

DEATHS IN ADULTS WITH CO-MORBIDITIES DURING COVID 19 IN RAJASTHAN: A DESCRIPTIVE ANALYSIS

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in

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by

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Under the Supervision and Guidance of

Dr. Seema Mehta

Academic Year 2019-21

DECLARATION BY STUDENT

I hereby declare that this dissertation titled '**Mortality in adults with Co-morbidities during Covid 19 in Rajasthan: A Descriptive analysis**' is the Bonafede record of my original research work. I declare that it has not been submitted to any other university or institution for the award of any degree or diploma. Information derived from the published or unpublished work of others has been duly acknowledged in the text.

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CERTIFICATE

This is to certify that dissertation titled '**Mortality in adults with Co-morbidities during Covid 19 in Rajasthan: A Descriptive analysis**' is a record of the research work undertaken by **Surbhi Garg** in partial fulfilment of the requirements for the award of the degree of MBA (Hospital and Health Management from the IIHMR University, Jaipur under my guidance and supervision and his/her approach to the research study has been sincere, scientific, and analytical.

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MBA-HM24

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Chapter 1: Introduction

1.1 Background of Research

With the primary case of corona viral infection rumoured from city, China on 31st December 2019, there has been unprecedented eruption of coronavirus (COVID-19). As of 2021, over 18 crore cases of corona infection were rumoured from 210 countries with thirty-nine lakhs deaths. Although, the primary case was rumoured from China, COVID-19 became devastating in alternative countries with USA, Spain, Italy, Germany, and France leading not solely within the variety of cases however conjointly in variety of deaths rumoured.

“Countries everywhere measure taking aggressive steps and adopting all potential preventive measures to stop the unfold of this infection. 1/2 the planet population is underneath the lockdown in April 2020 as a live to stop the unfold”.

“The first confirmed death was rumoured in Wuhan city on ninth January 2020. before long it unfolds outside the Asia, France quite forty countries and territories had rumoured deaths, in each continent except Antarctic continent”.

“The death numbers square measure thus rampant that the death rate is over 10% percent in as several as twenty countries round the world. India, as per the report of Ministry of Health & Family Welfare, Government of India, there have been three Crores positive cases of COVID-19 as on 22nd June 2021 and 3.93L deaths have occurred”.

“The unfold of SARS-Cov2 viral infection, normally called COVID-19, has caused a serious health concern everywhere the planet naming it a world pandemic. The infection is known to spread rigorously because of its high reproductive number that is estimated to be 3.28(Liu et al). The spread of the infection was not bound to any boundaries”.

1.2 Purpose of research

Unlike the countries affected earlier with this pandemic that have undergone the epidemiological transition, India still faces disease burden of infectious and chronic sickness challenges. This, in addition to economic condition, suboptimal health care access, disease transmission enablers (such as internally displaced migrant populations; and adverse weather events that compromises mitigation, access to worry, and care delivery) create things more advanced.

Indian population excluding nutritional deficiencies of macronutrients (proteins), micronutrients and vitamins (like fat-soluble vitamin, C or zinc). The high burden of insulin Resistance and Cardiometabolic Risk in Asian Indian population might confer a mortality risk and therefore shut vigilance during this set

India sadly incorporates a high burden of NCDs particularly fat, cardiovascular disease, diabetes and heart diseases, Cancer, disease, pulmonary disease excluding chronic kidney disease which can drive mortality. The virus host interactions which can drive mortality are going to be coupled via this risk score and vulnerable population

1.3 Importance of Research

It is the prevalence of a comorbid condition that is seen to be related to poor outcomes among the infected population. Comorbidity is stated an existing health condition in a patient that although in restraint will cause complications once an unexpected pathology happens. many lifestyle-related diseases and age-related conditions are found to be comorbid for many CoV infected cases. Not simply the present COVID-19 virus however additionally the earlier recorded infection unfolds of SARS-CoV and MERS-CoV.

It was evidently proven that the bodies immunity weakens in the presence of long-term diseases. The presence of one comorbid condition is found to have a hazard ratio of 1.79 and is increased to 2.59 (both 95% CI) with two or more conditions (guan et.al)ⁱ. In case of diabetes and high blood pressure, it is acknowledged that their risk will increase with age.

It is additionally lifestyle dependent as they will be avoided to a bigger extend if a healthy lifestyle is maintained. certain health issues that are caused by accidents or by birth cannot be utterly cured. once it is the case of Liver or kidney dysfunctions, it might arise because of biological science or lifestyle.

These conditions are identified for their long persistence within the host inflicting the body to eventually depend upon supplements and different artificial resource to keep up balance. All the mentioned comorbid conditions do not have a cure however solely a supplement-based treatment to supply a balanced health. Such a vital condition is exploited by a virulent infection like CoV to attach and prevail within the host, leading to the worst outcomes

“The connecting link to this associated comorbidity has been the angiotensin-converting enzyme-2 (ACE2) receptor as its site of virus multiplication. Research for decades together has proved that ACE2 is expressed in epithelial cells of the lung, intestine, kidney, and blood vessels” (Y., 2020)ⁱⁱ.

“The expression of ACE2 is substantially increased in patients with type 1 or type 2 diabetes, hypertension and it is the regulator not only of the blood pressure, inflammation, and immune mechanisms but also a regulator of electrolyte balance” (J.L., 2017)ⁱⁱⁱ.

“The increase deaths due to the novel coronavirus is due to unopposed activation of the local renin angiotensin system (RAS) in the lungs and heart. People with underlying comorbidities the increased RAS will predispose them to cytokine storm. In these people ACE 2 is protective which is consumed by the SARS cov2 and there is unopposed action of Angiotensin 2 leading to a cascade of cytokine storm of Interleukins: IL6, IL1 and others”.

“Human ACE 2 plays a key role in the pathogenesis of the cytokine storm. The Human ACE 2 and its receptors have several well know gene polymorphisms which are documented across ethnic groups”.

“There are average of six genetic variants associated with higher ratios of ACE2 cells: rs233575 (A), rs714205 (G), rs1978124 (C), rs879922 (G), rs2048683 (G), rs1877752 (C) which confer population risk in many ethnic groups including Asian Indians. Also, role of ACE inhibitors and Angiotensin Receptor blocker may paradoxically be protective and will need evidence base generation” (Joshi, May 2020)^{iv}.

1.4 Problem

“The COVID-19 disease mostly affects the respiratory tract inflicting respiratory illness in around 20%–25% cases, a few that more get to develop severe acute respiratory syndrome. The mortality rates vary from 2 to 15 and are higher among the aged and people with associated comorbid conditions like cardiovascular disease, anaemia cardiopathy, diabetes, and COPD” (Alqahtani JS, 2020) (Yang J, 2020)^{vii}

“In the middle of this current COVID-19 pandemic, there are an estimated 300 million cases of COPD within the community worldwide UN agency are additional at risk of not solely catch the infection however conjointly develop a lot of severe kind of the COVID-19 disease and have an enhanced chance of dying from it” (Lippi G, 2020)^{vii}.

“There are a calculable 55 million cases of COPD in India, that is already the second leading reason behind death and disability-adjusted life years” (D, 2020)^{viii}.

“Physicians in India got to be ready to not solely manage the COVID-19 pandemic however conjointly safeguard the vulnerable population of COPD. The SARS-CoV-2 virus that causes the COVID-19 sickness uses the angiotensin-converting protein receptor-2 to enter within the cells to cause the infection (Zhou P, 2020)^{ix}. ACE-2 receptors are expressed on the top surfaces of the polarized lung epithelial cells of each the higher and lower airways” (Leung JM, 14 may 2020)^x.

The numbers are considerably enhanced in patients with COPD compared to people who do not have COPD, and this has been considered that this accounts for not solely having a bigger risk of having the COVID-19 infection however conjointly for having a lot of severe kind of the sickness.

“The study found that critically ill COVID-19 patients with COPD had a 63 per cent risk of severe disease and a 60 per cent risk of mortality. On the other hand, critically ill patients without COPD had only a 33.4 per cent risk of severe disease, and 55 per cent risk of deaths, the researchers” said^{xi}.

“A new study by Williamson et al. recently published in *Nature* addresses this knowledge gap” (Williamson, 2020)^{xii}. “Patients with severe forms of CKD have a very high risk of COVID-19 deaths”.

“This study also highlights the importance of CKD as a risk factor for COVID-19 deaths. Study by Williamson et al. includes data for three subgroups with CKD (those with an estimated glomerular filtration rate (eGFR) of 30–60 ml/min/1.73 m², those with an eGFR of <30 ml/min/1.73 m² and those who were receiving maintenance dialysis) as well as a subgroup of solid organ transplant recipients” (Williamson, 2020).

“When the data for the CKD subgroups are compared, it becomes clear that a graded association exists between the level of kidney dysfunction and the risk of COVID-19 deaths” (Williamson, 2020).

“It also demonstrated that patients with severe forms of CKD have a very high risk of COVID-19 deaths, which is even higher than that of other known high-risk groups, including patients with hypertension, obesity, chronic heart disease or lung disease”

(Williamson, 2020). “Patients with CKD have multiple comorbidities like diabetes and cardiovascular disease, that need regular follow-up. Again, uncontrolled diabetes and cardiovascular disease cause quicker progression of CKD” (Williamson, 2020).

“Covid-19 positive people with underlying liver diseases such as cirrhosis or non-alcoholic fatty liver disease are at a higher risk of dying from the virus, as per a study presented at the Digital International Liver Congress (DILC)”. “The Start-up World quoted Professor Thomas Berg, section head at University Hospital's hepatology department in Germany, as saying at the conference that comorbidities show a “noteworthy role” in the severity of Covid-19 cases”.

“Cardiovascular is the most known risk factors, but nobody can see anything about the liver, added Berg while establishing a correlation between chronic liver disease and obesity with deaths during the pandemic”. “According to recent statistical data, over 25 per cent of the world's population might have non-alcoholic fatty liver disease, which is clearly connected to obesity, also a risk factor for Covid-19, Berg added”.

“He further suggested that non-cirrhotic liver disease does not cause severity in Covid-19 positive patients. However, the deaths risk increases if a patient develops cirrhosis during the fight against Covid-19. This risk can go up to 50 percent” (Awasthi, 2020)^{xiii}

The ongoing pandemic of coronavirus disease 2019 (COVID-19) caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has caused new healthcare and social crises around the world. This catastrophe but has victimised the cancer patients the foremost, adversely affecting diagnosis and treatment in concerning 55th of cases worldwide.

“It is typically assumed that patients with cancer are at the next risk of getting COVID-19. in addition, it is conjointly postulated that the severity and ensuing deaths is amplified in cancer patients with COVID-19 because of their older and therefore the immunocompromised state more worsened by cancer treatment.

Multiple studies from different geographical locations show that the case fatality rate (CFR) of the SARS-CoV-2 infected cancer patients varies from 3.7% to 61.5%” (Kalinsky K, 2020)^{xiv xv xvi}

The case mortality rate or deaths of covid 19 is coupled to the current vulnerability and therefore the important need to ought to develop Indian vulnerability score to focus and establish this set.

The key variables showing vulnerabilities within the early stages of the Indian corona pandemic seem to be age (more than 55 not 65 just like the world average, obesity (BMI >27), high blood pressure, diabetes, chronic heart / respiratory organ / renal /hepatic illness, congenital or acquired immunological disorder, further as people on long run immunological disorder or treatments together with transplant recipients aside from physiological condition or youngsters below 10).

This score can need validation within the Indian scenario and can permit a risk stratification to protect resources.

Clearly pandemic has pushed each central and state governments of India to manoeuvre up from the least payment on healthcare to a bigger pay and build public health infrastructure underneath numerous "Ayushman Bharat" and connected health schemes.

“The per capita pay for the GDP on health being one amongst all-time low within the world therefore a shift of fund allocation from Defence to defence of human health is clearly the requirement of the hour.

Public health infrastructure and important care can ought to be revamped. India has each political and peoples can battle this virus, and its aftermath each economically and health wise”.

Chapter 2: Review of Literature

2.1 It includes the studies focusing on the Covid deaths in adults with co-morbidities related to Kidney, Respiratory, Cancer and liver.

TITLE	DATE	AUTHOR	CONCLUSION
1.Outcomes of COVID-19 in Patients with Cirrhosis or Liver Transplantation 10.1016/j.jceh.2021.05.003 ^{xvii}	2021 May 12	Narendra S. Choudhary, Swapnil Dhampalwar, Neeraj Saraf, and Arvinder S. Soin	Coronavirus disease 2019 (COVID-19) is associated with a significant morbidity and mortality in patients with cirrhosis. There is a significantly higher morbidity and mortality due to COVID-19 in patients with decompensated cirrhosis as compared to compensated cirrhosis, and in patients with cirrhosis as compared to noncirrhotic chronic liver disease. The fear of COVID-19 before or after liver transplantation has led to a significant reduction in liver transplantation numbers, and patients with decompensated cirrhosis remain at risk of wait list mortality.
2.COVID-19 Infection in Children and Young Adults with Chronic Kidney Disease: A Single Centre Experience ^{xviii}	28 TH April, 2021	Swarnim, Madhavi Bharadwaj, Mukta Mantan, Onkar Singh Bhinder,	The presenting features of COVID-19 were similar in children and young adults with underlying CKD compared to their healthy counterparts; however, the mortality rate and intensive care requirement were higher, and duration of hospital stay too was longer.

		Urmila Jhamb	
3.Impact of chronic obstructive pulmonary disease on severity and outcomes in COVID-19 patients: A systematic review https://www.ijncd.org/text.asp?2021/6/1/10/314211 ^{xix}	21 st April, 2021	Ashutosh Nath Aggarwal, Ritesh Agarwal, Sahajal Dhoooria, Kuruswamy Thurai Prasad, Inderpaul Singh Sehgal, Valliappan Muthu	COPD patients with COVID-19 had a significantly higher risk of severe disease (summary RR 2.44, 95% confidence interval [CI] 1.93–3.09), hospitalization (summary RR 1.91, 95% CI 1.70–2.14), ICU admission (summary RR 1.81, 95% CI 1.35–2.43), mechanical ventilation (summary RR 1.75, 95% CI 1.35–2.28), and mortality (summary RR 2.40, 95% CI 1.93–2.51), as compared to COVID-19 patients without COPD. All analyses showed significant between-study heterogeneity. We conclude that comorbid COPD significantly increases the risk of severe disease and adverse outcomes among COVID-19 patients.
4.Clinical review of COVID-19 patients presenting to a quaternary care private hospital in South India: A retrospective study https://doi.org/10.1016/j.cegh.2021.100751 ^{xx}	26 th April, 2021	Prithvi Mohandas Sathya Periasamy Manimaran Marappan Arun Sampath Vanaja Kate Garfin Sundaram Vijit Koshy Cherian	In this single centre hospital-based study, late presentation, and more severe form of COVID pneumonia led to higher mortality although it had lower mortality rate for COVID-19 in comparison. Late phase of the pandemic showed better outcomes vs. the early group.

5.Prediction of mortality by age and multi-morbidities among confirmed COVID-19 patients: Secondary analysis of surveillance data in Pune, Maharashtra, India ^{xxi}	20 th March, 2021	Nikunj Kansara ¹ , Ashok B Nandapurkar ² , Rahul Maniyar ³ , Arun Kumar Yadav ⁴	Out of the 1270 deaths, 825 (65%) were male and 788 (62%) had one or more comorbidities. Logistic regression was done for predictors of death, and males (adjusted odds ratio: 1.6, 95% CI: 1.4–1.8), those with symptoms at the time of admission (adjusted odds ratio: 2.9, 95% CI: 2.5–3.4), and those with the presence of two or more comorbidities (adjusted odds ratio: 2.7, 95% CI: 2.2–3.4) were having a higher risk of death.
6.COPD and the risk of poor outcomes in COVID-19: A systematic review and meta-analysis ^{xxii}	18 th March, 2021	Firoozeh V. Gerayelia, Stephen Milnea, b,c , Chung Cheunga , Xuan Lia , Cheng Wei Tony Yanga , Anthony Tama , Lauren H. Choia , Annie Baea , Don D. Sin	Having a clinical diagnosis of COPD significantly increases the odds of poor clinical outcomes in patients with COVID-19. COPD patients should thus be considered a high-risk group, and targeted for preventative measures and aggressive treatment for COVID-19 including vaccination
7.COPD Management during the COVID-19 pandemic ^{xxiii}	6 th March, 2021	Sundeeep Santosh Salvi, Raja Dhar, PA Mahesh, Zarir	Patients with COPD are at a high risk of catching the COVID-19 infection, developing a more severe form of COVID-19 disease, and a greater risk of dying from it. COPD patients should therefore be

		Farooq Udhwadia, Digambar Behra	encouraged to adopt more restrictive measures to minimize potential exposures to COVID-19 and every effort must be made to reduce their contacts with suspected or confirmed cases of COVID-19. Staying at home, proper hand hygiene, and wearing a mask are crucial to reduce the risk of catching the COVID-19 disease. It is important to ensure that COPD is managed well with appropriate pharmacotherapy, vaccination (influenza and pneumococcal), and rehabilitation, and all measures must be undertaken to prevent the development of any acute exacerbation. COPD patients should not be admitted for acute exacerbations in COVID hospitals.
8.Prevalence and mortality of lung comorbidities among patients with COVID-19: A systematic review and meta-analysis 10.4103/lungindia.lungindia_497_20. ^{xxiv}	March, 2021	Mohammed G Alkhathami, Shailesh M Advani, Adil A Abalkhail, Fahad M Alkhathami, Mohammed K Alshehri, Ebtisam E Albeashy,	Mortality rates associated with these comorbidities was 30% (41/137) for COPD and 19% (7/37) for lung cancer, respectively. No mortality rates were reported for patients with asthma. This study offers latest evidence of prevalence of chronic lung conditions among patients with COVID-19. Asthma, followed by COPD and lung cancer, was the most common lung comorbidity associated with COVID-19, while the higher mortality rate was found in COPD. Future studies are needed

		Jihad A Alsalamah	to assess other lung comorbidities and associated mortality among patients diagnosed with COVID-19.
9.Causes of death and comorbidities in hospitalized patients with COVID-19 10.5603/ARM.a2021.0036 ^{xxv}	19 th Feb, 2021	Sefer Elezkurtaj, Selina Greuel, Jana Ihlow, Edward Georg Michaelis, Philip Bischoff, Catarina Alisa Kunze, Bruno Valentin Sinn, Manuela Gerhold, Kathrin Hauptmann, Barbara Ingold- Heppner, Florian Miller, Hermann Herbst, Victor Max Corman, Hubert Martin	Respiratory failure due to diffuse alveolar damage presented as immediate cause of death in fewer cases. Several comorbidities, such as hypertension, ischemic heart disease, and obesity were present in most patients. Our findings reveal that causes of death were directly related to COVID-19 in most decedents, while they appear not to be an immediate result of pre-existing health conditions and comorbidities. We therefore suggest that most patients had died of COVID-19 with only contributory implications of pre-existing health conditions to the mechanism of death.

10.Impact of COPD on COVID-19 prognosis: A nationwide population-based study in South Korea ^{xxvi}	12 th Feb, 2021	Sang Chul Lee, Kang Ju Son, Chang Hoon Han, Seon Cheol Park & Ji Ye Jung	Multivariate analyses showed that COPD was not a risk factor for respiratory failure but was a significant independent risk factor for all-cause mortality (OR = 1.80, 95% CI 1.11–2.93) after adjustment for age, sex, and Charlson Comorbidity Index score. Among COVID-19 patients, relatively greater proportions of patients with COPD received mechanical ventilation and intensive critical care. COPD is an independent risk factor for all-cause mortality in COVID-19 patients in Korea.
11.COVID-19 in chronic kidney disease: a retrospective, propensity score-matched cohort study ^{xxvii}	6 th Feb, 2021	Ahmet Burak Dirim, Erol Demir, Serap Yadigar, Nurana Garayeva, Ergun Parmaksiz, Seda Safak, Kubra Aydin Bahat, Ali Riza Ucar, Meric Oruc, Ozgur Akin Oto, Alpay	The mortality rates of COVID-19 patients with CKD had higher than COVID-19 patients without CKD. Also, AKI and respiratory failure were independently related to mortality.

12.COVID-19 mortality in cancer patients: a report from a tertiary cancer centre in India ^{xxviii}	21 st Jan, 2021	Anurag Mehta, Smreti Vasudevan, Anuj Parkash, Anurag Sharma, Tanu Vashist, Vidya Krishna	the best of our knowledge, this is the first study from India reporting the CFR, clinical associations, and risk factors for mortality in SARS-CoV-2 infected cancer patients. Our study shows that the frequency of COVID-19 in cancer patients is high. Recent anticancer therapies are not associated with mortality. Pre-existing comorbidities, especially diabetes, multiple comorbidities, and severe symptoms at presentation are significantly linked with COVID-19 related death in the cohort.
13.Predictors of mortality in patients with severe COVID-19 pneumonia - a retrospective study 10.5603/ARM.a2021.0036 ^{xxix}	2021	M Mahendra, Abhishek Nuchin, Ranjith Kumar, S Shreedhar, Padukudru Anand Mahesh	Severe COVID-19 pneumonia is associated with very high mortality, especially in a resource-constrained setting. The use of remdesivir may have to be considered early in the course of disease to prevent excess mortality related to COVID-19
14.COVID-19 mortality effects of underlying health conditions in India: a modelling study 10.1136/bmjopen-2020-043165 ^{xxx}	16 th Dec, 2020	Paul Novosad, correspondi ng author1 Radhika Jain,2 Alison Campion,3	Relative to England, Indians have higher rates of diabetes (10.6% vs 8.5%) and chronic respiratory disease (4.8% vs 2.5%), and lower rates of obesity (4.4% vs 27.9%), chronic heart disease (4.4% vs 5.9%) and cancer (0.3% vs 2.8%). Population COVID-19 mortality in India, relative to England, is most

		and Sam Asher ⁴	increased by uncontrolled diabetes (+5.67%) and chronic respiratory disease (+1.88%), and most reduced by obesity (−5.47%), cancer (−3.65%) and chronic heart disease (−1.20%). Comorbidities were associated with a 6.26% lower risk of mortality in India compared with England. Demographics and population health explain a third of the difference in share of deaths under age 60 between the two countries.
15.Impact of chronic liver disease upon admission on COVID-19 in-hospital mortality: Findings from COVOCA study https://doi.org/10.1371/journal.pone.0243701 ^{xxxix}	10 th Dec, 2020	Raffaele Galiero, Pia Clara Pafundi, Vittorio Simeon, Luca Rinaldi, Alessandro Perrella, Erica Vetrano, Alfredo Caturano, Maria Alfano, Domenico Beccia, Riccardo Nevola	Mortality of patients hospitalized for COVID-19 appears strongly affected by both clinical conditions on admission and comorbidities. Originally, we observed a very poor outcome in subjects with a chronic liver disease, alongside with an increase of hepatic damage.
16.Prevalence and predictors of death and	7 th Dec, 2020	Kunchok Dorjee,	Public health screening for COVID-19 can be prioritized based on risk-

severe disease in patients hospitalized due to COVID-19: A comprehensive systematic review and meta-analysis of 77 studies and 38,000 patients https://doi.org/10.1371/journal.pone.0243191 1 ^{xxxii}		Hyunju Kim, Elizabeth Bonomo, Rinchen Dolma	groups. Appropriately addressing the modifiable risk factors such as smoking, hypertension, and diabetes could reduce morbidity and mortality due to COVID-19; public messaging can be accordingly adapted.
17.COVID-19 and the liver https://doi.org/10.1016/j.jhep.2020.06.006 xxxiii	1 st Nov, 2020	Dinesh Jothimani Radhika Venugopal Mohammed Forhad Abedin Ilankumaran Kaliamoorthy Mohamed Rela	In the current pandemic, hepatic dysfunction has been seen in 14–53% of patients with COVID-19, particularly in those with severe disease. Cases of acute liver injury have been reported and are associated with higher mortality. Hepatic involvement in COVID-19 could be related to the direct cytopathic effect of the virus, an uncontrolled immune reaction, sepsis, or drug-induced liver injury. The postulated mechanism of viral entry is through the host angiotensin-converting enzyme 2 (ACE2) receptors that are abundantly present in type 2 alveolar cells. Interestingly, ACE2 receptors are expressed in the gastrointestinal tract, vascular endothelium and choanocytes of the liver. The effects of COVID-19 on underlying chronic liver disease

			require detailed evaluation and, with data currently lacking, further research is warranted in this area.
18.COVID-19 pandemic and care of chronic kidney diseases patients in India ^{xxxiv}	1 st Sep, 2020	Manas Ranjan Behera	COVID-19 significantly impacted health services for NCDs including care of CKD patients. Moreover, these people are at higher risk of severe COVID-19-related illness and death. It is vital that countries find innovative ways to ensure that essential services for CKD continue, even as they fight COVID-19.
19.CKD is a key risk factor for COVID-19 mortality https://doi.org/10.1038/s41586-020-2521-4 ^{xxxv}	26 th August, 2020	Ron T. Gansevoort & Luuk B. Hilbrands	These data also demonstrate that patients with severe forms of CKD have a very high risk of COVID-19 mortality, which is even higher than that of other known high-risk groups, including patients with hypertension, obesity, chronic heart disease or lung disease.
20.Poor outcomes in patients with cirrhosis and Corona Virus Disease-19 ^{xxxvi}	15 th August, 2020	Shalimar, Anshuman Elhence, Pramod Garg	COVID-19 is associated with poor outcomes in patients with cirrhosis, with worst survival rates in ACLF. Mechanical ventilation is associated with a poor outcome.
21.Mortality in patients with cancer and coronavirus disease 2019: A systematic review and pooled analysis of 52 studies	11 th August, 2020	Kamal S. Sainiab Marco Tagliament ocd Matteo Lambertinic d Richard McNallya Marco	Patients with cancer who develop COVID-19 have high probability of mortality. Appropriate and aggressive preventive measures must be taken to reduce the risk of COVID-19 in patients with cancer and to optimally manage those who do contract the infection.

https://doi.org/10.1016/j.ejca.2020.08.011 xxxvii		Romanoa Manuela Leonea Giuseppe Curigliano f Evandro de Azambuja g	
22.chronic kidney disease and hypertension with reference to COVID-19 ^{xxxviii}	21 st May, 2020	Manish Rathi ¹ , Tarun Jeloka ² , Narayan Prasad ³ , Shyam Bansal ⁴ , Sanjay Kumar Agarwal ⁵ , AK Bhalla ⁶	it is anticipated that few patients of CKD will experience episodes of acute kidney injury (AKI) following COVID-19 infection, and the renal function will further deteriorate. Such a decline in kidney function will however depend upon the severity of the infection. SARS-Cov-2 may affect the kidney directly through angiotensin-converting enzyme 2 (ACE2) receptors causing direct injury, glomerular injury by affecting effector T cell or immune-complex formation, and as a part of cytokine storm after virus-induced sepsis.
23.Prevalence, Severity and Mortality associated with COPD and Smoking in patients with COVID-19: A Rapid Systematic Review and Meta-Analysis	11 th May, 2020	Jaber S. Alqahtani, Tope Oyelade, Abdullah M. Aldhahir, Saeed M. Alghamdi, Mater	Although COPD prevalence in COVID-19 cases was low in current reports, COVID-19 infection was associated with substantial severity and mortality rates in COPD. Compared to former and never smokers, current smokers were at greater risk of severe complications and higher mortality rate. Effective preventive measures are required to

https://doi.org/10.1371/journal.pone.0233147 ^{xxxix}		Almehmadi, Abdullah S. Alqahtani, Shumonta	reduce COVID-19 risk in COPD patients and current smokers.
24.A cross-sectional study to assess impact of COVID-19 infection amongst patients with chronic kidney disease http://dx.doi.org/10.18203/2394-6040.ijcmph20210845 ^{xl}		Harshalkumar N. Mahajan, Smita S. Chavhan, Chinmay Gokhale, Balkrishna B. Adsul, Maharudra Kumbhar, Aniket Ingale	This study was conducted on 310 patients. Mean age was 53.33+14.21 years, and 191 (61.6%) of patients were male while mean duration of hospitalization was 16.78+10.31. Majority of the patients presented with symptoms like fever 80%, breathlessness 61.3%, and co-morbidities like Diabetes Mellitus 65.5% followed by Hypertension 61.8%. Patients (15.5%) over age of 60 years tested swab report positive for more than 5 times. Recovery rate being 76.1% while mortality rate found to be 23.87%.

Chapter 3: Methodology

3.1 Research Questions

- A. What were the symptoms in patients at the time of hospitalisation?
- B. Whether patients were suffering from any morbidities other than COVID?

3.2 Research Objectives

- To assess the prevalent symptoms and number of covid deaths with no comorbidities in one year (April 2020-March 2021)
- To identify the percentage of gender distribution in Covid deaths in one year (April 2020-March 2021)
- To analyse the age distribution of covid deaths in one year
- To analyse the comorbidities associated with respiratory, kidney and other diseases in Covid deaths post hospitalisation
- To compare the demographic profile (gender & age) of covid deaths of India and Rajasthan

3.3 Study Design and Setting

This was a cross-sectional study with descriptive research design using data provided by Integrated Disease Surveillance Project Cell in National Health Mission, Government of Rajasthan from April 2020 to March 2021 on Covid deaths of Rajasthan post hospitalisation.

3.4 Study Population and Sample size

It included 5110 covid deaths in Rajasthan in one year aged 0-60 years or above. 924 deaths records had been excluded from the study as the records being incomplete and some patient brought dead to the hospitals.

3.5 Inclusion and Exclusion criteria

- Inclusion criteria
 - Covid Mortality between April 2020-March 2021
 - Co-morbidities associated with Kidney, Respiratory and others
- Exclusion criteria
 - Patients who were brought dead

- Co-morbidities associated with Heart and diabetes

3.6 Study Duration

The study period was between May 2021 to June 2021.

3.7 Ethical Considerations

The study was conducted after all required approvals from NHM authorities. The purpose and confidentiality of the study was explained to the officials before conducting it. During the sorting and analysis of the data, the identification details including name, address, contact details of deceased, was skipped and locked, to ensure the privacy of the data.

To maintain the confidentiality of government data, only a part of the data was used in the research that is data from April 1, 2020, to March 31, 2021. It was ensured that the results do not reveal any identity of the deceased.

3.8 LIMITATIONS

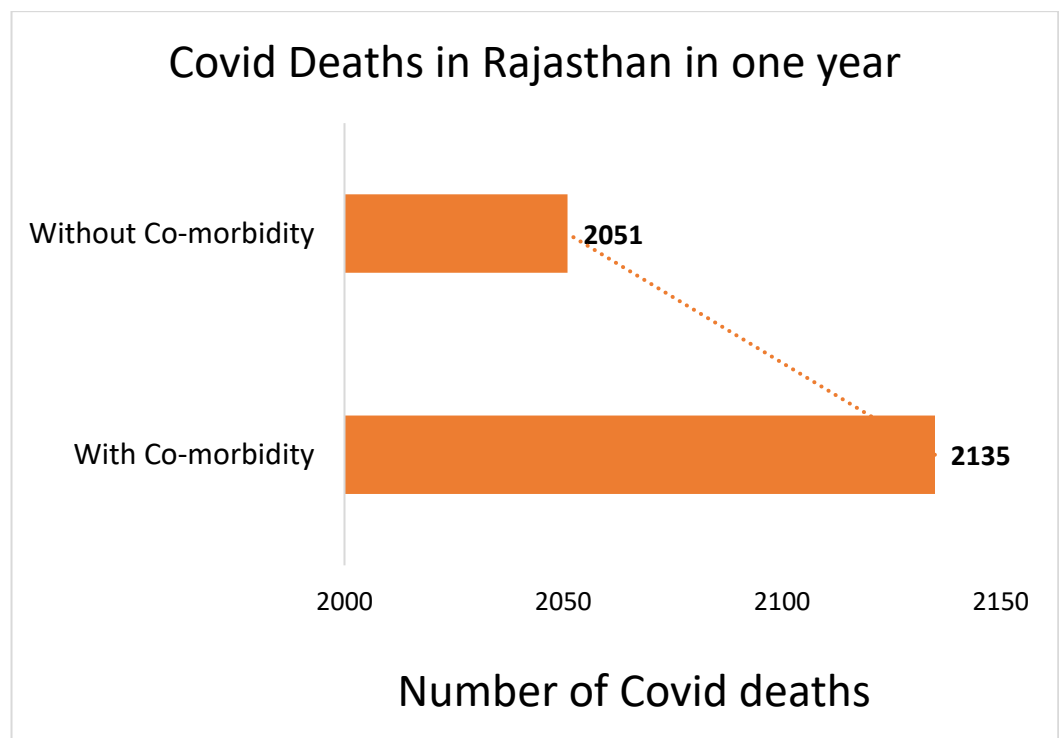
Due to privacy issues with NHM guidelines, the mortality and morbidity data of state could not be used as it is, hence the study had been conducted on covid deaths that occurred between April 30, 2020, and March 31, 2021. As there were cases where the patients died before the diagnoses, hence such cases had been skipped as comorbidities are not diagnosed.

Chapter 4: Findings

4.1 Covid deaths with or without co-morbidities in Rajasthan:

4.11 Data of covid deaths in Rajasthan recorded by IDSP Cell of NHM, Rajasthan was used to fulfil the desired first objective of the study. Total Covid deaths excluding the brought dead and not reported ones in one year were divided into two parts one with co-morbidities and other was without co-morbidities.

Figure 4.1: Distribution of Covid deaths in Rajasthan with co-morbidities and without co-morbidities (n =4186)



4.2 Gender wise distribution of Covid deaths in Rajasthan:

4.21 Out of all covid deaths reported in Rajasthan in one year, Males and females constituted 60% and 40% respectively.

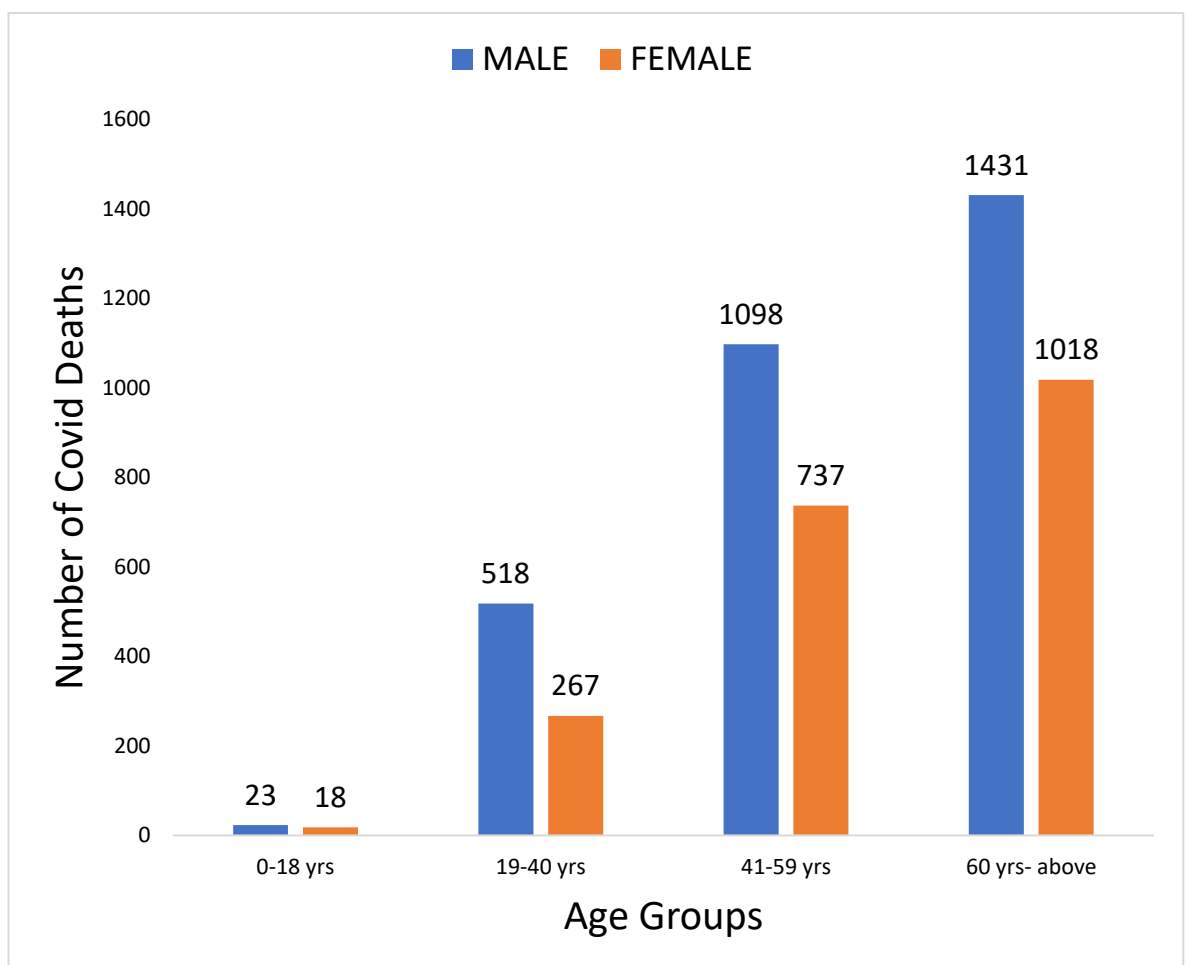
Table 4.2: Percentage of reported covid deaths in Rajasthan: gender wise (n = 5110)

COVID DEATHS IN 1 YEAR		
Gender	Number	Percentage (%)
Male	3070	60%
Female	2040	40%
Total	5110	

4.3 Age wise distribution of Covid deaths:

4.31 Analysis was subjected to identify the number of Covid deaths in the age group 0-18 years, 19-40 years, 41-59 years, and 60 years&above. Data was divided into male and female for all the age groups.

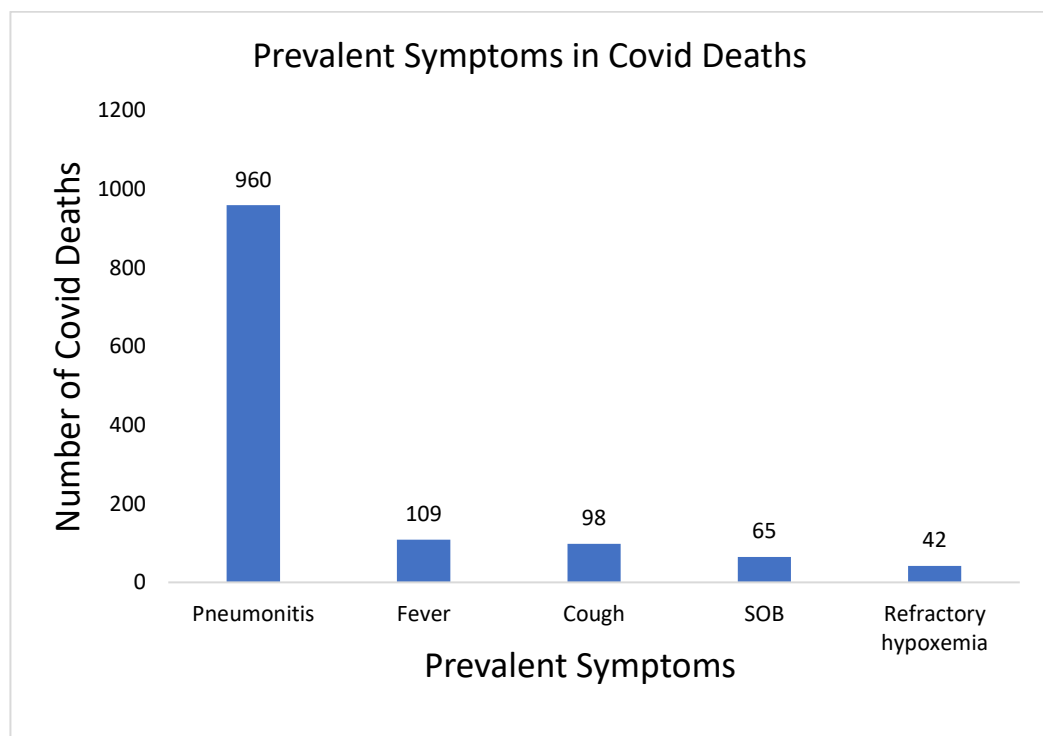
Figure 4.3: Distribution of Covid deaths in Rajasthan by age groups (n = 5110)



4.4 Clinical manifestation of Covid deaths in Rajasthan

4.41 Clinical characteristics of 1274 deceased patients were presented as remaining Covid deaths reported in the hospital did not show any symptoms. In this, most prevalent symptom being Pneumonitis constituted 960 Covid deaths followed by Fever;109, Cough;98, Shortness of breath;65 and refractory hypoxemia;42 Covid deaths

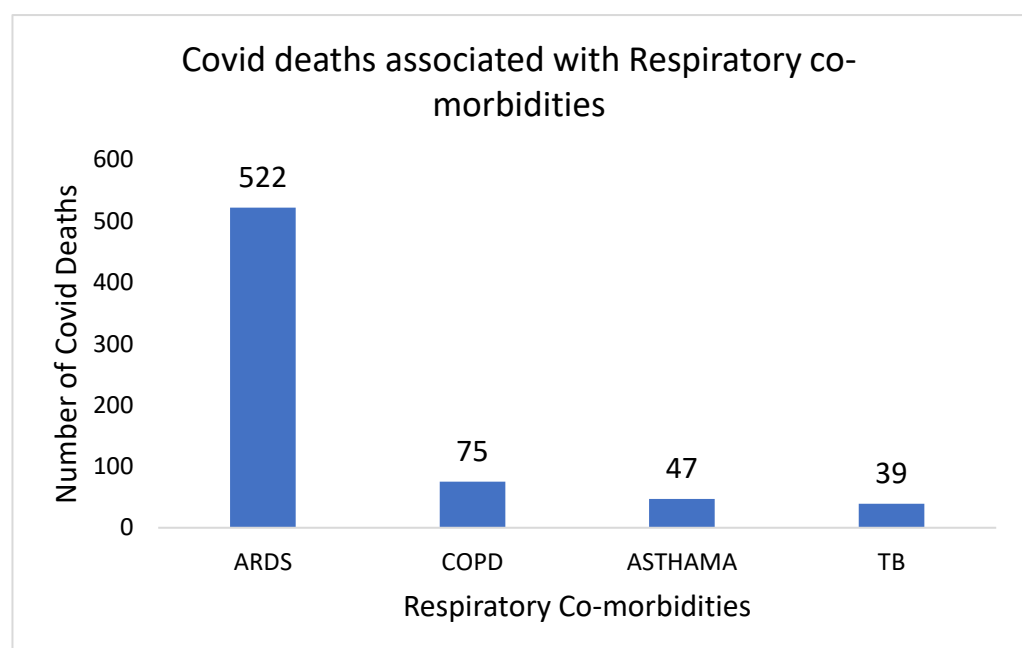
Fig 4.4: Reported Prevalent symptoms in Covid Deaths (n = 1274)



4.5 Covid Deaths associated with Respiratory Co-morbidities

4.51 Distribution of Respiratory co-morbidities associated with Covid deaths in Rajasthan in one year. From the 683 covid deaths reported ARDS included highest number of covid deaths that is 522, COPD 75, Asthma 47, and TB 39.

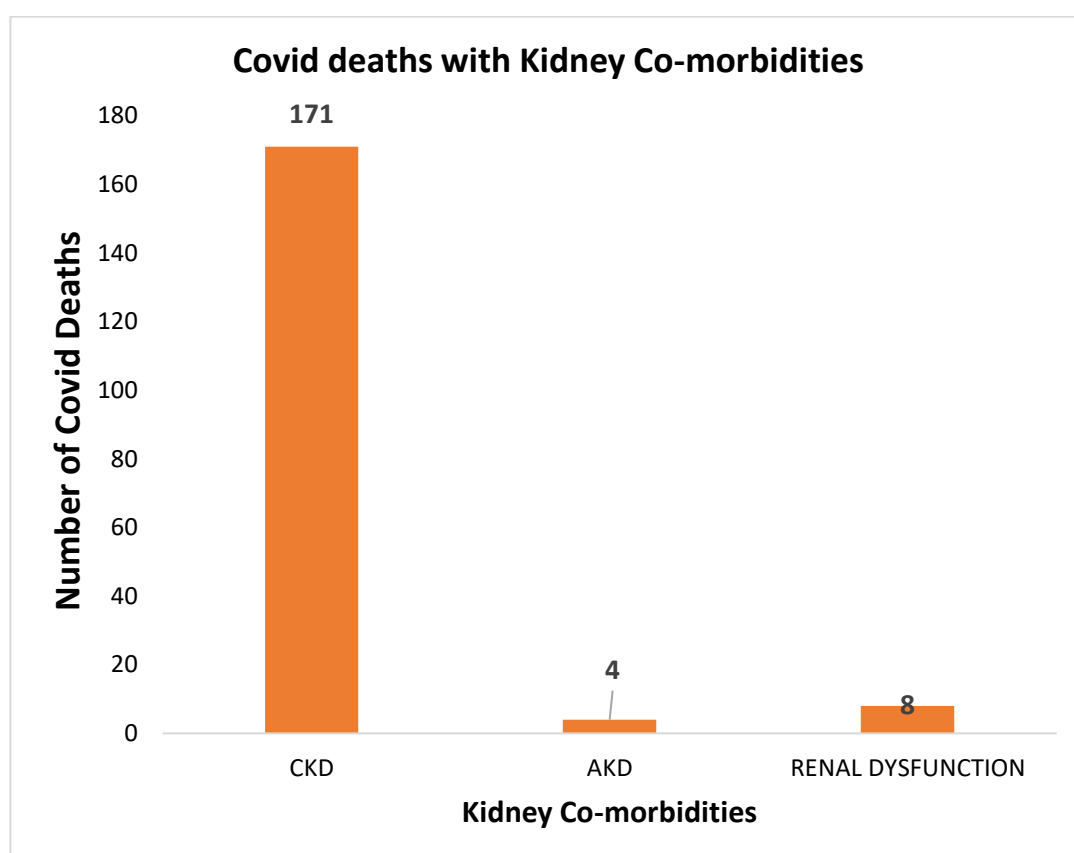
Figure 4.5: Covid Deaths with Respiratory co-morbidities (n = 683)



4.6: Covid Deaths associated with Kidney Co-morbidities

4.61 Covid deaths associated with kidney disease were recorded and analysed that chronic kidney disease was the highest number of Kidney co-morbidities in deceased patients in Rajasthan followed by Renal dysfunction and Acute kidney disease.

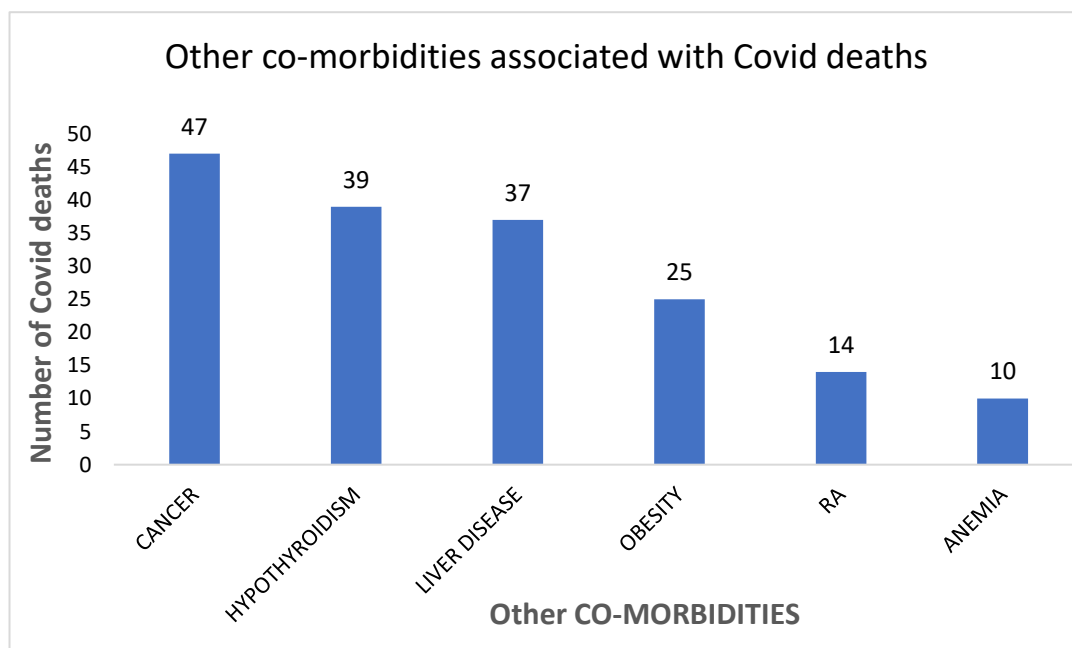
Figure 4.6: Covid deaths with Kidney co-morbidities (n = 183)



4.7 Other co-morbidities in Covid deaths in Rajasthan

4.71 Other than Respiratory and kidney co-morbidities there were other co-morbidities also in Covid deaths in Rajasthan. Cancer was the most common co-morbidity other than Respiratory, and kidney followed by Hypothyroidism, Liver disease, Obesity, Rheumatoid Arthritis, and anaemia.

Figure 4.7: Covid Deaths associated with Cancer, Hypothyroidism, Liver disease, Obesity, RA, and Anaemia (n = 172)

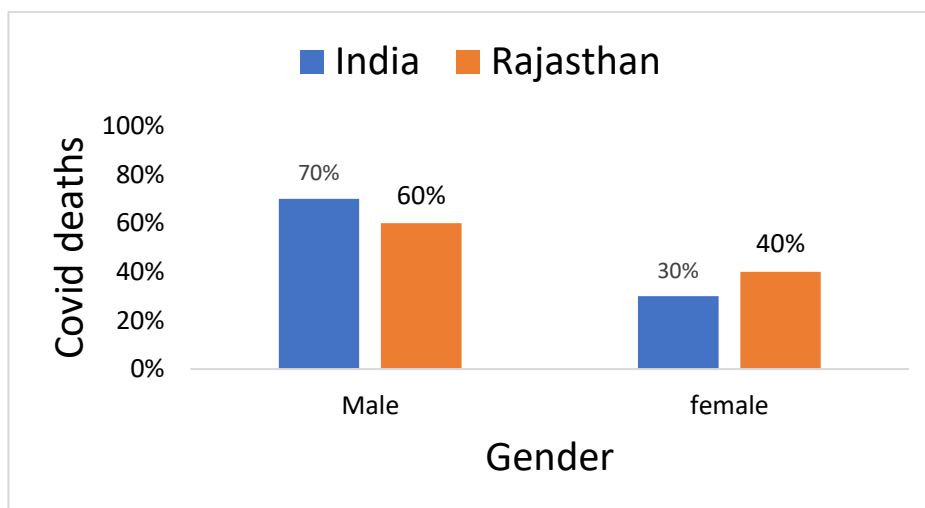


4.8 Demographic comparison of India and Rajasthan covid deaths

4.81 Gender wise comparison:

Data recorded for male and female covid deaths of India and Rajasthan was compared to analyse the gender wise distribution of covid deaths in India and Rajasthan simultaneously.

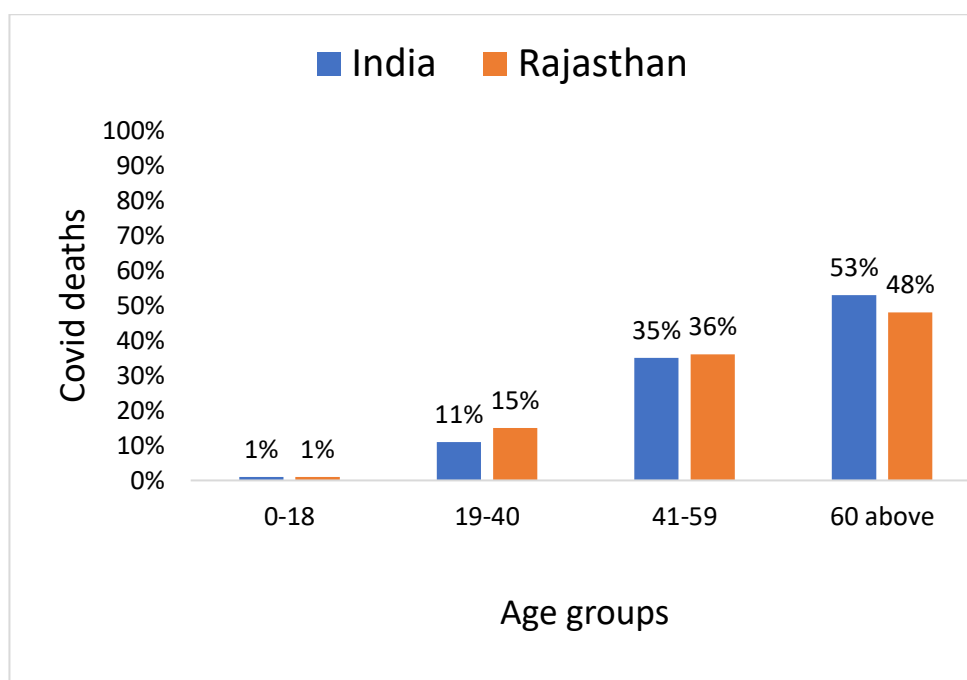
Fig 4.81: Gender distribution of India and Rajasthan covid deaths



4.82 Age wise comparison

Age distribution of covid deaths in India and Rajasthan was done to analyse the comparison between the two

Fig 4.82: Age wise distribution of India and Rajasthan



Chapter 5: Discussion

The aim of current study was to analyse the reported covid deaths in Rajasthan in one year that showed out of 4186 reported covid deaths 2135 were associated with co-morbidities and remaining 2051 were not associated with co-morbidities. Male predominance was there constituting 60% of covid deaths.

The study also showed the distribution of covid deaths in different age groups. As concluded the highest number of covid deaths were in age group 60 years and above that means older people were more prone to covid deaths due to weak immune response to the infection.

Of the total covid deaths reported to hospitals, a total of 1274 reported clinical symptoms and Pneumonitis being the most prevalent symptoms constituting 960 covid deaths followed by Fever;109, Cough;98, Shortness of breath;65 and refractory hypoxemia;42.

From the 4186 total covid death cases it was found 683 were associated with respiratory co-morbidities. The most seen was acute respiratory distress syndrome that was in 522 covid deaths followed by Chronic obstructive pulmonary disease 75, asthma 47 and TBIN 39 covid deaths.

The study also revealed the Kidney related co-morbidities in 183 reported covid deaths, most prominent was chronic kidney disease in 171 covid deaths, renal dysfunction in 8 and acute kidney disease in 4 covid dead. Other co-morbidities associated were in 172 covid deaths, highest being the cancer in 47 covid deaths.

The study also subjected to compare the demographic profile of covid deaths of India and Rajasthan. Male predominance in covid deaths was revealed both in India and Rajasthan constituting 70 and 60 % respectively. During comparison of age distribution of covid deaths, elderly people of 60 or above age group showing the highest number of covid deaths both in India and Rajasthan that was 53 and 48 % respectively.

Chapter 6: Conclusion

The reports of 4186 cases of deceased patients in Rajasthan were recorded by NHM Rajasthan. the most range of patients were affected by pre-existing co-morbid condition of urinary organ, respiratory organ or cancer, liver. This indicated that co-morbidities might play a very important role in COVID-19 Mortality.

As reported from most of the Rajasthan, around 2449 of deaths enclosed individuals aged higher than 60 years confirming that older individuals were at the next risk of developing COVID-19 infection. one in every of the apparent reasons for older individuals being additional liable to COVID-19 is also the low immunity, weak respiratory organ capability and will be the flexibility to cope up with physiological changes that occur within the body with ageing. they are additionally a lot of liable to have conditions like cardiac and respiratory organ illness, diabetes or nephritic issues that weakens the power of their body to fight with communicable disease.

Another pattern that is being discovered during this analysis is gender variations i.e., males appear to hit tougher that is 60% and are a lot of possible to own severe health problem than females constituting 40% of Covid mortality. this could be due to biological variations between men and women. Immune responses in women are a lot of strong as compared to men because of the presence of oestrogen hormone that is taking part in a protecting role in immunity of the patients.

It has been concluded whether in India or Rajasthan Males and people of 60 years or above are more vulnerable to covid deaths.

The limitation of the paper is that little variety of the deceased are enclosed with restricted clinical details.

Chapter7: Recommendations

- ❖ Male patients with COVID-19 were related to considerably enhanced risk of mortality compared to females.
- ❖ Patients with age ≥ 60 years were at a considerably large risk of mortality compared to those aged < 60 years.
- ❖ Mortality was considerably higher in those patients with renal disorder, cerebrovascular sickness, cardiovascular disease, respiratory illness, and cancer.
- ❖ Implementation of adequate protection and interventions for COVID-19 patients normally and especially male patients with age ≥ 60 years having comorbidities might considerably cut back the danger of mortality related to COVID-19.
- ❖ Patients with comorbidities ought to take all necessary precautions to avoid obtaining infected with severe acute respiratory syndrome CoV-2, as they sometimes have the worst prognosis.
- ❖ These precautions embrace regular handwashing with soap and water or use of alcohol-based hand sanitizer, limiting person-to-person contact and active social distancing, carrying a mask publicly places, and overall limiting about to public areas at now unless it is necessary.

Hence, there is a necessity for a worldwide public health campaign to boost awareness, on reducing the burden of those comorbidity sicknesses inflicting deaths in COVID-19-infected patients.

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