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DOI: 10.46903/gjms/19.03.1029

ORIGINAL ARTICLE

PREVALENCE OF MORTALITY AND ITS DISTRIBUTION BY SEX AND AGE GROUPS IN INDOOR COVID-19 PATIENTS IN D.I.KHAN DIVISION, PAKISTAN

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ABSTRACT

Background: COVID-19 has become one of the leading causes of morbidity and mortality. The objectives of this study were to determine the prevalence of mortality and its distribution by sex and age groups in indoor COVID-19 patients in D.I.Khan Division, Pakistan.

Materials & Methods: This cross-sectional study was conducted in the Department of Medicine, Gomal Medical College, D.I.Khan, Pakistan. A sample of 438 patients with positive SARS-CoV-2 RT-PCR was selected. Sex & age-groups were two demographic and presence of mortality was a research variable. The data type for all variables was nominal, except ordinal age groups. Prevalence & distribution were described by count and percentage with 95%CI. The hypotheses were tested by chi-square goodness of fit test.

Results: Out of 438 COVID-19 patients, mortality was 43 (9.82%), including 34 (7.76%) men and nine (2.06%) women. The mortality was 0% for 0-19 years, four (0.92%) for 20-39 years, 12 (2.74%) for 40-59 years and 27 (6.16%) ≥60 years. Our mortality 9.82% was lower than expected 20.95% (p=<.001). It was higher in men than women (p=<.001). It was highest in age group ≥60 years, while 0% in 0-19 years. It was similar to expected by sex (p=.070) and age group (p=<.207).

Conclusion: Our study showed 9.82% mortality in indoor COVID-19 patients. The mortality was lower than expected. The mortality was higher in men than women. It was highest in elderly, while zero in children and adolescents. It was similar to expected by sex and age group.

KEYWORDS: COVID-19, Pneumonia, Prevalence, Distribution, Children, Elderly, Females, Males, Pandemic, D.I.Khan, Division, Chi-square Goodness of fit Test.

Cite as: Aamir M, Ahmad W, Ahmad B, Khan A, Fawad M, Abdullah M. Prevalence of mortality and its distribution by sex and age groups in indoor COVID-19 patients in D.I.Khan Division, Pakistan. Gomal J Med Sci 2021 Jul-Sep; 19(3):91-7. https://doi.org/10.46903/gjms/19.03.1029

1. INTRODUCTION

1.1 Background: Coronavirus disease 19 (COVID-19) is an infectious disease caused by a novel coronavirus, which has been named by International Committee on Taxonomy of Viruses (ICTV) as severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2).[1]

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Date Submitted: 11-04-2021
Date Revised: 20-06-2021
Date Accepted: 26-06-2021

Corona viruses belong to subfamily Coronaviranae in the Coronaviridae family, which belongs to Nidovirales order.[2] Corona virus is single stranded RNA virus & the subfamily Coronaviranae is genotypically divided into four genera: alpha, beta, gamma & delta Coronaviruses.[3] The first case of COVID-19 was reported in December 2019 in Wuhan, China. The World Health Organization (WHO) announced COVID-19 as a global pandemic on March 11, 2020. The COVID-19 first patient in Pakistan was reported on February 26, 2020 in Karachi.[4]

Patients having COVID-19 may present with symptoms of fever, cough, myalgia & on investigations have normal or decreased leukocytes count & radiographic evidence of pneumonia.[5] In the past 2 decades, corona virus has caused three epidemic

outbreaks, namely severe acute respiratory syndrome (SARS), Middle East respiratory syndrome (MERS) & COVID-19.[6] In SARS-CoV-2, the severity of disease ranges from common cold and pneumonia to severe acute respiratory distress syndrome which can lead to death.[7] Recent epidemiological data indicate that there may be a gender predisposition to COVID-19, with men predisposed to being most severely affected, and older men accounting for most deaths.[8] Majority of deaths in COVID-19 were due to complications related to sepsis, ARDS & multi organ failure in adults with co-morbidities, whereas children having COVID-19 had better prognosis as compared to adults.[9]

Undurraga, et al.[10] reported 444,921 cases of COVID-19 from Chile, Latin America, from March 3, 2020 to August 31, 2020, studied by Ministry of Health Surveillance EPIVIGILA. Overall mortality was 15,756 (3.54%) (15,756*100/444,921=3.54). This mortality included 9,035 (2.03%) (9,035*100/444,921=2.03) men and 6,721 (1.51%) (6,721*100/444,921=1.51) women. Mortality by various age groups was as following; 33 (0.01%) (33*100/444,921=0.01) in 0-9 years, 20 (0.0044%) (20*100/444,921=0.0044) in 10-19 years, 97 (0.02%) (97*100/444921=0.22) in 20-29 years, 249 (0.06%) (249*100/444,921=0.06) in 30-39 years, 556 (0.12%) (556*100/444,921=0.12) in 40-49 years, 1581 (0.36%) (1581*100/444921=0.36) in 50-59 years, 3205 (0.72%) (3205*100/444,921=0.72) in 60-69 years, 4395 (0.98%) (4395*100/444921=0.98) in 70-79 years and 5620 (1.26%) (5620*100/444,921=1.26) in ≥80 years age group.

Munayco, et al.[11] reported a study from Peru for the period of March to May 2020, with overall mortality by COVID-19 as 7,660 (5.92%) out of 129,148 suspected COVID-19 patients. Distribution by sex was more for men 5,508 (4.26%) (5508*100/129148=4.26) than women 2,152 (1.66%) (2152*100/129148=1.66). The distribution by age groups was 21 (0.02%) (21*100/129148=0.02) for 0-9 years, 14 (0.01%) (14*100/129148=0.01) for 10-19 years, 51 (0.04%) (51*100/129148=0.04) for 20-29 years, 218 (0.17%) (218*100/129148=0.17) for 30-39 years, 639 (0.49%) (639*100/129148=0.49) for 40-49 years, 1430 (1.11%) (1430*100/129148= 1.11) for 50-59 years, 2264 (1.75%) (2264*100/129148=1.75) for 60-69 years, 1837 (1.42%) (1837*100/129148=1.42) in 70-79 years and 1186 (0.92%) (1186*100/129148=0.92) in ≥80 years age group.

Wu C, et al.[12] from Wuhan, China from December 25, 2019 to February 13, 2020 reported 201 COVID-19 patients. Overall mortality was 44 (21.89%) (44*100/201=21.89). This mortality included 29 (14.43%) (29*100/201=14.43) men and 15 (7.46%) (15*100/210=7.46) women.

Sarfaraz, et al.[13] reported 170 serious indoor COVID-19 positive cases from Karachi, Pakistan from March 19 to June 7, 2020. Overall mortality was 67 (39.41%) (67*100/170=39.41). This mortality included 52 (30.59%) (52*100/3851=30.59) men and 15 (8.82%) (15*100/175=8.82) women. Age group wise mortality was 24 (14.12%) (24*100/170=14.12) in ≤60 years and 43 (25.29%) (43*100/170=25.29) in >60 years.

1.2 Research Objectives (ROs): The objectives of this study were;

RO 1: To determine the prevalence of mortality of COVID-19 in D.I.Khan Division.

RO 2-3: To determine the distribution of COVID-19 mortality by sex & age groups in D.I.Khan Division.

1.3 Research (Null) Hypotheses (RHs)

H_{01}: The observed prevalence of mortality of COVID-19 is similar to its expected prevalence in D.I.Khan Division.

H_{02}: The observed distribution of mortality of COVID-19 by sex is similar to its expected distribution in D.I.Khan Division, Pakistan.

H_{03}: The observed distribution of mortality of COVID-19 by sex is similar to its expected distribution in D.I.Khan Division.

1.4 Significance: Having local data available on prevalence & distribution of mortality in COVID-19 cases in D.I.Khan Division, we can know about the sex & age groups having severe disease and highest mortality. This data can help public health officials to pursue potent actions to decrease mortality, particularly in age groups with highest risk of mortality.

2. MATERIALS AND METHODS

2.1 Study Design, Setting & Duration: This cross-sectional study was conducted in the Department of Medicine, Gomal Medical College, D.I.Khan, Pakistan from March 14, 2020 to April 6, 2021. The data was collected from IPMS system of COVID-19 ICU, HDU & Isolation Unit of MMM Teaching Hospital, D.I.Khan. Approval for the project was granted by the Institutional Ethical Committee.

2.2 Population & Sampling: As per 2017 census, the population of D.I.Khan Division was 2,803,147. For 2020, it was assumed to be 3 million; our population at risk. Using Raosoft® online sample size calculator,[14] sample size was calculated to be 438, with 95%CL, 0.932% margin of error, assumed prevalence of COVID-19 as 1% and population size of 3 million. The technique was consecutive. All the indoor (ICU, HDU & Isolation Unit) COVID-19 patients were eligible for inclusion in the study. A total of 2,825 suspected COVID-19 patients were admitted in ICU, HDU and Isolation Unit for the period of the study; out of which 438 cases were confirmed by SARS-CoV-2 RT-PCR.

2.3 Conduct of Procedure: The first step was sample collection which was conducted by nasopharyngeal swab. The swab was put in a vial containing

buffer solution which preserves the virus till the time the sample is processed. The second step was RNA extraction process, which converts RNA to DNA using Mag-Bind RNA Extraction Kit (Maccura & Big Fish companies). The third step was Master Mix process conducted in OOVSIGN machine. The final step is Amplification by PCR machine (Singuway Company) with SARS-CoV-2 specific primers. The presence of viral RNA indicates active SARS-CoV-2 infection. All these patients were investigated and managed as per standard clinical protocols.

2.4: Data Collection Plan: Sex (men/ women) & age-groups (0-19 years i.e. children & adolescents, 20-39 years i.e. early adult hood, 40-59 years i.e. late adult hood and ≥60 years i.e. elderly) were our two demographic variables and the presence of mortality was our single research variable. The data type for all these variables was nominal except age groups which was ordinal. A structured Performa was used as data collection tool to collect primary data from patients. Secondary data was collected through literature research.

2.5 Data Analysis Plan

2.5.1 Descriptive Statistics and Estimation of Parameters: All three variables being categorical were described by count & percentage. The estimated population parameters were given as confidence interval (CI) for proportion at 95% confidence level using Wilson score interval for binominal distribution. This calculation was done by using Statistics Kingdom calculator.[15]

2.5.2 Hypotheses Testing: Three hypotheses were substantiated by chi-square goodness of fit test,[16,17] using online statistical calculators; Statulator[18] for H_{01} & H_{02} and Statistics Kingdom Calculator[15] for H_{03}. Observed & expected counts, chi-square values are given with significance (p-value).

3. RESULTS

3.1.1 Prevalence of mortality: The overall mortality was 9.82% (95%CL 07.37-12.96) i.e. 43 among 438 COVID-19 patients. (Table 3.1.1)

3.1.2: Distribution of mortality by sex & age groups: Prevalence of mortality was higher in men 7.76% (95%CL 5.60-10.65) than women 2.06% (95%CL 1.08-3.85). It was highest in age group ≥60 years 6.16% (95%CL 4.27-8.82), followed by 40-59 years 2.74% (95%CL 1.57-4.72). (Table 3.1.2)

3.2 Hypotheses Testing

3.2.1 Observed vs. expected prevalence of mortality (H_{01}): Chi-square goodness-of-fit test verifies the difference between the observed counts from our sample (n=438) in column 2 (C2) against expected counts (C3) from a study by Wu C, et al.[12] from Wuhan, China (n=210). With difference in sample sizes, the expected counts are adjusted to

Table 3.1.1: Prevalence of mortality in indoor COVID-19 patients in D.I.Khan Division

Variable	Attributes	Sample Statistics		95%CI for proportion of population	
		Count	Percentage	Lower	Upper
Presence of mortality	Yes	43	09.82	07.37	12.96
	No	395	90.18	87.03	92.62
Total		438	100%	Population Parameters	

Table 3.1.2: Distribution of mortality by sex & age groups in indoor COVID-19 patients in D.I.Khan Division, Pakistan (n=438)

Variables	Attributes	Sample Size Count	Sample Statistics		95%CI for proportion	
			Percentage	Lower	Upper	
Sex	Men	318	34	34*100/438=7.76	05.60	10.65
	Women	120	09	09*100/438=2.06	01.08	03.85
Age Groups (Years)	0-19	27	0	0	0	0
	20-39	162	04	4*100/438=0.92	00.35	02.32
	40-59	157	12	12*100/438=2.74	01.57	04.72
	≥60	92	27	27*100/438=6.16	04.27	08.82
Mortality	Yes	438	43	43*100/438=9.82	07.37	12.96
	No		395	395*100/438=90.18	87.03	92.62
Total			438	100%	Population parameters	

our sample size (C4). C5, C6 & C7 shows relevant percentages. (Table 3.2.1.1)

With p-value <.001, H_{01} is rejected, confirming that the observed counts are different from the expected counts. Simply, our observed prevalence 9.82% is lower than expected prevalence 20.95% from a study by Wu C, et al.[12] (Table 3.2.1.2)

3.2.2 Observed vs. expected distribution of COVID-19 mortality by sex (H_{02}): Chi-square goodness-of-fit test testifies the difference between the observed counts from our sample (n=43) in column 2 (C2) against expected counts (C3) from a study by Wu C, et al.[12] from Wuhan, China (n=210). With difference in sample sizes/ denominators, the expected counts are adjusted to our sample size (C4). C5, C6 & C7 shows relevant percentages. (Table 3.2.2.1)

With p-value .070, H_{02} is accepted, confirming that the observed counts are statistically similar to the expected counts. Simply, our observed prevalence 7.76% for men is similar to what was expected 6.47% for men and our observed prevalence 2.06% for women is similar to what was expected 3.35% for women from a study by Wu C, et al.[12] (Table 3.2.2.2)

Table 3.2.1.1: Observed, expected & adjusted expected counts and %ages for prevalence of mortality in indoor COVID-19 patients in D.I.Khan Division, Pakistan (n=438)

Column 1- Mortality	C2-Observed counts	C3-Expected counts	C4-Adjusted expected counts	C5-Observed %ages	C6-Expected %ages	C7-Adjusted expected %
Yes	43	44	44*438/210 =91.77	9.82%	20.95%	91.77*100/438 =20.95%
No	395	166	166*438/210 =346.23	90.18%	79.05%	346.23*100/438 =79.05%
Total	438	210	438	100%	100%	100%

Table 3.2.1.2: Observed vs. expected prevalence of mortality in indoor COVID-19 patients in population of D.I.Khan Division, Pakistan (n=438)

Presence of Mortality	Observed count (proportion)	95%CI for proportion		Expected count (proportion)	Chi-square test		Z test	
		Lower	Upper		$\sum\chi^2$	p-value	Z-value	p-value
Yes	43 (0.10)	0.07	0.13	91.77 (0.21)	32.78	<.001	-5.73	<.001
No	395 (0.90)	0.87	0.93	346.23 (0.79)			5.73	<.001
Total	438 (1.00)			438 (1.00)	H_{01} rejected at alpha .05			d.f.=1

Table 3.2.2.1: Observed, expected & adjusted expected counts and %ages for distribution of mortality by sex in indoor COVID-19 patients in D.I.Khan Division, Pakistan (n=438)

Column1- Sex	C2-Observed counts	C3-Expected counts	C4-Adjusted expected counts	C5-Observed %ages	C6-Expected %ages	C7-Adjusted expected %
Men	34	29	29*43/44 =28.34	34*100/438 =7.76%	29*100/210 =13.81%	28.34*100/438 =6.47%
Women	09	15	15*43/44 =14.66	9*100/438 =2.06%	15*100/210 =7.14%	14.66*100/438 =3.35%
Total	43	44	43	43*100/438 =9.82%	44*100/210 =20.95%	43*100/438 =9.82%

Table 3.2.2.2: Observed vs. expected distribution of mortality by sex in indoor COVID-19 patients in D.I.Khan Division, Pakistan (n=438)

Mortality by sex	Observed count (proportion)	95%CI for proportion		Expected count (proportion)	Chi-square test		
		Lower	Upper		$\sum\chi^2$	d.f.	p-value
Men	34 (0.79)	0.67	0.91	28.34 (0.66)	3.27	1	.070
Women	09 (0.21)	0.09	0.33	14.66 (0.34)			
Total	43 (1.00)			43 (1.00)	H_{01} accepted at alpha .05		

Table 3.2.3.1: Observed, expected & adjusted expected counts and %ages for distribution of mortality by age groups in indoor COVID-19 patients in D.I.Khan Division (n=438)

Column 1-Age groups	C2-Observed counts	C3-Expected counts	C4-Adjusted expected counts	C5-Observed %ages	C6-Expected %ages	C7-Adjusted expected %ages
0-19 years	0	35	35*43/7660 =0.196	0*100/438 =0%	35*100/129148 =0.03%	0.196*100/438 =0.05%
20-39 years	04	269	269*43/7660 =1.510	4*100/438 =0.92%	269*100/129148 =0.21%	1.510*100/438 =0.34%
40-59 years	12	2069	2069*43/7660 =11.615	12*100/438 =2.74%	2069*100/129148 =1.60%	11.615*100/438 =2.65%
≥60 years	27	*5287*	5287*43/7660 =29.679	27*100/438 =6.16%	5287*100/129148 =4.09%	29.679*100/438 =6.78%
Total	43	7660	43	9.82%	7660*100/129148 =5.93%	43*100/438 =9.82%

Table 3.2.3.2: Observed vs. expected distribution of mortality by age groups in indoor COVID-19 patients in D.I.Khan Division, Pakistan (n=438)

Age Groups	Observed Counts (O)	Expected Counts(E)	O-E	$(O-E)^2$	X^2	$\sum X^2$	p-value
00-19 years	00	00.20	-0.20	0.04	0.20	4.56	.207
20-39 years	04	01.51	2.49	6.20	4.11		
40-59 years	12	11.61	0.39	0.15	0.01		
≥ 60 years	27	29.68	-2.68	7.18	0.24		
Total	43	43	00	H_{03} accepted at alpha .05			d.f.=3

3.2.3 Observed vs. expected distribution of COVID-19 mortality by age groups (H_{02}): Chi-square goodness-of-fit test testifies the difference between the observed counts from our sample (n=438) in column 2 (C2) against expected counts (C3) from a study by Munayco, et al.[11] from Peru (n=129,148). With difference in sample sizes/ denominators, the expected counts are adjusted to our sample size (C4). C5, C6 & C7 shows relevant percentages. (Table 3.2.3.1)

With p-value 0.207, H_{02} was accepted, confirming that the observed counts are statistically similar to the expected counts. Simply, our observed prevalence in each of our four age groups is similar to what was expected for these four age groups from a study by Munayco, et al.[11] from Peru (n=129,148). (Table 3.2.3.2)

4. DISCUSSION

4.1 Prevalence of mortality in indoor COVID-19 patients (H_{01}): The prevalence of mortality in COVID-19 in our study was 9.82% (95% CI 7.37%-12.96%). Higher mortality to our study was reported by Sarfaraz, et al.[13] from Karachi, Pakistan from March 19 to June 7, 2020 as 39.411764% and by Wu C, et al.[12] from Wuhan, China for the period from December 25, 2019 to February 13, 2020 as 21.89%. Lower prevalence was reported by Undurraga, et al.[10] from Chile, Latin America from March 3 to August 31, 2020 as 3.5413% and Munayco, et al.[11] from Peru for the period of March to May, 2020 as 5.92%. No Study could be retrieved from the literature which showed similar prevalence of COVID-19 mortality to our study.

4.2 Distribution of mortality in indoor COVID-19 patients by sex (H_{02}): The prevalence of COVID-19 mortality in our study was more in men 7.76% (95% CI 5.60-10.65) than women 2.06% (95% CI 1.08-3.85). Similar to our study was reported by Undurraga, et al.[10] from Chile, Latin America with higher mortality 2.0306% in men than 1.5106% women and by Munayco, et al.[11] from Peru, North America having higher mortality 4.26% in men than 1.66% women. Similarly Wu C, et al.[12] from Wuhan, China reported higher mortality 14.43% in men than 7.46% women and Sarfaraz, et al.[13] from Karachi, Pakistan reported higher mortality 30.59% in men than 8.82% women.

No study could be retrieved from literature which showed similar or higher mortality in women than men.

4.3 Distribution of COVID-19 mortality in indoor patients by age groups (H_{03}): The prevalence of COVID-19 mortality in our study was highest 6.1644% (4.27-8.82) in age group ≥60 years & lowest 0% in 0-19 years age group. Similar to our study was

reported from Peru by Munayco, et al.[11] from March to May 2020 having highest 4.0937% mortality in ≥60 years age group and lowest 0.0271% in 0-19 years. Matching to our study was also reported from Chile, North America by Undurraga, et al.[10] having highest mortality 0.01191% in ≥60 years age group & lowest 2.2509% in 0-19 years. None of the study from literature was having mortality higher in reciprocal order.

This study has few limitations. Firstly, some of the patients could not be followed up to their final outcome, since some patients were discharged once their symptoms were improved. Secondly few patients were also referred on their own request to higher centers for the management.

This study provides an important data on COVID-19 mortality distribution on basis of sex & various age groups. So, timely identification of COVID-19 patients at high risk of mortality can significantly improve proper management and resource allocation within hospitals. This study helps in providing data-driven approach to the understanding of male-female mortality risk and age related mortality risk. Without these data, the public are unaware about their disease risk and public policy responses cannot be specifically targeted.

4.4 Marwat Logical Trajectory of Research Process: We have adapted this logical and chronological trajectory in this study as devised by Dr. Muhammad Marwat.[19-22]

5. CONCLUSIONS & RECOMMENDATIONS

Our study showed 9.82% mortality in indoor COVID-19 patients. The mortality was lower than expected. The mortality was higher in men than women. It was highest in elderly, while zero in children and adolescents. It was similar to expected by sex and age group.

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CONFLICT OF INTEREST
Authors declare no conflict of interest.
GRANT SUPPORT AND FINANCIAL DISCLOSURE
None declared.

AUTHORS' CONTRIBUTION

The following authors have made substantial contributions to the manuscript as under:

Conception or Design:	MA, WA, AK
Acquisition, Analysis or Interpretation of Data:	MA, WA, BA, AK, MF, MA
Manuscript Writing & Approval:	MA, WA, BA, AK, MF, MA

All the authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.