature of the pandemic within different regions.

Keywords: COVID-19 Prevalence, Khyber Pakhtunkhwa, Pandemic Impact, Regional Variability, Public Health Strategies

Introduction

Coronavirus is a member of the corona viridae family. At the end of 2019, Wuhan, China's emerging commercial hub, had a coronavirus outbreak that killed over 1,800 people and infected over 70,000 during the first five days of the pandemic.[1] Chinese researchers dubbed this coronavirus the new coronavirus illness 2019 (2019-nCOV).[2] The initial severe acute respiratory syndrome coronavirus (SARS-CoV) epidemic occurred in China in 2003, and it has since spread to 29 countries, infecting around 9000 individuals with a fatality rate of more than 10%.[3] SARS-CoV-2 emerged on

December 26th, 2019, in Wuhan, China, and causes life-threatening pneumonia. It is the most deadly human coronavirus known so far.[4] The nations most afflicted by this epidemic include the United States, Brazil, Russia, Spain, the United Kingdom, Italy, France, Germany, China, India, Iran, and Pakistan.[5] The virus arrived in Pakistan on February 26th, 2020, when the Government of Pakistan publicly confirmed that a University of Karachi student with a travel history to the Islamic Republic of Iran had tested positive for COVID-19.[6] The Pakistani government halted all educational institutes in the country on March 14, 2020, followed by the closure of all shopping malls, partial lockdowns, public holidays in all other

government institutes, suspension of all public transit, and instructions to civilians to stay at home. According to the literature, this virus is opportunistic in character, attacking the elderly and patients with various co-morbidities with dire consequences, including death owing to acute respiratory distress and a cytokine storm in the body.[7]

Coronaviruses outbreak and human health

Several viral outbreaks resulting in human deaths have occurred throughout the last two decades. According to research, certain animal viruses have evolved the potential to transcend species and infect humans.[8] The first SARS-CoV epidemic, which was linked to seafood and wild animals, occurred in China in 2002.[9] Similarly, a similar pattern of infection was observed in the Middle East MERS-CoV epidemic in 2012. The experts are keen to understand more about the viral outbreak's relationship between the animal and the person. SARS-CoV and MERS-CoV viruses both gained genetic alterations that allowed them to cross species and find a new host. We had no specific treatment or vaccine for past coronaviruses, and the novel SARS-CoV-2 posed a new threat to our healthcare system. Human contact with animal life and environment, according to the researchers, may be a significant risk factor in the transmission of animal viruses into new hosts, including human. In the instance of H1N1, a similar occurrence was reported in 2009, when a cross-connection between pig, avian, and human viruses caused an influenza outbreak.[10]

Overview of the global spread of novel SARS-CoV-2

In December 2019, the new SARS-CoV-2 virus began spreading globally from the epidemic epicenter in Wuhan, China. The unique SARS-CoV-2 virus was transported by massive and frequent air travel between China, Europe, the United States, and other areas of the world. In December 2019 and early January 2020, there was substantially less surveillance, and airport monitoring methods failed to control the illness.[11] According to research findings, a distinct SARS-CoV-2 infected and asymptomatic population in Wuhan, China, transmitted more than 80% of illnesses to the rest of the world. The R0 value of new SARS-CoV-2 is 2-3, and infection continues to grow in the absence of prophylactic measures, potentially leading to a pandemic epidemic. Many nations have shown progress in decreasing infection rates and flattening the distinct SARS-CoV-2 disease curve.[12]

Internal transmission occurred because of poor testing facilities, rapid isolation, and other causes, notably in Pakistan's main cities when the bulk of overseas tourists returned home. Several studies have confirmed its transmission from person to person by direct touch and respiratory droplets.[13-15] Meteorological features, in addition to human-to-human transmission, are thought to be effective factors in viral transmission, survival, and viral dispersion across a vast geographic area. Another study discovered that humidity and temperature had an effect on COVID-19 mortality rates.[16] Clinical manifestations of 2019-nCoV infection have similarities with SARS-CoV where the most common symptoms include fever, dry cough, dyspnea, chest pain, fatigue and myalgia.[17] Less common symptoms include headache, dizziness, abdominal pain, diarrhea, nausea, and vomiting.[18] The most frequent symptoms among the first 425 confirmed cases in Wuhan are fever, dry cough, myalgia, and tiredness, with sputum production, headache, hemoptysis, stomach discomfort, and diarrhea being less common. Data from Khyber Pakhtunkhwa reported 224398 total cases, 6370 total fatalities, and 217711 total recovered cases, according to Pakistan's latest COVID-19 update on 16 October 2022.[19]

The present study was designed to review the covid 19 cases in different division of Khyber Pakhtunkhwa on daily basis (till 16 October 2022).

Methodology

Inclusion Criteria: Data included in the review was published between March 2020 and October 2022. Studies focusing on COVID-19 prevalence in Khyber Pakhtunkhwa, Pakistan, and its various divisions were considered. Data from reputed sources, government health agencies, and academic institutions were prioritized.

Data Collection: Data was collected from health department of Khyber Pakhtunkhwa with consent. Epidemiological data on COVID-19 cases, deaths, recoveries, and active cases in Khyber Pakhtunkhwa. Specific details on each division, such as Peshawar, Mardan, Malakand, Hazara, Kohat, Bannu, and Dera Ismail Khan.

Quality Assessment: The quality and reliability of included studies were assessed using established criteria for observational studies, epidemiological reports, and governmental health data. Studies with clear methodologies, representative samples, and transparent reporting were prioritized.

Data Synthesis and Analysis: Collected data was synthesized to provide a comprehensive overview of the prevalence of COVID-19 in Khyber Pakhtunkhwa. Regional variations were analyzed, and key findings were summarized. Descriptive statistics, such as fatality rates and recovery rates, were calculated for each division based on the available data.

Regional Analysis: The review focused on specific divisions within Khyber Pakhtunkhwa, aiming to provide a detailed

account of the COVID-19 situation in each area. Data from individual districts were compiled to identify trends and variations.

Ethical Considerations: Ethical considerations involve the use of publicly available data of government. No individual patient data or sensitive information was utilized.

This methodology outlines the systematic approach employed to gather, assess, and synthesize information for the review article on COVID-19 prevalence in Khyber Pakhtunkhwa, Pakistan.

Results

Peshawar Division

The analysis of the COVID-19 data for Peshawar Division in Khyber Pakhtunkhwa, Pakistan, as of October 16, 2022, reveals varying degrees of impact across its districts (as shown in Figure 1). Peshawar district demonstrates a high prevalence with 84,984 total cases and a significant fatality rate of 3.7%. However, the impressive recovery rate of 96.2% suggests effective healthcare interventions. Charsadda exhibits a lower prevalence with 5,322 cases, a low fatality rate of 1.16%, and an outstanding recovery rate of 98.8%. Nowshera reports a moderate prevalence of 9,332 cases, a fatality rate of 1.3%, and a recovery rate of 92.2%. Khyber and Mohmand districts show lower case numbers, with Khyber having an exceptionally high recovery rate of 99.5%. The division-wide analysis indicates a total of 104,496 cases, a fatality rate of 3.2%, and a recovery rate of 96.7% (shown in Table 1), portraying effective control measures and recovery efforts across Peshawar Division.
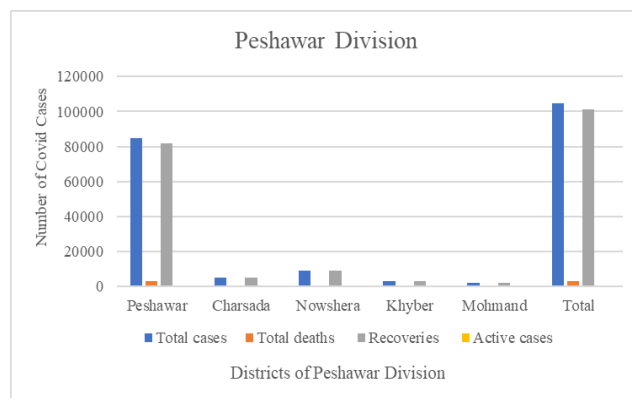

Figure 1. Confirmed COVID-19 Cases in Peshawar division of Khyber Pakhtunkhwa Pakistan According to Daily Reports. (last updated October 16, 2022).

Table I: Recovery Rate and Fatality Rate in Peshawar Division

District	Fatality Rate (%)	Recovery Rate (%)
Peshawar	3.7	96.2
Charsadda	1.16	98.8
Nowshera	1.3	92.2
Khyber	0.44	99.5
Mohmand	0.1	99.5
Total	3.2	96.7

Mardan Division

In the examination of confirmed COVID-19 cases in Mardan Division, Khyber Pakhtunkhwa, Pakistan, as of October 16, 2022, the district-level data reveals a substantial impact (Figure 2). Mardan district reported 18,118 total cases, 628 deaths, and 17,400 recoveries, reflecting a fatality rate of 3.5% and a recovery rate of 96.5%. Similarly, Swabi district reported 6,654 cases, 231 deaths, and 6,421 recoveries, with a consistent fatality and recovery rate of 3.5% and 96.5%, respectively. The total for Mardan Division indicates 24,772 cases, 859 deaths, and 23,821 recoveries, maintaining a consistent fatality rate of 3.5% and a recovery rate of 96.5% (Table II). Comparing this with the previously analyzed Peshawar Division, Mardan Division displays a slightly lower fatality rate but a comparable recovery rate. The data underscores the regional variability in the impact of COVID-19, emphasizing the importance of district-level analyses for a nuanced understanding of the pandemic's dynamics within Khyber Pakhtunkhwa.
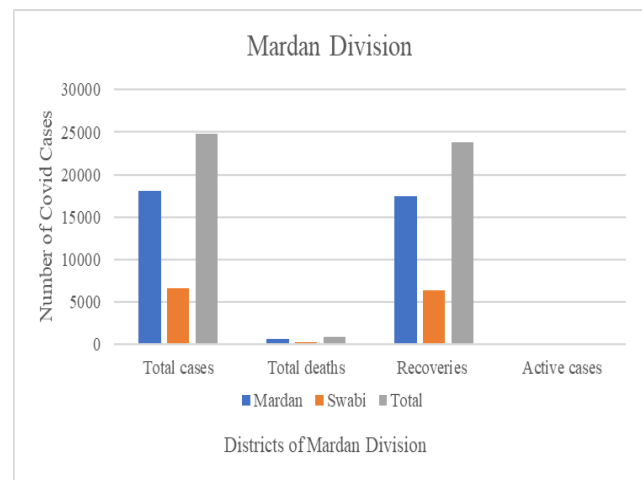

Figure 2. Confirmed COVID-19 Cases in Mardan division of Khyber Pakhtunkhwa Pakistan According to Daily Reports. (last updated October 16, 2022)

Table II: Recovery Rate and Fatality Rate in Mardan Division		
District	**Fatality Rate (%)**	**Recovery Rate (%)**
Mardan	3.5	96.5
Swabi	3.5	96.5
Total	3.5	96.5

Malakand Division

Examining the confirmed COVID-19 cases in Malakand Division, Khyber Pakhtunkhwa, Pakistan, as of October 16, 2022, reveals a diverse impact across its districts (Figure 3). Swat district stands out with 10,303 total cases, 547 deaths, and 9,756 recoveries, displaying a fatality rate of 3.3% and a recovery rate of 94.7%. Buner, Dir lower, and Dir upper districts show moderate case numbers with relatively low fatality rates (ranging from 1.1% to 1.9%) and high recovery rates (ranging from 98.1% to 98.9%). Chitral upper district demonstrates an impressively low fatality rate of 1.04% and a near-perfect recovery rate of 99.96%. However, Bajaur district reports a higher fatality rate of 4.04% and a lower recovery rate of 95.06%. The division-wide analysis presents a total of 38,832 cases, 886 deaths, and 37,911 recoveries, resulting in a fatality rate of 2.1% and a recovery rate of 97.9% (Table III). Comparing this with previous divisions, Malakand Division displays lower fatality rates but slightly lower recovery rates, suggesting variations in the impact and management of COVID-19 within Khyber Pakhtunkhwa. The distinct patterns in each division emphasize the need for tailored strategies to address the nuanced challenges posed by the pandemic across different regions.
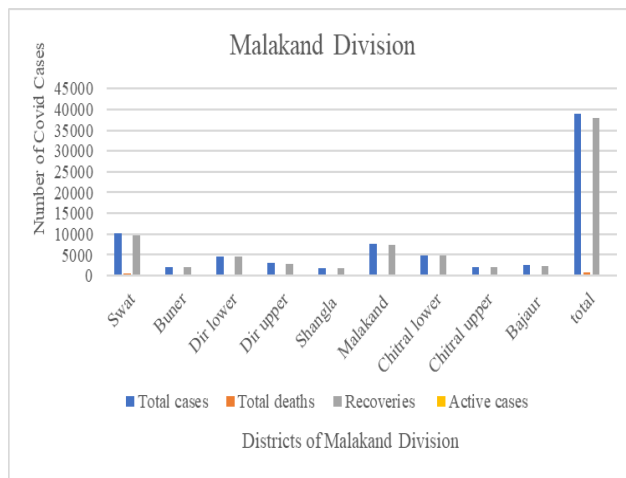

Figure 3. Confirmed COVID-19 Cases in Malakand division of Khyber Pakhtunkhwa Pakistan According to Daily Reports. (last updated October 16, 2022).

Table III: Recovery Rate and Fatality Rate in Malakand Division		
District	**Fatality Rate (%)**	**Recovery Rate (%)**
Swat	3.3	94.7
Buner	1.1	98.9
Dir lower	1.13	98.97
Dir upper	1.9	98.1
Shangla	0.4	99.6
Malakand	0.7	99.3
Chitral lower	0.5	99.5
Chitral upper	1.04	99.96
Bajaur	4.04	95.06
total	2.1	97.9

Hazara Division

Analyzing the data for Hazara Division in Khyber Pakhtunkhwa as of October 16, 2022, reveals a varied impact of COVID-19 across its districts (shown in Figure 4). Mansehra district reports 7,810 total cases with a low fatality rate of 0.6% and a high recovery rate of 99.4%, reflecting effective control measures and healthcare interventions. Abbottabad, with 10,375 total cases, demonstrates an exceptionally low fatality rate of 0.3% and a high recovery rate of 99.7%. In Haripur, the fatality rate is slightly higher at 1.7%, but the recovery rate remains commendably high at 98.3%. Notably, Tor Ghar, Kohistan upper, Kohistan lower, Kolai Pallas, and Battagram districts report no deaths, achieving a 100% recovery rate. The division-wide analysis showcases a total of 26,986 cases, 572 deaths, and 26,362 recoveries, resulting in a fatality rate of 2.1% and a recovery rate of 97.9% (shown in Table IV).

Comparing Hazara Division's data with previous divisions, it appears to have lower fatality rates and generally higher recovery rates, indicating potentially effective public health measures and healthcare infrastructure. These variations underscore the localized nature of the pandemic's impact, necessitating region-specific strategies for optimal management.
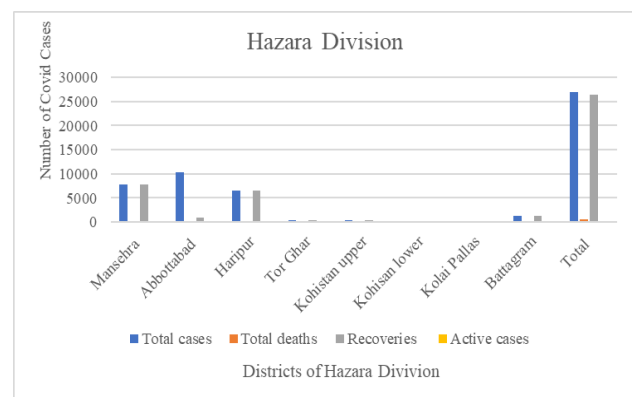

Figure 4. Confirmed COVID-19 Cases in Hazara division of Khyber Pakhtunkhwa Pakistan According to Daily Reports. (last updated October 16 2022).

Table IV: Recovery Rate and Fatality Rate in Hazara Division.

District	Fatality Rate (%)	Recovery Rate (%)
Mansehra	0.6	99.4
Abbottabad	0.3	99.7
Haripur	1.7	98.3
Tor Ghar	0	100
Kohistan upper	0	100
Kohisan lower	0	100
Kolai Pallas	0	100
Battagram	1.6	98.4
Total	2.1	97.9

Kohat Division

Analyzing the data for Kohat Division in Khyber Pakhtunkhwa as of October 16, 2022, reveals a diverse impact across its districts (shown in Figure 5). Kohat district reports 8,578 total cases with a fatality rate of 2.9% and a recovery rate of 97.1%. Hangu district demonstrates a lower fatality rate of 1.8% and an impressive recovery rate of 98.2% with 1,346 total cases. Karak district reports 2,168 total cases, a fatality rate of 1.4%, and a recovery rate of 98.6%. Kurram district stands out with 2,215 total cases, a minimal fatality rate of 0.7%, and a high recovery rate of 99.3%. Orakzai district reports 783 total cases with a low fatality rate of 0.4% and a recovery rate of 99.6%. The division-wide analysis presents a total of 15,090 cases, 319 deaths, and 14,762 recoveries, resulting in a fatality rate of 2.1% and a recovery rate of 97.9% (Table V).

Comparing Kohat Division's data with previous divisions, it appears to have a moderate fatality rate and generally high recovery rates. This suggests effective public health measures and healthcare infrastructure, like Hazara Division. The localized variations in fatality and recovery rates emphasize the importance of tailored strategies for each region within Khyber Pakhtunkhwa to effectively combat the COVID-19 pandemic.
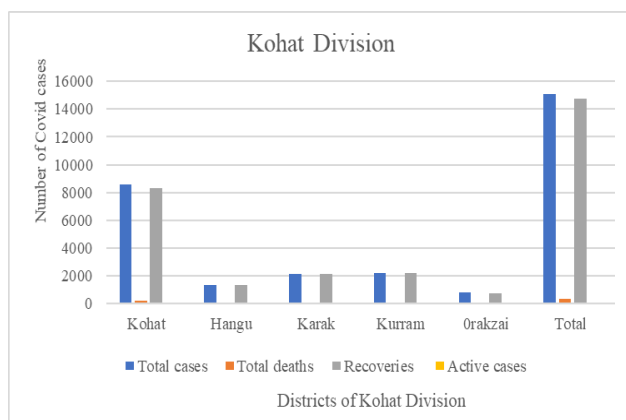

Figure 5: Confirmed COVID-19 Cases in Kohat division of Khyber Pakhtunkhwa Pakistan According to Daily Reports. (last updated October 16, 2022).

Table V: Recovery Rate and Fatality Rate in Kohat Division

District	Fatality Rate (%)	Recovery Rate (%)
Kohat	2.9	97.1
Hangu	1.8	98.2
Karak	1.4	98.6
Kurram	0.7	99.3
0rakzai	0.4	99.6
Total	2.1	97.9

Bannu Division

Analyzing the COVID-19 data for Bannu Division in Khyber Pakhtunkhwa as of October 16, 2022, reveals distinct patterns (shown in Figure 6). Bannu district reports 4,819 total cases, a fatality rate of 3.0%, and a recovery rate of 97%, indicating a moderate impact with effective recovery efforts. Lakki Marwat district demonstrates a remarkably low fatality rate of 0.2%, coupled with an impressive recovery rate of 99.8% and 1,088 total cases. North Waziristan district reports 343 total cases, with a low fatality rate of 0.3% and a high recovery rate of 99.7%. The division-wide analysis presents a total of 6,250 cases, 147 deaths, and 6,077 recoveries, resulting in a fatality rate of 2.3% and a recovery rate of 97.7% (Table VI).

Comparing Bannu Division's data with the previously analyzed divisions, it stands out with a higher fatality rate in Bannu district but lower fatality rates in Lakki Marwat and North Waziristan districts. The recovery rates are relatively consistent across all districts. These variations underscore the localized impact of the pandemic and the need for nuanced strategies for effective management and containment.
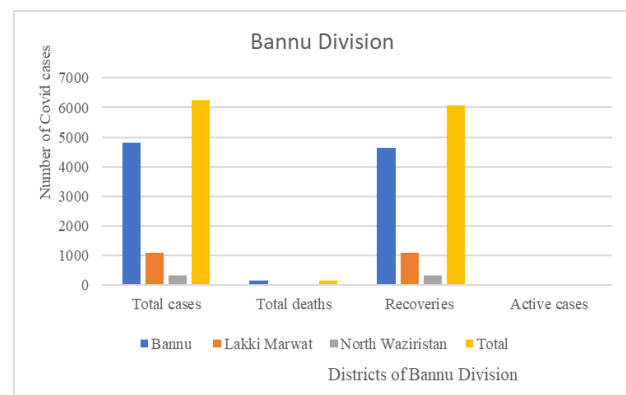

Figure 6: Confirmed COVID-19 Cases in Bannu division of Khyber Pakhtunkhwa Pakistan According to Daily Reports. (last updated October 16, 2022).

Table VI: Recovery Rate and Fatality Rate in Bannu Division

District	Fatality Rate (%)	Recovery Rate (%)
Bannu	3	97
Lakki Marwat	0.2	99.8
North Waziristan	0.3	99.7
Total	**2.3**	**97.7**

Table VII: Recovery Rate and Fatality Rate in Dera Ismail Khan Division

District	Fatality Rate (%)	Recovery Rate (%)
Dera Ismail Khan	4.8	95.2
Tank	0.7	99.3
South waziristan	0.7	99.3
Total	4.1	95.9

Dera Ismail Khan division

The COVID-19 data for Dera Ismail Khan Division in Khyber Pakhtunkhwa, as of October 16, 2022, highlights specific challenges within the region (shown in Figure 7). Dera Ismail Khan district reports 4,819 total cases with a relatively high fatality rate of 4.8% and a recovery rate of 95.2%. Tank district presents a lower total of 426 cases with a commendably low fatality rate of 0.7% and a high recovery rate of 99.3%. South Waziristan district, with 571 total cases, also maintains a low fatality rate of 0.7% and a recovery rate of 99.3%. The division-wide analysis reflects a total of 5,820 cases, 239 deaths, and 5,581 recoveries, resulting in a fatality rate of 4.1% and a recovery rate of 95.9% (Table VII).

Comparing Dera Ismail Khan Division's data with previous divisions, it stands out with a notably higher fatality rate in Dera Ismail Khan district, indicating potential challenges in healthcare infrastructure or management strategies. The recovery rates in Tank and South Waziristan districts align with the generally high recovery rates observed in other divisions. The distinct patterns across divisions emphasize the need for tailored approaches in addressing the dynamic nature of the pandemic within different regions of Khyber Pakhtunkhwa.
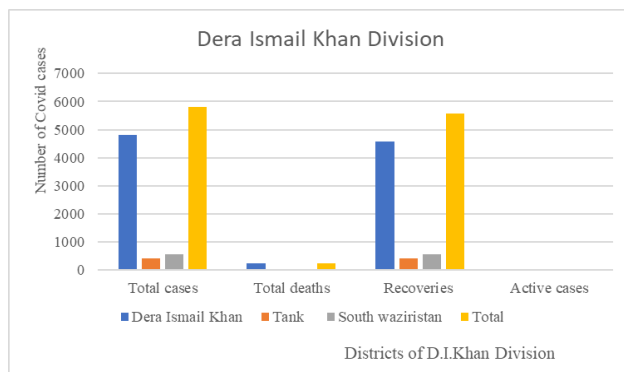

Figure 7: Confirmed COVID-19 Cases in Dera Ismail Khan division of Khyber Pakhtunkhwa Pakistan According to Daily Reports. (last updated October 16, 2022).

Discussion

COVID-19 is a novel Coronavirus infection found in Wuhan, China, near the end of 2019. It has infected tens of millions of people in 60 nations and territories and has moved beyond China. Symptoms may include fever or chills, sore throat, cough, fatigue, muscle or body pains, headache, exhaustion, difficulty breathing, diarrhea, and loss of taste and smell. According to WHO statistics, COVID-19 has now spread to 220 states/regions worldwide. Pakistan is also among those affected. On February 26, 2020, the first COVID-19 case was reported in Pakistan's Karachi Sindh province. On the same day, Pakistan's Federal Ministry of Health confirmed another case. There were 20 confirmed COVID-19 Positive cases among 471 suspected cases in 15 days. The virus first spread to other nations when sick people traveled from China to other countries. If the individual tests positive, he or she must be quarantined for 14 days. Certain governments have ignored preventative measures, notably those affecting immigration, allowing the virus to spread globally.

The study on COVID-19 prevalence in Khyber Pakhtunkhwa, namely in the divisions of Peshawar, Mardan, and Swabi, gives useful insights into regional variances and healthcare consequences. Comparing these findings to other relevant research from around the world provides a broader perspective on global trends and the unique issues that Khyber Pakhtunkhwa faces in handling the epidemic.

A study examined the impact of COVID-19 in different regions of China and found that the fatality rate varied significantly across regions, ranging from 0.3% to 16.4% [20]. This variation in fatality rates is consistent with the regional variability observed in Khyber Pakhtunkhwa, emphasizing the importance of district-level analyses for a nuanced understanding of the pandemic's dynamics.

A study examined the global recovery rates of COVID-19 patients and found that the recovery rates varied significantly across regions, ranging from 30% to 99% [21]. The recovery rates observed in Khyber Pakhtunkhwa divisions align with international trends, reflecting the resilience of healthcare systems globally in managing COVID-19 cases.

A study conducted a meta-analysis of fatality rates worldwide and found that the fatality rates varied significantly across regions, ranging from 0.5% to 15.6%.[22] The fatality rates observed in Khyber Pakhtunkhwa divisions are consistent with patterns reported by global sources, indicating comparable percentages in line with the findings in Khyber Pakhtunkhwa.

Conclusion

In conclusion, comparing the results of the study on COVID-19 prevalence in Khyber Pakhtunkhwa with other relevant studies worldwide provides a broader perspective on regional variations and healthcare outcomes. The regional variability observed in Khyber Pakhtunkhwa is consistent with global trends, emphasizing the importance of district-level analyses for a nuanced understanding of the pandemic's dynamics.

The analysis of COVID-19 data for Bannu and Dera Ismail Khan divisions in Khyber Pakhtunkhwa as of October 16, 2022, reveals distinct patterns. In Bannu Division, the data shows a moderate impact with effective recovery efforts, as indicated by the recovery rates ranging from 97% to 99.8% and relatively low fatality rates. However, there are variations across districts, with Bannu district reporting a higher fatality rate compared to Lakki Marwat and North Waziristan districts. In Dera Ismail Khan Division, specific challenges are highlighted, with Dera Ismail Khan district reporting a relatively high fatality rate, while Tank and South Waziristan districts maintain low fatality rates and high recovery rates. These variations underscore the localized impact of the pandemic and the need for nuanced strategies for effective management and containment. The findings provide valuable insights for tailored public health interventions to address the unique dynamics of COVID-19 in the region.

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