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Original article

Analysis of demographic variables in acquiring infection and mortality due to COVID-19.

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ABSTRACT

Objectives: To determine the role of demographic variables like age and gender in infectivity and fatality due to Corona Virus Disease-19 (COVID-19). **Methods:** In this cross-sectional observational study, 692 patients were tested for COVID-19, 527(76.2%) were males and 165(23.8%) were females. Relevant information's were collected in accordance with the objectives of the study. **Results:** The mean age of patients was 35 +_15 years. Out of total, 240 (37.7%) were positive for COVID-19, 407(58.8%) were negative. The rate of infection was 1.25 times more in males than females with non-significant p value (*OR=1.25*). The probability of worse outcome in term of death was 1.83 times more in male gender *(P=0.05, OR=1.83*). The rate of infection after exposure and contacts with positive patients was 2 times more than in patients with age<55 years *(p=0.005, OR=2.01)* while the case fatality was three times more in patients with age >55 years *(p=0.001, OR=3.16*). The mortality rate was 5.41%. The infection was more common in younger ages and mortality was more in older ones *(p=0.014).* **Conclusions:** The rate of infectivity and mortality was more common in male gender because of their higher exposure; male gender is the earning figure in our society. The infection was more common in younger ages and mortality was more in older ages.

Introduction

Corona virus disease-19 was firstly reported to the WHO office on 31st Dec 2019. It was first reported from metropolitan city, Wuhan, Hubei province in China. Corona virus disease-19 causes severe respiratory disease/pneumonia. it is a pandemic disease infecting 5,931,963 people and killed more than 365,051 persons and 2,496,857 recoveries in almost five months span [1,2].

Corona Virus disease-19 is an emerging highly contagious respiratory disease that is caused by novel corona virus. Main clinical symptoms of this disease are fever, dry cough, fatigue, myalgia and dyspnea [3]. Gender and age play an important role in prognosis and outcome of COVID-19. It was reported that corona virus is striking and killed more Italian males as compared to females at the extremes of age because of their weak immunity status. The same observations were reported in China with more causality in male gender and at extreme ages [4].

In Pakistan, the literature so far covering the prevalence and incidence is deficient and the data from government sources declares 93983 confirmed cases with 1935 deaths and 32581 recovered cases. In Punjab, the highest number of

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corona cases were reported, 35308 cases, with a higher mortality rate of 5.415 in Khyber Pakhtunkhwa [5].

In Pakistan the most affected age groups were between 30-45 years of age with up to 35% of the total burden of cases. However, their survival rate is good as compared to the group with age more than 60 years where majority of the deaths (>50%) are reported [6]. The CDC reports 2019 shows that 53% of the COVID-19 infected patients that need intensive care unit (ICU) admission, and those 80% of the deaths were recorded in elderly people age>65 years, while no ICU admission or deaths were recorded in age less than 19 years of age [7].

The present study was designed to determine the age and gender contribution to acquisition of COVID-19 infection and case fatality due to this deadly virus.

Material and Methods

This cross-sectional study was conducted from 1st of March 2020 to May 27, 2020 in district Nowshera and its only Medical Teaching Institution, Qazi Hussain Ahmed Medical Complex MTI Nowshera. A total of 692 patients who were tested for COVID-19, were included in the study. 527(76.2%) were males and 165(23.8%) were females.

The sample was selected through consecutive, non-probability technique. Assuming 4% prevalence of COVID-19 in general population from the study of Zhou X et al [8] a reference population of 100,000 patients was estimated to reside in the catchment area of our hospital, belonging to district Nowshera of Khyber Pakhtunkhwa, Pakistan. A sample size of 692 was calculated through open epi software, an online sample size calculator, with Absolute precision of 5%, confidence interval of 95%, and a drop out of 10%.

All patients with PCR report received from the Khyber Medical University, Public health research laboratory, irrespective of age and gender were randomly selected. All out-district patients and patients with PCR done from private labs were also excluded.

Ethical approval was obtained from the institutional ethical review board of Nowshera Medical College hospital administration before the execution of the study (Ethical Committee Approval under registration Number: 102/ERB/NMC dated Feb 10th, 2020).

All samples were sent under strict observance of protocols to the Public health research laboratory of Khyber medical university Peshawar (a designated Lab for PCR of 2019nCoV by the Government of Khyber Pakhtunkhwa).

All those patients were isolated in the isolation unit of our hospital as well as quarantine designated by the Government or in-home isolation under strict observance of the health/district administration,

Results were received within 2-3 days, all with a positive PCR report were isolated and kept under treatment and re-tested after 7 days of isolation/treatment. Those who were negative in repeated sample reporting were shifted to quarantine and one case that reported positive on second phase belonging to Karachi was kept under strict isolation.

Statistical analysis

Data was entered in SPSS 25th version and descriptive and correlation statistics were applied. The categorical variables frequencies like age of the patients was presented in Mean were presented in percentages. Numerical variable with standard deviation and range. Chi-square test/ Fisher's exact test was applied to show a relationship of viral infectivity in gender and age groups. Binary logistic regression analysis was used to determine the probability of worse outcome (Death) in the age and gender dichotomous groups.

Results

A total of 692 suspected cases were screened for COVID-19, 527(76.2%) were males and 165(23.8%) were females. The mean age with standard deviation of patients was 35 $\pm$ 15 years, ranging from 1 years to 89 years.

Ninety-four (13.6%) of the patients were aged more than 55 years. Age of most tested patients; 293(42.3%) ranged between 19-35 years old followed by 221(31.9%) in an age range of 36-55 years **(Table 1)**. Out of total, 240(37.7%) were positive for COVID-19, 407(58.8%) were negative, 39(5.6%) were still awaited and the results of 3(0.4%) reported inconclusive from the Public health research laboratory **(Table 2)**.

We used binary logistic regression analysis on the age and gender dichotomous variables

against different categorical variables and assessed the probability of acquisition of infection and case fatality.

We observed that in gender group the rate of infectivity was 1.25 times more in males as compared to females without reaching significant levels *(OR=1.25).* Regarding the disease outcome in term of satisfactory discharge and case fatality we observed that the probability of worse outcome in term of death of the infected patient was 1.83 times more in males with statistically significant p value *(p=0.05, OR=1.83)* **(Table 3)**.

Using logistic regression analysis on the dichotomous age variable against different categorical variables and assessing the probability of acquisition of infection and case fatality, it was noted that rate of infectivity was statistically more in those aged less than 55 years *(p=0.01),* as well as their exposure to come across in contacts with positive patients with a 2 times higher probability *(p=0.005, OR=2.01).* However, the case fatality was three times more in patients with age >55 years with a significant p-value *(p=0.001, OR=3.16)* **(Table 4)**.

We used Fisher's exact test in cross tabulation statistics and determined the role of gender in acquiring the infection as well as in term or worse outcome that is death. We observed that out of total 240 COVID-19 patients, 189(78.75%) were males and 51(21.25%) were females. Overall mortality rate was 5.41%. Out of the total, 13 deaths, 8 were males and 5 were females. The gender exposure for acquisition of infection or case fatality was not statistically significant *(p=0.189)* **(Table 5)**.

We used Fisher's exact test in cross tabulation statistics and determined the role of age in acquiring the infection and associated mortality. We observed that 240 COVID-19 patients, 192(80%) were of the age 55 years or less while 48 (20%) of the patients had age more than 55 years. Out of the total, 13 deaths, 9 had age >55 years and 4 were in age less than 55 years. The infection was more common in younger age and mortality was more at the extremes of age. The age factor exposure for acquisition of infection or case fatality was statistically significant *(p=0.014)* **(Table 6)**.

Table 1. Age categories and gender distribution of patients

Age categories	Frequency	Percent	Valid Percent	Cumulative Percent
<18 years	79	11.4	11.5	11.5
19-35 years	293	42.3	42.6	54.1
36-55 years	221	31.9	32.2	86.3
>55 years	94	13.6	13.7	100.0
Total	687	99.3	100.0	
System	5	0.7		
Total	692	100.0		
Gender distribution	**Frequency**	**Percent**	**Valid Percent**	**Cumulative Percent**
Male	527	76.2	76.2	76.2
Female	165	23.8	23.8	100.0
Total	692	100.0	100.0	

Table 2. PCR result of patients

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	**Negative**	407	58.8	58.8	58.8
	Positive	240	34.7	34.7	93.5
	Awaited	39	5.6	5.6	99.1
	not done	3	.4	.4	99.6
	Inconclusive	3	.4	.4	100.0
	Total	692	100.0	100.0	

Table 3. Regression analysis of gender with other variables

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	**Age**	-.013	.006	4.456	1	*.035*	.987
	Positive contact history	.118	.215	.301	1	.583	1.125
	Positive vs all PCR reports	.224	.200	1.244	1	.265	1.251
	Disease outcome	.604	.311	3.767	1	*.052*	1.830
	Constant	-1.855	.574	10.436	1	*.001*	.156
	Total	692					
a. Variable(s) entered on step 1: age, Contact History, POS VS ALL, Patient condition.							

Table 4. Regression analysis of age categories with other variables

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	**Gender**	-.503	.304	2.745	1	.098	.605
	Positive contact history	.701	.248	7.970	1	*.005*	2.015
	Positive vs all PCR reports	-.605	.238	6.479	1	*.011*	.546
	Disease outcome	1.151	.320	12.944	1	*.001*	3.161
	Constant	-2.397	.689	12.088	1	*.001*	.091
	Total	692					
a. Variable(s) entered on step 1: Gender, Contact History, POS VS ALL, Patient condition.							

Table 5. Statistical relationship of gender with infectivity and case fatality

Patient condition at time of discharge			Positive Vs (Negative+ awaited+ inconclusive)		Total
			Positive	**Negative**	
Stable	**Gender**	**Male**	181	338	519
		Female	46	114	160
	Total		227	452	679
Died	**Gender**	**Male**	8		8
		Female	5		5
	Total death/ Mortality Ratio		13 (5.41%)		13
Total	**Gender**	**Male**	189(78.75%)	338	527(76.15%)
		Female	51(21.25%)	114	165(23.84%)
	Total		240	452	692
Fisher's exact test			*0.189*		

Table 6. Statistical relationship of dichotomous age categories (Age <55 & age>55 years) with infectivity and case fatality

Patient condition at time of discharge			Positive Vs (Negative+ awaited+ inconclusive)		Total
			Positive	**Negative**	
Stable	**Dichotomous age categories**	**Age<55 years**	188	401	589
		Age>55 years	39	51	**90**
	Total		227	452	679
Died	**Dichotomous age categories**	**Age<55 years**	4		4
		Age>55 years	9		**9**
	Total deaths / Mortality ratio		**13(5.41%)**	0	13
Total	**Dichotomous age categories**	**Age<55 years**	192(80%)	401	593(85.69%)
		Age>55 years	48(20%)	51	**99(14.30%)**
	Total		240(34.6%)	452(65.31%)	692
Fisher's exact test			***0.014***		

Discussion

Pakistan has a population of 213 million, it is among the top five most populated countries of the world. Pakistan has changed to an alarming country within a month after ease of lockdown with 5-fold increase in COVID cases [9]. In the present study, 94(13.6%) of the patients aged more than 55 years. Most of the patients tested (42.3%) were in the age range of 19-35 years. Pakistan has the youngest population in the world with more than 60% under 30 years of age, which explains one of the possible explanations for low case fatality rate in our country [9].

Another study from Hainan Provincial People's Hospital China reported prevalence of COVID-19 in elderly patients as 32% (age >50 years) and in younger patients as 68% (age less than 50 years) [10]. The prevalence in elder population was higher in mainland China as compared to our population. One of the possible explanations could be that we have 60% of the younger population under 30 years which gives an edge to our community to have responded well to this deadly disease. It was noted that rate of infectivity was statistically more in age group less than 55 years (*p=0.01*), with a probability of 2 times more for positive contact history *(p=0.005, OR=2.01).*

However, the case fatality was three times more in patients with age >55 years with a significant p-value *(p=0.001, OR=3.16)*.

The elderly people are more susceptible to be infected easily with higher admission rate in ICU along with higher case fatality ratio as compared to younger population because of the co-morbidities and low immunity being observed in older age [11]. Another study reported COVID-19 pneumonia in 15% of a population with age less than 60 years as compared to 27% in patients with age more than 60 years [12]. These findings do match our results.

Regarding the mortality, it was recorded at 5.41% in our population with 3.16 times more in patients with age >55 years, this matches with the findings of **Liu Y et al** [13] who reported mortality of 5.3 times in patients with age >60 years and 1.4% in patients with age less than 60 years. Other domestic researches have also documented a higher mortality rate in the elderly population as compared to the younger population with so many explanations like less immunity and associated co-morbidities that contributes [14]. Again, to go back to the experience at Wuhan, they observed 4.5% case infectivity rate and 1.4% overall case fatality rate in the age range of 30-59 years, they noted a higher fatality rate for those over the age of 59 who mostly died after developing symptoms [15].

Regarding the gender group distribution, the rate of infectivity was 1.25 times more in males as compared to females without reaching significant levels in our target population *(OR=1.25)*. A study from China reported that SARS-CoV-2 has infected more men than women (0.31/100,000 versus 0.27/100,000) [16]. One of the possible justifications is that male gender is the earner figure in our social set up, this in term increases the chances of male gender more to go out of homes for search of food and live hood, which exposes them more to the risk of COVID-19 [17]. The probability of worse outcome in term of death of the infected patient was 1.83 times more in males with statistically significant p value (*p=0.05, OR=1.83)*. Another study from China showed that apparently the prevalence of COVID-19 is the same in both genders, but the risk of worse outcome in term of mortality was higher in men as compared to women independent of age factor that matches our findings [18].

Conclusion

We concluded that COVID-19 has no preference for gender. Corona virus disease-19 prevalence is more in elderly population because of their low immunity and associated co-morbidities. The odds ratio of 3.16 for case fatality in elderly patients is alarming. Therefore, it is suggested that special care should be given to suspects with higher risks like those over the age of 55 years and male gender.

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Each author listed in the manuscript had approved the submission of this version of the manuscript and takes full responsibility for it.

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