Original Article

Study of the Characteristics of Positive Contacts and Hospitalized Cases in Multiple Waves of the Covid -19 Pandemic in Pali District of Western Rajasthan: A Secondary Data Analysis

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Abstract

Background: Coronavirus disease 2019 (COVID-19), the pandemic that invaded the world in 2020, caused more than 70 million cases and exceeded a million and a half deaths worldwide by the end of the year. Age and sex have been identified as two of the prominent risk factors in COVID-19 deaths. Early epidemiological studies conducted in China, India, and Iran revealed that fewer females were infected by SARS-CoV2(4-9).

It is imperative for national governments to identify which population members are at high risk of becoming ill or more likely to die. This analysis emphasizes the early epidemiological features of COVID-19 cases in the OPD in order to guide to policy decisions on the health, commercial, social, and economic fronts in case of any future surge in Covid cases.

Methods: The data collected during contact tracing (urban and rural) and hospital admissions during the periods: February 2020 to October 2020 (first wave) and April 2021 to June 2021 (second wave) and December 2021 to February 2022 (Third wave) were analyzed for demographics and other characteristics.

Present study shows that frequency of positive case is more in rural people in age group II (15-50 years) than urban people. Male case is higher in rural areas and female cases are higher in urban areas, hospital admission and ICU admission were higher in rural people while death was reported higher in urban areas.

Better targeting of interventions may help to limit expensive interventions such as intensive care admissions and avoid deaths. To create an efficient, equitable response to the pandemic, especially in countries where resources are limited awareness of the roles of gender, age and geography in the outbreak are imperative.

Key words: Covid-19, pandemic, demographics, role of gender, age, ICU, deaths

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Introduction

Coronavirus disease 2019 (COVID-19), the pandemic that invaded the world in 2020, caused more than 70 million cases and exceeded a million and a half deaths worldwide by the end of the year[1]. The World Health Organization declared COVID-19 a pandemic on March 11, 2020, as unprecedented numbers of positive cases spread across the globe[2].

Age and sex have been identified as two prominent risk factors in COVID-19 death sepidemiological studies conducted in China, India, and Iran revealed that fewer females were infected by SARS-CoV2[3,4].

Public health response to COVID-19 required behavior changes—isolation at home, wearing masks, hand hygiene, avoiding and limiting social gatherings and their effectiveness depends on generalized compliance. Original data from two waves of a survey conducted in March−April 2020 in eight Organizations for Economic Co-operation and Development countries showed large gender differences in COVID-19−related beliefs and behaviors. Women were found more likely to perceive the pandemic as a serious health problem and to agree and comply with restraining measures. More conscious adherence to Covid appropriate behavior among women contributed to substantial gender differences in mortality and women-led countries responded effectively to the pandemic. Hence gender-based public health policies and communication were important in this pandemic as also stated by Klein et al in 2020[5].

A complex interplay among biological, behavioral, environmental, and socioeconomic factors led to gender -specific COVID-19 outcomes. Sex differences in the immune response to infectious diseases and the role of sex steroids regulating immunity have been reported. It has been proposed that estrogens may exert protective effects against COVID-19 and a clinical trial is underway to determine if estradiol can reduce the severity of COVID-19 infection[6,7,8]. Pandemic related micro-level studies have focused on comorbidities but few studied sociodemographic factors

Knowledge on the association between demographic factors and different severity stages of COVID-19 such as duration and severity of infection, intensive care unit (ICU) admissions and death was needed to provide differences in underlying pathophysiological mechanisms like immunity, coagulopathy and comorbidities. This knowledge guides clinical decision-making, non pharmaceutical interventions and screening especially when there is a shortage in healthcare resources such as ICU beds as also felt by Brien et al in their study [9].

These demographic factors may also be important for studying their confounding effect on the design and interpretation of clinical trials and treatment protocols. The aim of this secondary data analysis was to describe the association between demographic factors and COVID-19 in different waves of the pandemic to guide to policy decisions on the health, commercial, social, and financial aspects in case of any future surge in Covid-19 cases.

Objectives:

1. To describe demographic characteristics and compare all three waves in Pali district.
2. To compare characteristics of District hospital admissions in all three waves.
3. To recommend caution in future epidemics on lessons learnt in all three waves based on key analysis outcomes of this study.

Methods

- Study Period – 6 months
- Study design: Secondary data analysis of the Hospital admissions and contact tracing data generated between 1st March 2020 and February 28th 2022 covering all three waves.
- Study area: Department of Community Medicine and Anatomy, GMC Pali
- Data collection and analysis: The data collected during contact tracing (urban and rural) and data of hospital admissions from the hospital medical record during the periods: February 2020 to October 2020 (first wave) and April 2021 to June 2021 (second wave) and December 2021 to February 2022 (Third wave) were analyzed. It was analyzed using excel and SPSS software (Version 22) in terms of proportions, percentage and Chi-Square test was used to compare and contrast the data between the multiple waves.

- Ethical considerations: The study was approved by the Institutional Ethics Committee of Government Medical College, Pali, Rajasthan.

Results

On comparison of the three waves, the second wave in the district had higher ICU admissions and deaths with rural admissions being more and worst affected age was between 15-50 years as seen in Table 1.

Table 1: Demographic difference between the three waves in Pali District, 2021

Variables	Total (n=60357)	First Wave (n_1=16676)	Second Wave (n_2=26443)	Third Wave (n_3=17238)
Male	38060 (63.1%)	10966 (65.8%)	16540 (62.5%)	10554 (61.2%)
Female	22297 (36.9%)	5710 (34.2%)	9903 (37.5%)	6684 (38.8%)
Below 15 years	4663 (7.7%)	1042 (6.2%)	1542 (5.8%)	2079 (12.1%)
15 to 50 years	41871 (69.4%)	10972 (65.8%)	19174 (72.5%)	11725 (68.0%)
Above 50 years	13823 (22.9%)	4662 (28.0%)	5727 (21.7%)	3434 (19.9%)
Urban	16598 (27.5%)	2852 (17.1%)	5198 (19.7%)	8548 (49.6%)
Rural	43759 (72.5%)	13824 (82.9%)	21245 (80.3%)	8690 (50.4%)

Table 2. Differences seen among rural and urban areas in all three waves of Covid -19 pandemic in Pali District Rajasthan 2021

Variables		Total (n=60357)	Rural (n_1=43759)	Urban (n_2=16598)	P-Value
Gender					
	Male	38060 (63.1%)	27767 (63.5%)	10293 (62.0%)	0.001057
	Female	22297 (36.9%)	15992 (36.5%)	6305 (38.0%)	
Age					
	Below 15 years	4663 (7.7%)	3441 (7.9%)	1222 (7.4%)	0.047106
	15 to 50 years	41871 (69.4%)	30249 (69.1%)	11622 70.0%)	
	Above 50 years	13823 (22.9%)	10069 (23.0%)	3754 (22.6%)	

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Hospital					
	Yes	9781 (16.2%)	9171 (21.0%)	610 (3.7%)	<0.00001
	No	50576 (83.8%)	34588 (79.0%)	15988 (96.3%)	
ICU Admitted					
	Yes	665 (1.1%)	622 (1.4%)	43 (0.3%)	<0.00001
	No	59692 (98.9%)	43137 (98.6%)	16555 (99.7%)	
Death					
	Yes	845 (1.4%)	343 (0.8%)	502 (3.0%)	<0.00001
	No	59512 (98.6%)	43416 (99.2%)	16096 (97.0%)	
p-value<0.05 considered significant					

Table 3. Differences seen among male and female population in all three waves of Covid -19 pandemic in Pali District Rajasthan 2021.

Variables		**Total (n=60357)**	**Male (n_1=38060)**	**Female (n_2=22297)**	**P-Value**
Hospital					
	Yes	9781 (16.2%)	6076 (16.0%)	3705 (16.6%)	0.0358
	No	50576 (83.8%)	31984 (84.0%)	18592 (83.4%)	
ICU Admitted					
	Yes	665 (1.1%)	408 (1.1%)	257 (1.2%)	0.8389
	No	59692 (98.9%)	37652 (98.9%)	22040 (98.8%)	
Death					
	Yes	845 (1.4%)	496 (1.3%)	349 (1.6%)	0.00818
	No	59512 (98.6%)	37564 (98.7%)	21948 (98.4%)	
p-value<0.05 considered significant					

Discussion

Present study conducted is a secondary data analysis of all test screenings and cases of the COVID-19 pandemic in Pali, Rajasthan, India, from January 2020 to May 2021 results showed over 60,357 confirmed cases of COVID-19 and 845 deaths during that 17-month period. Gender showed significant differences- morbidity, hospital admission, ICU admission and deathwas higher among males. High testing rates led to the identification of more cases in subsequent waves thus, differences in the identified number of cases and the actual number of cases largely depends on the extent of testing and diagnosis as suggested by Baig et al [10]. However, some studies suggest that increase in confirmed cases and deaths due to the corona virus was associated with significantly disturbed market situations , depressed sentiment, implementation of restrictions and lockdowns which contributed to the financial instability and increased illness[10,11].

In this study comparison of all three waves showed reported cases were higher among males, age group 15 to 50 years, and rural areas. Hospital admission and deaths were highest in second wave while ICU admissions was highest in first wave. However, other global studies have shown more equal distributions between the genders for case frequency, but males surpassed females in intensive care admission and death[12].

Our study showed the age distribution of COVID-19 cases was similar to worldwide data in which patients were from all age groups. Althoughin later waves COVID-19 transmission had increased in all age groups, the increase was most significant among the young in Europe and the United States unlike our study where the young continued to be the least affected[13,14]. A significant feature of an infectious disease is its severity, including its ability to cause death. Our overall case-fatality was 0.93 (95%CI 0.83–1.04), which was consistent with worldwide figures. Global figures also showed higher death rates for men compared to women. Male to female fatality rates in countries with available data ranged from 3.5 to 1[13].

Deaths from COVID-19 have occurred more in the elderly as per our data. The high prevalence of COVID-19 infections and deaths in Spain and Italy were probably due to older populations. Median population ages for Italy and Spain were 46.5 and 43.5 years respectively, and the percentage over age 65 years were 25% and 20% respectively[13,14].

In comparing case rates, the potential effect of false negatives and unconfirmed cases between both sexes should be taken into consideration. However, the impact of sex on susceptibility to CoV2 infection cannot be entirely excluded in our studies. Our findings regarding increased mortality in CoV2+ males are consistent with prior reports, suggesting that sex may modify CoV2 infection or susceptibility to experiencing disease caused by this infectious agent[14,15]. Indeed, intrinsic biological differences may be contributing to higher susceptibility to infection and poorer outcomes in males compared to females. Literature suggests that an inherent difference in the activation of an adaptive immune responses in females, including elevated cytotoxic T cell activation and up regulated expression of antiviral and pro-inflammatory genes such as interferon-gamma (IFNG) that have estrogen response elements[16,17,18,19]. Thus, female sex hormones may play a role in the risk reduction for worse outcomes in the setting of COVID-19. Better designed prospective studies are required to confirm the impact of sex on COVID-19 morbidity and mortality.

Origin of the second wave (December 2020–March 2021) has been traced to a wholesale shrimp market of Wuhan, China. There was an increase in new cases during this period attributed to the strain B.1.36.16, which would replace the A.6 strain of the first wave [20]. Dense living conditions in community and the lack of personal precautions to prevent infection spread contributed to spread in clusters and families who were in contact with a confirmed case[21]. During the third wave (April2021 to September 2021), super spreading events were identified at entertainment establishments. Number of cases increased to more than the first and second waves combined but very few required hospital admissions. Additionally, strain Alpha-B.1.1.7 was presented; which spread much faster than other variants, both strains Beta-B.1.351 and Data-B.1.617.2 were found during third wave.

Our results indicate that the Second wave was most serious among all the waves but this finding

differs from other studies like from Thailand by Kunno J et al (2020) showing that the first wave of COVID-19 pandemic had the most negative impact on public health[22]. In contrast, the second wave showed unstable evolutionary dynamics. Also, sufficient epidemiologic investigations and contact tracing could not be performed during the third wave, as there was a marked increase in the proportion of unknown routes of transmission[23]

Reason for the clear differences across phases and waves is not yet known, although it has been suggested that the new delta variant of COVID-19 emerged in Pali the middle of 2021, and transmission to the general population was replicated across the country.

This finding was also observed by Matsunaga N et al in a study conducted in Japan where the second wave had a smaller proportion of severe cases (12.0% vs33.1%) as compared to first wave and Mortality (1.2% vs 7.3%) in hospitalized ordischarged patients was also lower in the second wave[24]. A different finding was observed in a study by Fan G et al 2021 and Sigler et al 2021, based on data collected from 53 countries where the second wave had a smaller proportion offatal cases as compared to first wave[25,26]. Similar finding was observed by Simone I et al (2021) in Spain where the second wave had lower case fatality rate(13.2% vs 24%) as compared to first wave[27].

Conclusions

The second wave was the worst in Pali district of Western Rajasthan. In all three waves the males, ages 15-60 years, hospital admissions, ICU admissions and deaths amongst rural population remained higher.

Recommendations: Demographic and sex aggregated data analysis ensures better targeting of interventions and limits expensive interventions such as intensive care admissions and avoidable deaths for future waves. Such data is also important for planning vaccination campaigns as the more vulnerable populations are identified as high risk to create an efficient, equitable response to the pandemic, especially in countries where resources are limited. Continuous scrutiny of the roles of gender, age and geography in the outbreak are much needed.

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References

1. World Health Organization. Coronavirus Disease (COVID-19) Situation report. 21September 2020.
2. Chen N, Zhou M, Dong X, Qu J, Gong F, Han Y, et al. Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: adescriptive study. Lancet. 2020; 395(10223):507–13.
3. Williamson EJ, Walker AJ, Bhaskaran K, Bacon S, Bates C, Morton CE, et al. Open SAFELY: factors associated with COVID-19 death in 17 million patients. Nature. 2020.
4. Kalyanaraman MR, Dolle J, Grami S, Adule R, Li Z, Tatem K, et al. Characteristics and outcomes of COVID-19 patients in New York City's public hospital system. PLoS ONE 15(12) Dec2020 : e0243027. https://doi.org/10.1371/journal.pone.0243027
5. Klein SL, Dhakal S, Ursin RL, Deshpande S, Sandberg K, Mauvais-Jarvis F Biological seximpacts COVID-19 outcomes. PLoS Pathog. 2020;16(6):e1008570.
6. Chanana N, Palmo T, Sharma K, Kumar R, Graham BB, Pasha Q. Sex-derived attributes contributing to SARS-CoV-2 mortality. Am J Physiol EndocrinolMetab. 2020 Sep 1;319(3):E562-E567. doi: 10.1152/ajpendo.00295.2020. Epub 2020 Jul 29. PMID: 32726128; PMCID: PMC7473885
7. Zhang J, Wang X, Jia X, Li J, Hu K, Chen G, et al. Risk factors for disease severity, unimprovement, and mortality in COVID-19 patients in Wuhan. China Clin Microbiol Infect.2020;26(6):767–72.
8. Jin JM, Bai P, He W, Wu F, Liu XF, Han DM, Liu S, Yang JK. Gender Differences in Patients With COVID-19: Focus on Severity and Mortality. Front Public Health. 2020 Apr 29;8:152. doi: 10.3389/fpubh.2020.00152. PMID: 32411652; PMCID: PMC7201103.
9. Klein SL, Jedlicka A, Pekosz A. The Xs and Y of immune responses to viral vaccines. The Lancet Infectious diseases. 2010; 10(5):338–49. Epub 2010/04/27.

10. Baig AS, Butt HA, Haroon O, Rizvi SAR. Deaths, panic, lockdowns and US equity markets: The case of COVID-19 pandemic. Financ Res Lett. 2021 Jan;38:101701. doi: 10.1016/j.frl.2020.101701. Epub 2020 Jul 25. PMID: 32837381; PMCID: PMC7381907.

11. Shams SA, Haleem A, and Javaid M, "Analyzing COVID- 19 pandemic for unequal distribution of tests, identified cases, deaths, and fatality rates in the top 18 countries," Diabetes & Metabolic Syndrome: Clinical Research & Reviews, 2020; 14(5) 953–961.

12. Maraqa B, Al-Shakhra K, Alawneh M, Jallad R, Alkaila M. Demographic factors associated with COVID-19-related death in Palestine. Public Health Pract (Oxf). 2021 Nov;2:100145. doi: 10.1016/j.puhip.2021.100145.

13. The Sex Gender and COVID 19 project, The COVID-10 Sex-Disaggregated Data Tracker, 2020 https://globalhealth5050.org/the-sex-gender-and-covid-19-project/the-data-tracker/

14. Sannigrahi S, Pilla F, Basu B, Basu AS, Molter A. Examining the association between socio-demographic composition and COVID-19 fatalities in the European region using spatial regression approach. Sustain Cities Soc. 2020 Nov;62:

15. Eskandari A, Brojakowska A, Bisserier M, Bander J, Garikipati VNS, Hadri L, Goukassian D, Fish K. Retrospective analysis of demographic factors in COVID-19 patients entering the Mount Sinai Health System. PLoS One. 2021 Jul 16;16(7):e0254707. doi: 10.1371/journal.pone.0254707. PMID: 34270621; PMCID: PMC8284665.

16. Gebhard C, Regitz-Zagrosek V, Neuhauser HK, Morgan R, Klein SL. Impact of sex and gender on COVID-19 outcomes in Europe. Biology of sex differences. 2020; 11(1):29. Epub 2020/05/27. https://doi.org/10.1186/s13293-020-00304-9 PMID: 32450906; PubMed Central PMCID: PMC7247289.

17. Boissier J, Chlichlia K, Digon Y, Ruppel A, Mone´ H. Preliminary study on sex-related inflammatory reactions in mice infected with Schistosomamansoni. Parasitology research. 2003; 91(2):144–50. Epub 2003/08/12. https://doi.org/10.1007/s00436-003-0943-1 PMID: 12910415.

18. Hewagama A, Patel D, Yarlagadda S, Strickland FM, Richardson BC. Stronger inflammatory/cytotoxic T-cell response in women identified by microarray analysis. Genes and immunity. 2009; 10(5):509–16. Epub 2009/03/13. https://doi.org/10.1038/gene.2009.12 PMID: 19279650; PubMed Central PMCID: PMC2735332.

19. Bukowska A, Spiller L, Wolke C, Lendeckel U, Weinert S, Hoffmann J, et al. Protective regulation of the ACE2/ACE gene expression by estrogen in human atrial tissue from elderly men. Experimental biology and medicine (Maywood, NJ). 2017; 242(14):1412–23. Epub 2017/07/01. https://doi.org/10.1177/1535370217718808 PMID: 28661206;

20. Khan I, Haleem A, Javaid M, "Analysing COVID-19 pandemic through cases, deaths, and recoveries," Journal ofOral Biology and Craniofacial Research, 2020,vol. 10(4) 450–469.

21. Department of Disease Control, Corona Virus Disease (COVID-19), Department of Disease Control, Nonthaburi, Thailand, 2021 https://ddc.moph.go.th/viralpneumonia/eng/index.php

22. Kunno J, Supawattanabodee B, Sumanasrethakul C, Wiriyasivaj B, Kuratong S, Kaewchandee C. Comparison of Different Waves during the COVID-19 Pandemic: Retrospective Descriptive Study in Thailand. Guillen Nieto GE, editor. AdvPrev Med. 2021 Oct 8;1–8.

23. Soriano V, Ganado-P, Sanchez-Santos M et al., "Main differences between the first and second waves of COVID-19 in Madrid, Spain," International Journal of Infectious Diseases, vol. 105, pp. 374–376, 2021.

24. Matsunaga N, Hayakawa K, Asai Y, Tsuzuki S, Terada M, Suzuki S, Ohtsu H, Kitajima K, Toyoda A, Suzuki K, Suzuki M, Saito S, Uemura Y, Shibata T, Kondo M, Nakamura-Uchiyama F, Yokota K, Saito F, Izumi K, Sugiura W, Ohmagari N. Clinical characteristics of the first three waves of hospitalised patients with COVID-19 in Japan prior to the widespread use of vaccination: a nationwide observational study. Lancet Reg Health West Pac. 2022 Mar 16;22:100421.

25. Fan G, Yang Z, Lin Q, Zhao S, Yang L, He D. Decreased Case Fatality Rate of COVID-19 in the Second Wave: A study in 53 countries or regions. TransboundEmerg Dis. 2021 Mar;68(2):213-215. doi: 10.1111/tbed.13819. Epub 2020 Sep 17. PMID: 32892500.

26. Sigler T, Mahmuda S, Kimpton A et al.,"Socio-spatial determinants of COVID-19 diffusion: the impact of globalisation, settlement characteristics and population," Globalization and Health, 17(1), 56-61, 2021.

27. Simone M. Emery A ,Hazzard RL, Eisenberg VM, Larson ME, Neumark-Sztainer, D. (2021). Disordered eating in a population-based sample of young adults during the COVID-19 outbreak. The International journal of eating disorders, 54(7), 1189–1201. https://doi.org/10.1002/eat.23505