



Distribution of COVID-19 by Sex and Age Groups and Its Association with Travel and Contact History: An Overview of Early Epidemic

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Authors' contributions

This work was carried out in collaboration among all authors. Author HK designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors SA, ZK and FB managed the analyses of the study and approved the manuscript final version.

Article Information

DOI: 10.9734/MRJI/2020/v30i830251

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Complete Peer review History: <http://www.sdiarticle4.com/review-history/60795>

Received 20 August 2020

Accepted 09 September 2020

Published 30 September 2020

Original Research Article

ABSTRACT

Objectives: To determine the frequency of COVID-19 and its association with age, gender, travel and exposure.

Methods: This cross-sectional study was conducted in COVID-19 clinic, Qazi Hussain Ahmed Medical Complex, Nowshera, from February 2020 to April 2020. A total of 260 suspects were included under strict criteria. Patients received in general OPD and emergencies were excluded. Data was entered in a format in SPSS version 25 for analysis and reporting. Descriptive, inferential and correlation statistics were used.

Results: Out of a total 260 of suspects/patients, 66(25.4%) females and 194(74.6%) were males. The nasopharyngeal swabs of 63(24.23%) cases were sent for viral detection selected for PCR testing on the bases of a scoring system. Out of 63 cases 18(6.92%) were COVID-19 positive,

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32(12.30%) negative and results of 12(4.61%) were still awaited. The estimated relative risk in male gender was $rr=1.08$, 95%CI, 0.77-1.55 and in age group>60 years was $rr=2.27$, 95%CI, 1.35-5.14. There was a positive statistically significant correlation of disease in patients with contact and travel history ($p=0.05$, $\rhoho=0.12$; $p=0.001$, $\rhoho=0.34$), respectively.

Conclusion: The results suggest that the age>50 years has higher susceptibility for COVID-19. Similarly, infectivity with 2019-nCoV has a statistically significant correlation with travel history, contact history and age.

Keywords: COVID-19; pandemic; epidemiology; etiological factor.

1. INTRODUCTION

COVID-19 (Corona virus disease) was first reported from metropolitan city of Wuhan, Hubei Province of China in December 2019, which causes severe respiratory disease/pneumonia. The etiology of COVID-19 is yet to be confirmed, but the majority of the scientists agree that it most likely originated from the zoonotic corona virus, SARS-CoV that emerged in 2002 [1].

COVID-19, is an emerging highly contagious respiratory disease that is caused by a novel corona virus. Its main clinical symptoms are fever, dry cough, fatigue, myalgia and dyspnea [2]. Case fatality rate of 2.3% has been reported from China that is lower than SARS (9.5%), MERS (34.4%) and H7N9 (39%) [3].

The World Health Organization (WHO) declared an emergency after an ongoing rapid epidemic of COVID-19 in China by the mid of February 2020, the number of laboratories confirmed cases reached to 60,000 with more than 1,700 deaths and the virus reached more than 30 countries outside China [4].

In Pakistan, lots of work is being conducted to report the prevalence and incidence, however the so reported data from government sources declare 4000 confirmed cases with 54 deaths. Punjab is the province with the highest number of corona cases reaching 2000 [5].

According to the federal government reports the cases can reach as up to 50000 by 25th April 2020 which is quite alarming. There is partial lockdown across the country to contain virus [6,7].

Gender and age matters when there is talk about the prognosis and outcome of COVID-19. The New York time has reported that the corona virus is striking and felling more Italian males as compared to females in extreme of age because of their weak immunity status. They further elaborated that the Italian model of mortality is a trend mirror of what they observed in China with

more causality in the male gender and at the extreme age [8] Studies from China have reported that individuals with extreme of ages and those with the immune-compromised state are at more risk of getting 2019-nCoV infection [9].

The battle against COVID-19 is continue across the globe in all affected countries. For that valued reason the people's adherence to preventive and precautionary measures are essential, which largely depends on the knowledge attitude and practice of people toward COVID, as travel and contact history increases the chances of infectivity in exponential mode [10] The rationale of the conducting study was to determine the prevalence of the disease and to understand the different risk factors responsible for the transmission of the disease in times of early epidemic in the country.

2. METHODOLOGY

This cross-sectional study was conducted from Feb. 2020 to April 2020 in the COVID-19 clinic of QHAMC Nowshera. All suspects individuals attended COVID-19 clinic irrespective of age and gender were randomly selected. All patients with irrespective of symptoms came to an emergency or outdoor patient department (OPD) were excluded.

Assuming 1% prevalence of COVID-19 in general population of Nowshera; 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 260 was calculated through Raosoft®, an online sample size calculator, with confidence interval of 95% [11].

The ethical endorsement was obtained from the institutional ethical review board of Nowshera Medical College hospital administration before the execution of the survey vides (Notification No-102/NMC/ERB Dated 10th Feb 2020).

All those suspected with COVOD proforma score more than 5 were subjected for testing their nasopharyngeal swabs for 2019-nCoV, this applies only on sampling from QHAMC. This scoring system was adopted from the Govt of Pakistan Guidelines' clinical management guidelines for COVID-19. Infections Ministry of National health services regulation and coordination, Islamabad, Pakistan; April 2, 2020 and Centre of disease control reports [12,13].

The majority of the sampling was selected from the COVID-19 clinic of Qazi Hussain Ahmed Medical Complex 222(85.4%), however the patient whose PCR was sent by the district health authorities were also included from the district line list 38 (14.6%).

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 2019-nCoV by the Government of Khyber Pukhtunkhwa).

All those patients whose sample was collected were isolated mainly in the isolation unit of our hospital as well as Quarantine designated by the Government or very few cases in home isolation under strict observance of the health/district administration to ensure to contain the virus.

Results were received in 2- 3 days, all patients with positive PCR reports were isolated and kept under treatment, and their samples were taken and tested again 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 the second phase belonging to Karachi was kept under strict isolation. All the suspects with a score less than five were not subjected to laboratory investigation, advised precautionary measures and sent home.

Data was entered in SPSS 25th version and descriptive and correlation statistics were applied. Numerical variables were presented in the form of mean with standard deviation. Categorical variables were presented with percentages. Chi-square test/Fischer Exact test was applied to show an association of infection with age and gender groups.

The relative risk of COVID-19 was determined in age and gender groups using risk assessment in cross-tabulation descriptive statistics. Correlation matrix was constructed using Spearman Correlation statistics in SPSS to determine the correlation of test positivity, age, gender, contact, travel history and disease outcome.

3. RESULTS

Out of total of 260 suspects, the mean age of the suspects was 32 ± 15 years. There were 66 (25.4%) females and 194 (74.6%) males.

Regarding the testing result out of 62, 18(6.92%) were Positive for COVID-19, 32(12.30%) negative, 12(4.61%) were awaited for reporting. On the estimation of the risk exposure in age groups we observed that 165(63.46%) were in the age group 19-40 years, 40(15.38%) in 41-60 years, 36(13.86%) with age < 18 years and 19(7.3%) cases with age > 60 years (Tables 2 and 3).

Table 1. Criteria for COVID-19 scoring system

Consideration	Score
Fever	1
Cough	1
Sore throat	1
Diarrhea or myalgia	2
Shortness of breath	2
Travel history	2
Contact history with of epidemic area traveler, Chest	1
Pain, Mass gathering, Leucopenia, Lymphopenia each	
Contact history with confirmed case/ Close relatives of the COVID-19 patients	6
Total	16
Strategy to act	
Score: <5	Quarantine /stay home
Score: 6-8	Do Labs & Inform Focal Person
Score: >8	Labs: Needs Isolation/admission inform district Focal Person-COVID-19

Using the chi-square/Fischer exact test, we observed the association of infection within gender groups using di-chotomous variables. It was noted that the Odds ratio and risk estimation in male gender was $OR=1.37$, 95%CI, 0.35-5.29 and $rr=1.08$, 95%CI, 0.77-1.55, respectively (Table 3).

A statistically significant difference was noted in age groups ($p=0.024$). The risk estimation in di-chotomous age categories showed a higher relative risk of COVID-19 infection in patients with age >60 years ($rr=2.27$, 95%CI, 1.35-5.14), as compared to that with age <60 years ($rr=0.66$, 95%CI, 0.28-2.11) (Table 4).

To determine the correlation of infection with, age, gender, contact, travel history and disease outcome using spearman ranked correlation test we designed the correlation matrix. There was moderate uphill positive correlation of infection

with contact ($p=0.05$, $\rho=0.12$) and travel history, ($p=0.001$, $\rho=0.34$), respectively. Regarding the gender, we observed a positive correlation of male gender with contact history ($p=0.03$, $\rho=0.13$). When the variables impacts were studied on each other it was observed that travel history has a high uphill positive correlation with positive contacts ($p=0.001$, $\rho=0.71$). Regarding the contact history we observed a moderate significant correlation of an increase in age (age rank) ($p=0.001$, $\rho=0.34$), male gender ($p=0.03$, $\rho=0.13$) and travel history ($p=0.001$, $\rho=0.72$) (Table 5).

4. DISCUSSION

To the best of our knowledge this is the first-ever study to give information distribution of COVID-19 by sex and age groups and correlation of travel and contact history with 2019nCoV infectivity from Pakistan.

Table 2. Statistical relationship between Age and gender groups with infection

PCR result	Age categories				Total (%)
	<18years	19-40years	41-60years	>60years	
Negative	5(1.92%)	23(8.85%)	3(1.15%)	1(0.38%)	32(12.31%)
Positive	3(1.15%)	8(3.08%)	3(1.15%)	4(1.54%)	18(6.92%)
Awaited	1(0.38%)	9(3.46%)	2(0.77%)	0	12(4.62%)
not done	27(10.38%)	124(47.69%)	32(12.31%)	14(5.38%)	197(75.77%)
Inconclusive	0	1(0.38%)	0	0	1(0.38%)
Total(%)	36(13.86%)	165(63.46%)	40(15.38%)	19(7.3%)	260
Gender categories					
	Male	Females	Total		
Negative	23(8.85%)	9(3.46%)	32(12.30%)		
Positive	14(5.38%)	4(1.54%)	18(6.92%)		
Awaited	10(3.85%)	2(0.77%)	12(4.61%)		
not done	146(56.15%)	51(19.62%)	14(5.38%)		
Inconclusive	1(0.38%)	0	1(0.38%)		
Total(%)	194(74.61%)	66(25.4%)	260		

Table 3. Statistical relationship of gender with COVID-19

PCR result	Gender		Total
	Male	Female	
Negative	23(46%)	9(18%)	32(64%)
Positive	14(28%)	4(8%)	18(36%)
Total	37(74%)	13(26%)	50
Chi-square test (CI=95%)*			
Relative risk of infection	Value	Lower	Upper
Odds Ratio(M/F)	1.37	0.35	5.29
For cohort Gender = Male	1.08	0.77	1.5
For cohort Gender = Female	0.79	0.28	2.2
Number of Valid Cases	50		

Table 4. Relationship/Association of COVID-19 with age

PCR result	Age categories		Total
	Age<60 y	Age> 60y	
Negative	31(62%)	1(2%)	32(64%)
Positive	14(28%)	4(8%)	18(36%)
Total	45(90%)	5(10%)	50
Chi-square test (CI=95%)*			
Relative risk of infection	Value	Lower	Upper
Odds Ratio(M/F)	2.27	1.35	5.14
For cohort Gender = Age> 60y	1.05	0.57	1.51
For cohort Gender = Age<60 y	0.66	0.28	2.11
Number of Valid Cases	50		

Table 5. Correlation matrix showing the Spearman's correlation coefficient (rs) for PCR positivity with different etiological factors

Category	Infection	Gender	Age	History of travel	Disease outcome
Gender	rho p	0.02 0.75			
Age	rho p	-0.084 0.175	-0.079 0.207		
Travel History to an epidemic area	rho p	.122* 0.05	0.103 0.099	-0.118 0.057	
Disease outcome	rho p	-0.203 0.103	0.229 0.055	0.212 0.088	-0.164 0.188
Contact History	rho p	.344** 0	.132* 0.033	-0.056 0.373	.719** 0
Number of suspects	260	260	260	260	260

In the present study, out of 260, 63/260(24.23%) of the suspects were subjected to a screening of viral profile due to resources constrain and score more than 5 on the COVID-point scoring scale and their nasopharyngeal swabs were sent for PCR reporting to Khyber medical university Public health Research Lab. Living in a developing country there are so many constrains and hindrances in achieving success to fight against communicable diseases like COVID-19. The Virus Transport Media (VTM) provided by the government was limited like in quantity of 20 to thirty, so it was decided by the administration with the consultation of clinicians and microbiologists to make use of these VTM under observance of strict criteria. Secondly there is a stigma associated with COVID-19, people have got a stat of anxiety and depression, and they rush for tests to reduce the level of anxiety. The best test is PCR detection 2019-nCoV as declared by the government that is costly and not affordable to all sectors as well as drains government resources. Scoring in such a situation is the need for time to avoid wastage of resources. In many countries they keep in mind

the risk factors in the form of age, gender, travel history, higher markers level like d-dimers>1ug/ml etc are the clues that help clinicians to identify patients for further trial [13,14].

It was observed that 18(6.92%) cases were COVID-19 positive in the present study. The majority of the data of the Qazi Hussain Ahmed Medical Complex 222/260(85.38%) were by extraction of selectees for PCR from the suspects presenting to the COVID 19 clinic.

Our findings for positive cases amongst the suspected cases are higher than reported by Tian et al. [15] (5%), and Zhou et al. [16] (4%) from China, however we are reporting a lower percentage of positive cases among the suspects than reported by Quilty et al. [17] (12%) and Mizumoto et al. [18]. (17%); the reason probably is their target population and reporting from high epidemic areas of China.

The findings of Luo et al. [19] (10%) are matching our results, while the findings of the Qiu

et al. [20] who reported 33% positive cases in strong suspects with a history of travel to Wuhan China, and 89% of the cases with close contact with Confirmed COVID-19 patients [19]. This difference could be due to the reason that they directly followed the family members of COVID-19 patients where the infectivity ratio was as high as 89%. Regarding the history of exposure to epidemic areas with infectivity rate of (33%) in Qiu et al. [20] study and 30% as reported by Anzai et al. [21].

As the entry of the virus in our district is still in the initial stages, the proportion of positive cases is low at 6.9%.

However, the infectivity in cases of close contacts or travel to an epidemic area is higher (14.6%) as compared to asymptomatic/clinically health suspects (3.15%). Our findings are comparable to other international studies mainly reported from China, Japan, Italy and India, where also they observed a different proportion of COVID-19 in asymptomatic suspects vs cases with a history of close contact and travel [14-21].

Using Spearman correlation to draw a correlation matrix for different variables measuring their quantitative correlation with Covid-19 infection, we observed a statistically significant moderate uphill positive correlation of PCR positivity (infectivity with 2019-nCoV) of the suspects/patients with contact ($p=0.05$, $\rho=0.12$). Similarly travel history and infectivity had a statistically significant correlation in COVID-19 ($p=0.001$, $\rho=0.34$).

That is the point where the message to stay home comes true, as whenever an individual has more history of travel he exposes himself to infectivity with 2019-nCoV, by coming across contacts of COVID-19 patients. Therefore, the best only option to contain the virus is to reduce mobility, to reduce contacts and to appraise the message of social distancing.

Similarly it was observed that the Odds ratio in male to female was $OR=1.37$ for acquiring infection ($OR=1.37$, 95%CI, 0.35-5.29), with risk estimation in male gender of $rr=1.08$, 95%CI, 0.77-1.55. However, the literature is still in search of gender conflict in acquiring the disease. A study from China reported that SARS-CoV-2 has infected more men than women (0.31/100,000 versus 0.27/100,000) [22].

A statistically significant difference was noted among the age groups ($p=0.024$). The risk estimation in di-chotomous age categories showed a higher relative risk of COVID-19 infection in patients with age >60 years as compares to those with age <60 years ($rr=1.05$ vs $rr=0.66$). Another study from China reported 80% of the causalities (deaths) due to COVID-19 were in the adults aged >60 years as compared to 0.1% in the group aged <19 years [23] Similarly, Italy is the second most affected country in the world by the time this manuscript was written, with more than 40000 cases of SARS-CoV infection. They reported higher mortality in aged people as compared to the younger population that identifies an immunity gap [24].

5. CONCLUSION

This study concluded that 2019-nCoV in general has no preference for gender. Infectivity with COVID-19 is more in the aged population as compared to the younger population that identifies its opportunistic nature and a love for immunity gap. The relative risk of 2.4 for age more than 50 years confirms it a risk factor for COVID-19. Infectivity of with 2019-nCoV has a moderate to high statistically significant correlation with travel and contact history.

6. SUGGESTIONS AND WAY FORWARD

It is suggested that special care should be given to suspects with higher risks like in age <60 years & age >60 years, with history of travel to an epidemic area or contact with COVID-19 patients.

There were some un-avoidable limitations in the study like limited resources, limited VTM/UTM (Virus/Universal Transport Medium), short duration of study and low number of positive cases, though we had an acceptable population of suspects.

However, the strength of the study was to prove statistically the important risk factors like history of travel, exposure history, age factor and role of gender in the acquisition of infection and gender competition for surviving in COVID-19.

Therefore, it is suggested that further studies should be carried out covering a maximum duration of the study the maximum number of positive patients and if possible to cover a higher the number of COVID-19 patients, and deaths reported so far, to correlate different risk factors

with morbidity and mortality of this pandemic disease.

CONSENT

Prior informed verbal consent was also obtained from all suspects and they were assured of confidentiality.

ETHICAL APPROVAL

The study protocol was approved by the Office of the Chairman Ethical Board Nowshera Medical College Nowshera, Khyber Pakhtunkhwa.

ACKNOWLEDGEMENT

Dr Mohammad Arif- Hospital Director, Qazi Hussain Ahmed Medical Complex Nowshera

1. Dr Abu zar- Focal person COVID-19, District Nowshera
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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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DOI: 10.3855/jidc.12600

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Peer-review history:
The peer review history for this paper can be accessed here:
<http://www.sdiarticle4.com/review-history/60795>