A STUDY ON HOSPITAL BASED COVID 19 DEATHS AND MORBIDITIES IN RAJASTHAN

Dissertation submitted to

The IIHMR University, Jaipur

For the partial fulfilment for the award of the degree of

Master of Business Administration (MBA)

in

Hospital and Health Management

by

Yogesh Tejwani

Under the Supervision and Guidance of

Dr. Nutan Prabha Jain

Academic Year 2019-21

DECLARATION BY STUDENT

I hereby declare that this dissertation titled '**A Study on Hospital Based COVID 19 Deaths and Morbidities in Rajasthan'** 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 Information derived from the published or unpublished work of others has been duly acknowledged in the text.

Name of Student: Yogesh Tejwani

Date: 2/07/2021

CERTIFICATE

This is to certify that dissertation titled '**A Study on Hospital Based COVID 19 Deaths and Morbidities in Rajasthan'** 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.

Dr Nutan Prabha Jain,
IIHMR University, Jaipur

Dr Dhirendra Kumar,
Dean, IIHMR University, Jaipur

ACKNOWLEDGEMENT

The internship and dissertation opportunity I had with National Health Mission (NHM), Rajasthan was an excellent chance for learning and professional development. I would like to express my sincere gratitude to all those who provided me with the opportunity to work on the study, during Internship.

I would like to express my sincere and heartfelt thanks to Shri Sudhir Kumar Sharma, Mission Director, National Health Mission, Rajasthan for permitting to work in this crucial time of pandemic of COVID

I am also grateful to Dr. Praveen Aswal, State Nodal Officer, IDSP, NHM Rajasthan for their constant support and supervision enabled me to keep on the correct path and allowing me to carry out me project at the esteemed organization.

I would like to acknowledge with much appreciation the crucial role of the Dr. Deepa Meena, State Epidemiologist, NHM Rajasthan for providing me relevant and required information to complete the study.

I would also like to express my thanks and regards to Dr. Nutan Prabha Jain (Professor, IIHMR University, Jaipur) for being such an excellent guide & providing unfailing support and assistance.

I extend my regards to Prof. P.R Sodani (President) and Mr. Anshul Goyal (Placement officer) IIHMR University, Jaipur (Rajasthan) for being a constant source of motivation in completing the project.

Finally, I thank my family & friends including Surbhi Garg and Sriram Suresh for their constant support and for keeping me motivated throughout my journey.

Sincerely,
Yogesh Tejwani
MBA-HM24

Table of Contents

CHAPTER 1: INTRODUCTION

1.1 Background

The spread of SARS-Cov2 virus infection, commonly known as COVID-19, has caused a major health concern all over the world naming it a global pandemic.

With the primary case of corona viral infection rumoured from Wuhan, China on 31st December 2019, there has been unprecedented eruption of coronavirus malady (COVID-19). 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 Y et al). The spread of the infection was not bound to any boundaries.

Globally, as of 9 June 2021, there have been 173,609,772 confirmed cases of COVID-19, including 3,742,653 deaths, reported to WHO.

As of 7 June 2021, India had 4.23% positivity rate, 94.55% recovery rate and 1.22% COVID mortality rate.

Table 1: COVID 19 Status in selected states (as on June 7, 2021)

States	Test Positivity Rate (%)	Case Fatality Rate (%)	Recovery Rate (%)	Active Rate (%)	Population (Crore)
Global	0.5	2.17	70.27	6.3	767
India	7.63	1.31	95.31	1.41	136
Maharashtra	5.6	1.7	95.5	2.8	12.62
Karnataka	9.8	1.2	90.9	7.9	7.05
Kerala	14.7	0.4	94.4	5.2	3.48
Tamil Nadu	12.4	1.2	89.9	8.9	7.88
Andhra Pradesh	11.2	0.7	93.5	5.8	9.25
Uttar Pradesh	0.3	1.3	97.9	0.8	23.5
West Bengal	10.7	1.1	97.8	1	10.19
Delhi	0.6	1.7	98	0.3	3.1
Chhattisgarh	2.8	1.3	96.7	2	2.98
Rajasthan	**2**	**0.9**	**97.8**	**1.2**	**8.07**

Source: *www.COVID19india.org*

The Table 1.1 shows that Maharashtra has highest fatality rate followed by Karnataka and Kerala. However, according to the ratio, Delhi reported higher fatality than Karnataka. Rajasthan stood at 10th place in COVID death rate.

Meanwhile, Kerala had highest test positivity rate as on June 7, 2021, followed by Tamil Nadu. While Delhi reported highest recovery rate followed by Uttar Pradesh and Rajasthan.

Tamil Nadu topped the list with highest active rate, followed by Karnataka and Andhra Pradesh. The study is being conducted on Rajasthan's COVID deaths as in average of all the states of India, Rajasthan stood near to the average fatality rate.

Comorbidity is referred to an existing health condition in a patient which though under control can cause complications when a sudden dysfunction occurs. Several lifestyle related diseases and age-related conditions are found to be comorbid for several CoV infected cases. Not just the current COVID-19 virus but also the earlier recorded infection spread of SARS-CoV and MERS-CoV.

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). 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.

Although the bulk of COVID-19 patients present with mild or no symptoms, some patients will develop severe pneumonia, acute respiratory distress syndrome (ARDS), multi-organ failure, and death. Clinical predictors may provide vital clues regarding efficient resource planning and allocation during an epidemic .

“Diabetes Mellitus (DM) is one among the foremost prevalent chronic conditions with devastating multi-systemic complication and was estimated to possess inflicted 463 million people in 2019” (Saeedi P. et al.). It is not yet known whether people with DM are more susceptible to COVID-19, but several studies have reported the association between severe COVID-19 infection with DM (Zhou F., Yu T et al.) (Guo W. et al.). It was postulated that the angiotensin converting enzyme 2 (ACE2) may be the plausible explanation of this association (Ma R.C.W et al.).

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.

1.2 Study Questions

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

1.3 Objectives of the Study

A. To review the literature on COVID related indicators.
B. To study COVID Deaths in Rajasthan and associated morbidities.
C. To study the symptoms amongst COVID 19 death patients at the time of hospitalisation.

CHAPTER 2: REVIEW OF LITERATURE

Title	Author	Date/Year	Objectives	Methods	Key Findings
Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study	Fei Zhou, MD Ting Yu, MD Ronghui Du, MD Guohui Fan, MS Ying Liu, MD Zhibo Liu, MD et al.	March 11, 2020	To explore risk factors of in-hospital death for patients and describe the clinical course of symptoms, viral shedding, and temporal changes of laboratory findings during hospitalisation.	This retrospective cohort study included two cohorts of adult inpatients (≥18 years old) from Jinyintan Hospital and Wuhan Pulmonary Hospital (Wuhan, China). All adult patients who were diagnosed with COVID-19 according to WHO interim guidance were screened, and those who died or were discharged between Dec 29, 2019 (ie, when the first patients were admitted), and Jan 31, 2020, were included in our study. Since these two hospitals were the only designated hospitals for transfer of	191 patients (135 from Jinyintan Hospital and 56 from Wuhan Pulmonary Hospital) were included in this study, of whom 137 were discharged and 54 died in hospital. 91 (48%) patients had a comorbidity, with hypertension being the most common (58 [30%] patients), followed by diabetes (36 [19%] patients) and coronary heart disease (15 [8%] patients). Multivariable regression showed increasing odds of in-hospital death associated with older age (odds ratio 1·10, 95% CI 1·03–1·17, per year increase; p=0·0043), higher Sequential

				patients with COVID-19 from other hospitals in Wuhan until Feb 1, 2020, our study enrolled all adult inpatients who were hospitalised for COVID-19 and had a definite outcome (dead or discharged) at the early stage of the outbreak.	Organ Failure Assessment (SOFA) score (5·65, 2·61–12·23; p<0·0001), and d-dimer greater than 1 μg/mL (18·42, 2·64–128·55; p=0·0033) on admission. Median duration of viral shedding was 20·0 days (IQR 17·0–24·0) in survivors, but SARS-CoV-2 was detectable until death in non-survivors. The longest observed duration of viral shedding in survivors was 37 days.
Morbidity and mortality trends of COVID 19 in top 10 countries	Shanker Matta, K.K. Chopra, and V.K. Arora	October 8, 2020	To highlight morbidity and mortality trends of COVID 19 in the last 3 months in top 10 countries of the world. highlights	Deals with the COVID 19 morbidity and mortality patterns in top 10 countries in the last 3 months. Study covers references from around 38 studies.	With the phenomenal increase in cases and deaths in top 10 countries various interventions are being undertaken. New countries are coming up in the list of top 10, and all are showing an increasing trend in terms of

			morbidity and mortality trends of COVID 19 in the last 3 months in top 10 countries of the world.		mortality and morbidity. Interventions like the COVAX vaccine initiative, serology surveillance, introduction of travel bans, advisory to avoid mass gatherings, introduction of social distancing measures etc have definitely played a major role in controlling the pandemic but the cases are still increasing.
COVID-19 mortality effects of underlying health conditions in India: a modelling study	Paul Novosad, Radhika Jain, Alison Campion, and Sam Asher	December 16, 2020	To model how known COVID-19 comorbidities affect mortality rates and the age distribution of mortality in a large lower-middle-income country (India),	Design: Modelling study. Setting: England and India. Participants: Individual data were obtained from the fourth round of the District Level	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

			and to identify which health conditions drive differences with high-income countries.	Household Survey and Annual Health Survey in India, and aggregate data were obtained from the Health Survey for England and the Global Burden of Disease, Risk Factors and Injuries Studies.	England, is most 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.
Risk Factors Associated With In-Hospital Mortality in a US National Sample of	Ning Rosenthal, MD, MPH, PhD; Zhun Cao, PhD; Jake Gundrum, MS; et al	Dec 10, 2020	To characterize patients with COVID-19 treated in US hospitals and to examine risk	A retrospective cohort study was conducted to address the study objectives using the most up-to-date PHD data. This cohort study was	In this cohort study of 64 781 patients with COVID-19 treated in 592 US hospitals during April and May 2020, the in-hospital mortality rate was 20.3% among inpatients,

Patients With COVID-19			factors associated with in-hospital mortality.	conducted using Premier Healthcare Database, a large geographically diverse all-payer hospital administrative database including 592 acute care hospitals in the United States. Inpatient and hospital-based outpatient visits with a principal or secondary discharge diagnosis of COVID-19 (International Classification of Diseases, Tenth Revision, Clinical Modification diagnosis code, U07.1) between April 1 and May 31, 2020, were included.	and severe complications were common. Receipt of statin, angiotensin-converting enzyme inhibitors, and calcium channel blockers were associated with decreased odds of mortality, but the combination use of hydroxychloroquine and azithromycin was associated with increased odds of mortality.
Risk factors for mortality in patients with	Mohammad Parohan, Sajad Yaghoubi, Asal	June 8, 2020	Current meta-analysis of retrospective	Online databases including Web of Science, PubMed, Scopus, Cochrane Library	In total, 14 studies with 29,909 COVID-19 infected patients and 1445 cases of

Coronavirus disease 2019 (COVID-19) infection: a systematic review and meta-analysis of observational studies	Seraji, Mohammad Hassan Javanbakht, Payam Sarraf & Mahmoud Djalalia Mohammad Parohan, Sajad Yaghoubi, Asal Seraji, Mohammad Hassan Javanbakht, Payam Sarraf & Mahmoud Djalalia		cohort studies was done to summarize available findings on the association between age, gender, comorbidities and risk of death from COVID-19 infection.	and Google scholar were searched to detect relevant publications up to 1 May 2020, using relevant keywords. To pool data, random-effects model was used. Furthermore, sensitivity analysis and publication bias test were also done.	death were included in the current meta-analysis. Significant associations were found between older age (≥65 vs <65 years old) (pooled ORs = 4.59, 95%CIs = 2.61–8.04, p < .001), gender (male vs female) (pooled ORs = 1.50, 95%CIs = 1.06–2.12, p = .021) and risk of death from COVID-19 infection. In addition, hypertension (pooled ORs = 2.70, 95%CIs = 1.40–5.24, p = .003), cardiovascular diseases (CVDs) (pooled ORs = 3.72, 95%CIs = 1.77–7.83, p = .001), diabetes (pooled ORs = 2.41, 95%CIs = 1.05–5.51, p = .037), chronic obstructive pulmonary

					disease (COPD) (pooled ORs = 3.53, 95%CIs = 1.79–6.96, p < .001) and cancer (pooled ORs = 3.04, 95%CIs = 1.80–5.14, p < .001), were associated with higher risk of mortality.
Cardiovascular Disease, Drug Therapy, and Mortality in COVID-19	Mandeep R. Mehra, M.D., Sapan S. Desai, M.D., Ph.D., SreyRam Kuy, M.D., M.H.S., Timothy D. Henry, M.D., and Amit N. Patel, M.D.	June 18, 2020	To investigate the relationship between underlying cardiovascular disease and COVID-19 outcomes and to evaluate the association between cardiovascular drug therapy and mortality in this illness.	Using an observational database from 169 hospitals in Asia, Europe, and North America, we evaluated the relationship of cardiovascular disease and drug therapy with in-hospital death among hospitalized patients with COVID-19 who were admitted between December 20, 2019, and March 15, 2020, and were recorded in the Surgical Outcomes Collaborative	Of the 8910 patients with COVID-19 for whom discharge status was available at the time of the analysis, a total of 515 died in the hospital (5.8%) and 8395 survived to discharge. The factors we found to be independently associated with an increased risk of in-hospital death were an age greater than 65 years (mortality of 10.0%, vs. 4.9% among those ≤65 years of age; odds ratio, 1.93; 95%

				registry as having either died in the hospital or survived to discharge as of March 28, 2020.	confidence interval [CI], 1.60 to 2.41), coronary artery disease (10.2%, vs. 5.2% among those without disease; odds ratio, 2.70; 95% CI, 2.08 to 3.51), heart failure (15.3%, vs. 5.6% among those without heart failure; odds ratio, 2.48; 95% CI, 1.62 to 3.79), cardiac arrhythmia (11.5%, vs. 5.6% among those without arrhythmia; odds ratio, 1.95; 95% CI, 1.33 to 2.86), chronic obstructive pulmonary disease (14.2%, vs. 5.6% among those without disease; odds ratio, 2.96; 95% CI, 2.00 to 4.40), and current smoking (9.4%, vs. 5.6% among former smokers or nonsmokers; odds

					ratio, 1.79; 95% CI, 1.29 to 2.47). No increased risk of in-hospital death was found to be associated with the use of ACE inhibitors (2.1% vs. 6.1%; odds ratio, 0.33; 95% CI, 0.20 to 0.54) or the use of ARBs (6.8% vs. 5.7%; odds ratio, 1.23; 95% CI, 0.87 to 1.74).
Effects of COVID-19 on mortality: A 5-year population-based study in Oman	Adil Al Wahaibi Amal Al-Maani Fatma Alyaquobi Amina Al-Jardani Bader Al Rawahi Seif Al-Abri	December 22, 2020	The aim of this study was to investigate the effects of COVID-19 on mortality in Oman.	A cross-sectional retrospective analysis of mortality data from 1 January 2015 to 16 August 2020 was undertaken. Baseline mortality estimated using the Farrington flexible model and excess mortality were calculated for the pandemic period (16 March–16 August 2020)	During the pandemic period, there was a 15% [95% confidence interval (CI) 14–17] increase in all-cause mortality from baseline. When classifying by cause, there was a 9% (95% CI 5–12) increase in deaths due to respiratory diseases, a 2% (95% CI 1–4) increase in deaths due to infectious diseases and a 9% (95% CI

				according to cause of death, place of death and age group.	8–11) increase in unclassified deaths. In terms of place of death, 12% (95% CI 11–14) of excess mortality occurred in hospitals and 7% (95% CI 5–8) occurred in homes during the pandemic period. Patients aged >60 years recorded a 15% (95% CI 13–16) increase in all-cause mortality during this period.
Prediction of mortality by age and multi-morbidities among confirmed COVID-19 patients: Secondary analysis of surveillance data in Pune, Maharashtra, India	Nikunj Kansara, Ashok B Nandapurkar, Rahul Maniyar, Arun Kumar Yadav	March 20, 2021	To identify the predictors of mortality among hospitalized COVID-19 cases in a state of India	The epidemic was concentrated in three cities of Maharashtra, namely Pune, Thane, and Mumbai. Pune has 44 dedicated COVID hospitals (DCHs) with intensive care unit (ICU) facilities and 91 dedicated COVID	The results showed that male gender has a 1.6 times higher risk of mortality than females even after adjusting for age, symptoms, and comorbidities. The presence of comorbidities has a higher incremental risk of death. COVID case with any

				health-care centers without ICU facilities. In addition, 91 COVID care centers function as sample collection centers and isolation facilities for asymptomatic and mild cases. The data of all confirmed COVID cases were entered into a centralized database. Secondary data analysis was done on 11,278 cases admitted from April 4, 2020, to July 17, 2020. The data on the demographic and clinical details and the outcome	symptoms has higher (2.9 times) risk of mortality than COVID case with no symptoms even after adjustment for age, sex, and comorbidities.

				(discharge/death) of all confirmed cases were collected.	
The Effect of Age on Mortality in Patients With COVID-19: A Meta-Analysis With 611,583 Subjects	Clara Bonanad MD, PhD Sergio García-Blas MD, PhD, Francisco Tarazona-Santabalbina MD, PhD et al	July 7, 2020	Initial data on COVID-19 infection has pointed out a special vulnerability of older adults.	We performed a meta-analysis with available national reports on May 7, 2020 from China, Italy, Spain, United Kingdom, and New York State. Analyses were performed by a random effects model, and sensitivity analyses were performed for the identification of potential sources of heterogeneity. Setting and participants COVID-19–positive patients reported in literature and national reports.	A total of 611,1583 subjects were analyzed and 141,745 (23.2%) were aged ≥80 years. The percentage of octogenarians was different in the 5 registries, the lowest being in China (3.2%) and the highest in the United Kingdom and New York State. The overall mortality rate was 12.10% and it varied widely between countries, the lowest being in China (3.1%) and the highest in the United Kingdom (20.8%) and New York State (20.99%). Mortality was <1.1% in patients aged <50 years and it increased exponentially after

				Measures All-cause mortality by age.	that age in the 5 national registries. As expected, the highest mortality rate was observed in patients aged ≥80 years. All age groups had significantly higher mortality compared with the immediately younger age group. The largest increase in mortality risk was observed in patients aged 60 to 69 years compared with those aged 50 to 59 years (odds ratio 3.13, 95% confidence interval 2.61-3.76).
Prevalence and Associated Risk Factors of Mortality Among COVID-19 Patients: A Meta-Analysis	Farha Musharrat Noor & Md. Momin Islam	September 12, 2020	The main aim of this study was to find the prevalence of mortality among hospitalized COVID-19	Three electronic databases including PubMed, Science Direct and Google Scholar were searched to identify relevant cohort studies of COVID-19 disease from January 1, 2020, to August	In this meta-analysis, a total of 58 studies with 122,191 patients were analyzed. The pooled prevalence rate of mortality among the hospitalized COVID-19 patients was 18.88%, 95% CI

			infected patients and associated risk factors for death.	11, 2020. A random-effects model was used to calculate pooled prevalence rate (PR), risk ratio (RR) and 95% confidence interval (CI) for both effect measures. Cochrane chi-square test statistic Q, I2I2, and τ2τ2 tests were used to measure the presence of heterogeneity. Publication bias and sensitivity of the included studies were also tested.	(16.46–21.30), $p < 0.001$. Highest mortality was found in Europe [PR 26.85%, 95% CI (19.41–34.29), $p < 0.001$] followed by North America [PR 21.47%, 95% CI (16.27–26.68), $p < 0.001$] and Asia [PR 14.83%, 95% CI (12.46-17.21), $p < 0.001$]. An significant association were found between mortality among COVID-19 infected patients and older age (> 65 years vs. < 65 years) [RR 3.59, 95% CI (1.87–6.90), $p < 0.001$], gender (male vs. female) [RR 1.63, 95% CI (1.43–1.87), $p < 0.001$], ICU admitted patients [RR 3.72, 95% CI (2.70–5.13), $p < 0.001$], obesity [RR 2.18, 95% CI (1.10–4.34),

					$p < 0.05$], hypertension [RR 2.08,95% CI (1.79–2.43) $p < 0.001$], diabetes [RR 1.87, 95% CI (1.23–2.84), $p < 0.001$], cardiovascular disease [RR 2.51, 95% CI (1.20–5.26), $p < 0.05$], and cancer [RR 2.31, 95% CI (1.80–2.97), $p < 0.001$]. In addition, significant association for high risk of mortality were also found for cerebrovascular disease, COPD, coronary heart disease, chronic renal disease, chronic liver disease, chronic lung disease and chronic kidney disease.

CHAPTER 3: METHODOLOGY

3.1 Study Setting

This study has been conducted on secondary data provided by Integrated Disease Surveillance Project (IDSP) cell at NHM Rajasthan. This study is Descriptive in nature.

3.2 Sampling and Sample Size

Secondary data of COVID deaths in Rajasthan was collected during April 1, 2020 – March 31, 2021. It was used to study the COVID deaths retrospectively. Of the complete mortality data, the brought dead cases were deducted to get the actual cases with that were hospitalised.

From the total data received of 5440 COVID Deaths that took place in financial year 2020-21 in Rajasthan, 447 were found to be as “brought dead” hence they were excluded in the analysis and the remaining 4993 was the actual sample.

3.3 Study Duration

Three Months (April 1 – July 1, 2021).

3.4 Data Collection Methods

The data was collected form the state level IDSP unit where the data was reported by all the district IDSP cells on daily basis which was then compiled at NHM Rajasthan in a Master sheet.

3.5 Data Analysis

The partial data was provided in the MS Excel format, and frequency and percentages were calculated.

3.6 Ethical Consideration

The study has been 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, age, address, contact details of deceased, were skipped and locked, to ensure the privacy of the data. In order 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.

Along with this, the variables used were only morbidities of the deceased and date of death. It was ensured that the results do not reveal any identity of the deceased.

CHAPTER 4: RESULTS

Some of the results are presented according to the total number of COVID Deaths, that is 5,440 while others are focused upon comorbidities. Age wise distribution revealed that 48 per cent COVID Deaths were in the elderly (60 plus years persons), followed by 41-59 years (36%); 19-40 years (15%), and just one percent among children (Table 4.1). Sex-wise distribution shows that 60 percent COVID Deaths were in males while rest 40 percent COVID deaths were in female.

Table 4.1: Percent distribution of COVID Deaths by age groups (n=5440)

Age Group	**Number of deaths**	**Percentage of deaths**
0-18 yrs	41	1
19-40 yrs	785	14
41-59 yrs	1835	34
60 yrs and above	2779	51

Of total 5440 COVID deaths, 3264 were males while rest 2176 were females.

A majority of COVID deaths were found among elderly persons. More men (60%) died then women.

From the total data received of 5440 COVID Deaths, 447 were found to be as “brought dead” hence they were excluded in the analysis and the remaining 4993 has been further analysed.

4.2: COVID deaths were divided into two parts: one with co-morbidities and other was without co-morbidities. Almost one-half of the deaths had co-morbidities.

Table 4.2: Percent Distribution of COVID deaths by status of comorbidities. (n=4993)

Total COVID Deaths	**Number of deceased**	**Percentage of Deaths**
Death with Comorbidities	2473	50.5
Death with no Comorbidities	2520	49.5

Out of 4993 reported deaths 2473 (50%) were associated with co-morbidities.

4.3: A total of 2473 cases were identified with number of co-morbidities associated with COVID deaths in Rajasthan in the last one year.

Table 4.3: Percent Distribution of COVID deaths with respect to number of comorbidities. (n=2473)

Number of Comorbidities	Number of Deceased	Percentage of Deceased
One	1441	57
Two	745	30
Three	244	10
Four	40	2
Five	3	1

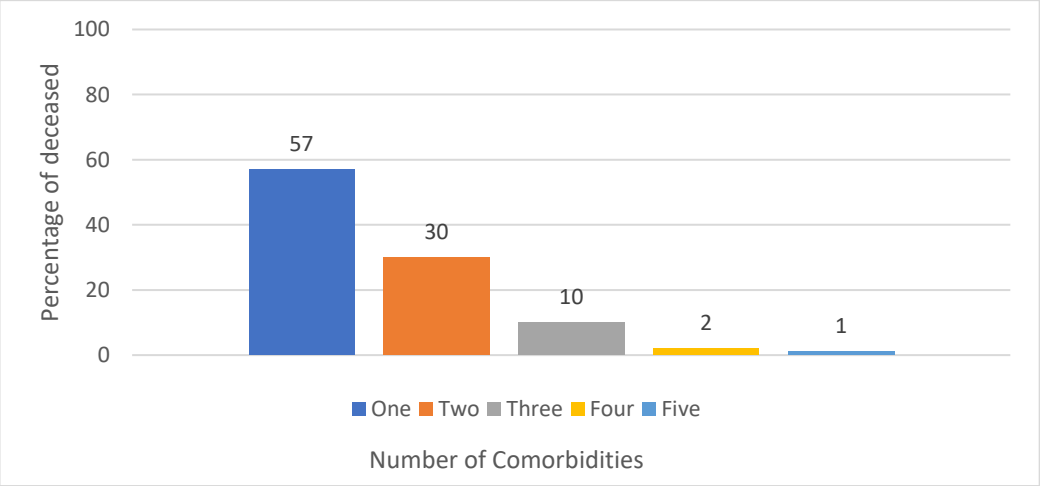

Figure 4.3: Percent Distribution of COVID deaths with respect to number of comorbidities

These were maximum five comorbidities identified in patients and minimum to one. Of all, 59% deaths were reported with one comorbidity, followed by 30% deaths with two comorbidities, 8% with three two comorbidities, 2% deaths with two comorbidities and three deaths with maximum comorbidities that is 1%.

Of actual sample of 4993 COVID Deaths, 2473 deceased had comorbidities of which 854 were symptomatic while rest 1619 were asymptomatic.

While of 2520 deaths which were without comorbidities, 1274 were symptomatic while rest 1246 were asymptomatic.

4.4 Clinical characteristics of 1274 deceased patients presented that, Pneumonitis was most prevalent symptom in deceased patients followed by Fever, Cough, Shortness of breath and refractory hypoxemia.

Table 4.4: Percent Distribution of COVID Deaths by status of comorbidities and by symptoms (n=1274)

Symptoms in COVID Mortality	**Symptoms with Comorbidities**	**Symptoms with No Comorbidities**	**Total Deaths with symptoms**
	n=854	n=420	n=1274
Pneumonitis	660 (77%)	300 (71%)	960 (75%)
Fever	69 (8%)	40 (10%)	109 (9%)
Cough	60 (7%)	38 (9%)	98 (8%)
Shortness of Breath (SOB)	45 (5%)	20 (5%)	65 (5%)
Refractory Hypoxemia	20 (3%)	22 (5%)	42 (3%)

Most common symptoms in COVID Deaths: Pneumonitis (75%) followed by second most common symptoms that was Fever in 9% COVID deceased, cough in 8%, Shortness of breath in 5% and refractory hypoxemia in 3% of COVID deceased.

4.5: To understand the major non-communicable diseases as co-morbidities associated with COVID deaths in Rajasthan in the past one year, include heart, diabetes mellitus, respiratory and kidney diseases. While Cancer, Hyperthyroidism, Obesity and Parkinson's were also associated.

Table 4.5: Percent Distribution of COVID deaths with respect to types of comorbidities (n=2473)

Major Comorbidities Classified	**Number of deceased**	**Percentage of deceased**
Heart Diseases	1204	49
Diabetes Mellitus	787	32
Respiratory Diseases	230	9
Kidney Diseases	174	7
Cancer	63	2
Hyperthyroidism, Obesity and Parkinson's	15	1

Major comorbidities among COVID deaths in Rajasthan mainly included Heart Diseases, Diabetes Mellitus, Respiratory Diseases and Kidney Diseases. According to the data reported heart diseases topped the list with 49% deaths following by Diabetes with 32%, respiratory diseases with 9% and kidney diseases with 7% deaths. While other NCDs including Cancer, Hyperthyroidism, Obesity and Parkinson's were also identified but in comparatively a lesser number of patients.

From above table, we have analysed top two comorbidities: heart diseases and Diabetes Mellitus as they cover maximum number of COVID deaths.

Out of 1204 COVID deaths which were associated with heart related comorbidities, the results revealed that of every 10 deaths, 7-8 persons were suffering from hypertension.

Table 4.6: Percent Distribution of COVID deaths by types of heart related comorbidities (n=1204)

Comorbidities	Number of deceased	Percentage of Deceased
Hypertension	891	74
IHD	64	5
Coronary Artery Disease (CAD)	249	21

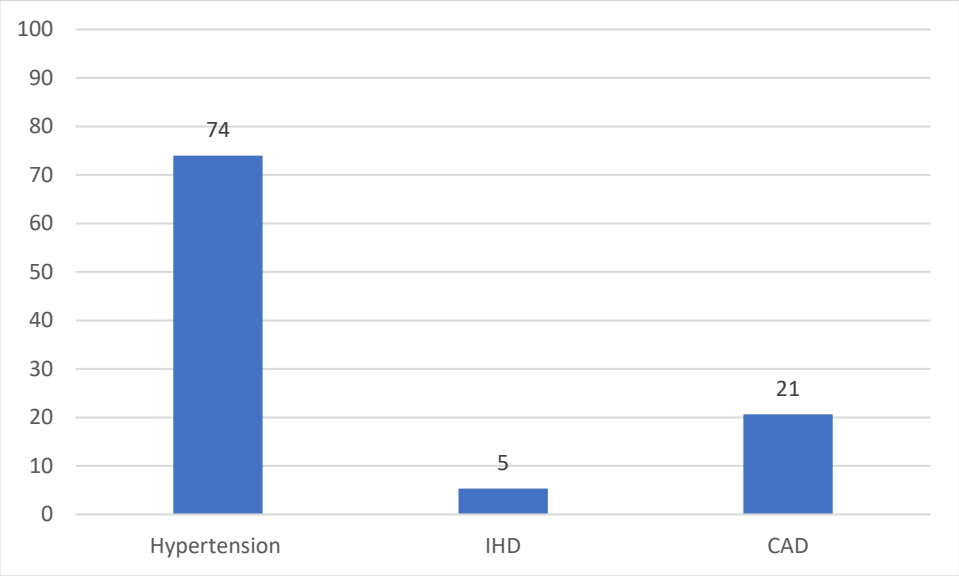

Figure 4.6: Percentage distribution of COVID deaths by types of heart related comorbidities

COVID deaths associated with heart disease were recorded and analysed. Of all, Hypertension as a comorbidity recorded highest deaths that is 74%, followed by CAD – 21%, and IHD – 5%.

Out of 787, COVID deaths which were associated with diabetes mellitus, the results revealed that of every 10 deaths, 5-6 persons were suffering from type 2 diabetes.

Table 4.7: Distribution of COVID deaths with respect to type of diabetes Mellitus (n=787)

Diabetes	Number of deceased	Percentage of deceased
Type 1	345	44
Type 2	442	56

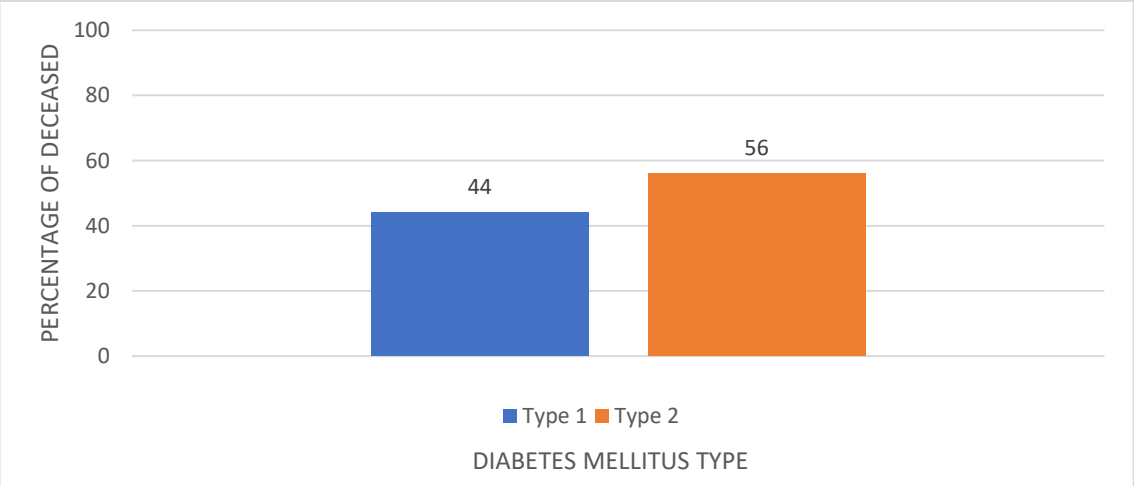

Figure 4.7: Percentage distribution of COVID deaths with respect to type of diabetes Mellitus

COVID deaths associated with diabetes mellitus were recorded and analysed. Of all, diabetes mellitus type 2 recorded highest deaths that is 56%, followed by type 1 – 44%.

CHAPTER 5: DISCUSSION

The reports of 4993 cases of deceased patients in Rajasthan were recorded by NHM Rajasthan. The maximum number of patients were suffering from pre-existing co-morbid condition of Heart, Diabetes, Pulmonary or cancer, liver. This indicated that co-morbidities may play an important role in COVID-19 Mortality.

As announced from a large portion of the Rajasthan, around death of 5440 included individuals matured over 60 years affirming that more seasoned individuals were at a higher danger of creating COVID-19 contamination.

As per literature review, the data analysed matches with the other studies. As most of the deceased with comorbidities had hypertension. While diabetes was the second highest comorbidities identified in other studies as well.

As per the study analysis, majority of COVID deaths included people above 60 years of age which matches with the analysis of the other studies conducted in the country.

The symptoms that were studied resulted that pneumonitis was observed in highest number of deaths followed by fever, cough and shortness of breath. The analysis matches with other studies as well. As researchers have shown similar analysis in their studies mentioning elderly aging over 60% were more vulnerable and were identified to highest number in COVID death rates.

One of the undeniable explanations behind more seasoned individuals being more defenceless to COVID-19 might be the low resistance, frail pneumonic limit and might be the capacity to adapt up to physiological changes that happen in the body with maturing. They are additionally more inclined to have conditions like cardiovascular and lung illness, diabetes mellitus or renal issues that debilitates the capacity of their body to battle with irresistible sickness. Frail invulnerable instruments combined with cytokine flood is one of the significant causes that at last prompts diminished cell oxygenation at the degree of alveoli, has been accounted for to be the primary driver of death. Another example that is being seen in this exploration is sex contrasts i.e., guys appear to hit more enthusiastically that is 60% and are bound to have serious ailment than females establishing 40% of COVID mortality.

CHAPTER 6: CONCLUSION

After the literature review and study analysis, it was concluded that males with Novel COVID-19 were significantly at higher risk of mortality than females and as per data males counted higher mortality rate than females in Rajasthan.

Patients with more than 60 years of age were at a massive risk of death compared to those with less than 60 years of age. While mortality was observed to be more with heart comorbidities in which most of the deceased suffered from hypertension.

Whether patients with comorbidities or with no comorbidities, around one-third of them showed symptoms. Of these highest patients were observed with pneumonitis as a common symptom followed by fever and cough.

While of patients suffering from Diabetes, more than half of the deceased were suffering with diabetes type 2 and rest by diabetes type 1. Hence, there was a significant difference identified between type 1 and type 2. Patients suffering with type 2 diabetes were at higher risk of COVID mortality.

CHAPTER 7: REFERENCES

Ying Liu, Albert A Gayle, Annelies Wilder-Smith, Joacim Rocklöv the reproductive number of COVID-19 is higher compared to SARS coronavirus Journal of Travel Medicine, Volume 27, Issue 2, March 2020, taaa021,

Guan, W., Liang, W., Zhao, Y., Liang, H., Chen, Z., Li, Y., . . . He, J. (2020, May 01). Comorbidity and its impact on 1590 patients with COVID-19 in China: A nationwide analysis. Retrieved October 20, 2020, from https://erj.ersjournals.com/content/55/5/2000547

Wan Y. Shang J. Graham R. Baric R.S.Li F.

Receptor recognition by novel corona virus from Wuhan: an analysis based on decade long structural studies of SARS. J Virology. 2020; 17: 7

https://doi.org/10.1128/JVI.00127-20

Li X.C. Zhang J. Zhuo J.L. The Vaso protective axes of the renin-angiotensin system: physiological relevance and therapeutic implications in cardiovascular, hypertensive and kidney diseases. Pharmocol Res. 2017; 125: 21-38

Shashank R Joshi Indian COVID-19 Risk Score, Comorbidities and Mortality Journal of the association of the physicians of India May 2020 ISSN 0004 – 5772 VOLUMES :68 https://www.japi.org/index.php

Alqahtani JS, Oyelade T, Aldhahir AM, Alghamdi SM, Almehmadi M, Alqahtani AS, et al. Prevalence, severity and mortality associated with COPD and smoking in patients with COVID-19: A rapid systematic review and meta-analysis. P LoS One 2020;15: e0233147.

Yang J, Zheng Y, Gou X, Pu K, Chen Z, Guo Q, et al. Prevalence of comorbidities and its effects in patients infected with SARS-CoV-2: A systematic review and meta-analysis. Int J Infect Dis 2020; 94:91-5

Lippi G, Henry BM. Chronic obstructive pulmonary disease is associated with severe coronavirus disease 2019 (COVID-19). Respir Med 2020; 167:105941.

Behera D. Management of chronic respiratory diseases in the Era of COVID-19. Indian J Chest Dis Allied Sci 2020; 62:45-50

Zhou P, Yang XL, Wang XG, Hu B, Zhang L, Zhang W, et al. A pneumonia outbreak associated with a new coronavirus of probable bat origin. Nature 2020; 579:270-3

Leung JM, Yang CX, Tam A, Shaipanich T, Hackett TL, Singhera GK, et al. ACE-2 expression in the small airway epithelia of smokers and COPD patients: implications for COVID-19. Eur Respir J. 2020 May 14;55(5):2000688. Doi: 10.1183/13993003.00688-2020. PMID: 32269089; PMCID: PMC7144263.

Ankita Bhandari Smoking, COPD linked with higher death risk from COVID-19: Study May 12, 2020, https://zeenews.india.com/india/smoking-copd-linked-with-higher-death-risk-from-covid-19-study-2282917.html

Williamson, E. J. et al. Factors associated with COVID-19-related death using Open SAFELY. Nature 584, 430–436 (2020).

Prahasti Awasthi Liver diseases present comorbidity for Covid-19, says study Aug 31, 2020, https://www.thehindubusinessline.com/news/science/liver-disease-present-comorbidity-for-covid-19-says-study/article32484284.ece

Kalinsky K, Accordino MK, Hosi K, Hawley JE, Trivedi MS, Crew KD, et al. Characteristics and outcomes of patients with breast cancer diagnosed with SARSCov-2 infection at an academic center in New York City. Breast Cancer Res Treat. 2020;182(1):239-42.

He W, Chen L, Yuan G, Fang Y, Chen W, Wu D, et al. COVID-19 in persons with haematological cancers. Leukemia. 2020;34(6):1637-45.

Saini KS, Tagliamento M, Lambertini M, McNally R, Romano M, Leone M, et al. Mortality in patients with cancer and COVID-19: A systematic review and pooled analysis of 52 studies. Eur J Cancer. 2020;doi: 10.1016/j.ejca.2020.08.011

Narendra S Choudhary , Swapnil Dhampalwar , Neeraj Saraf Arvinder S Soin Outcomes of COVID-19 in Patients with Cirrhosis or Liver Transplantation 2021 May 12 DOI: 10.1016/j.jceh.2021.05.003

Swarnim Swarnim, Madhavi Bharadwaj, Mukta Mantan, Onkar Singh Bhinder, Urmila Jhamb COVID-19 Infection in Children and Young Adults with Chronic Kidney Disease: A Single Centre Experience 28th April, 2021

Ashutosh Nath Aggarwal, Ritesh Agarwal, Sahajal Dhooria, Kuruswamy Thurai Prasad, Inderpaul Singh Sehgal, Valliappan Muthu Impact of chronic obstructive pulmonary disease on severity and outcomes in COVID-19 patients: A systematic review 21st April 2021 https://www.ijncd.org/text.asp?2021/6/1/10/314211

Prithvi Mohandas Sathya Periasamy Manimaran Marappan Arun Sampath Vanaja Kate Garfin Sundaram Vijit Koshy Cherian Clinical review of COVID-19 patients presenting to a quaternary care private hospital in South India: A retrospective study 26th April 2021

https://doi.org/10.1016/j.cegh.2021.100751

Nikunj Kansara1, Ashok B Nandapurkar2, Rahul Maniyar3, Arun Kumar Yadav4 Prediction of mortality by age and multi-morbidities among confirmed COVID-19 patients: Secondary analysis of surveillance data in Pune, Maharashtra, India 20th 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 COPD and the risk of poor outcomes in COVID-19: A systematic review and meta-analysis 18th March 2021

Sundeep Santosh Salvi, Raja Dhar, PA Mahesh, Zarir Farooq Udwadia, Digambar Behra COPD Management during the COVID-19 pandemic 6th March 2021

Mohammed G Alkhathami, Shailesh M Advani, Adil A Abalkhail, Fahad M Alkhathami, Mohammed K Alshehri, Ebtisam E Albeashy, Jihad A Alsalamah Prevalence and mortality of lung comorbidities among patients with COVID-19: A systematic review and meta-analysis March 2021 10.4103/lungindia.lungindia_497_20

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, Helena Radbruch, Frank L. Heppner & David Horst Causes of death and comorbidities in hospitalized patients with COVID-19 19th Feb 2021 10.5603/ARM.a2021.0036

Sang Chul Lee, Kang Ju Son, Chang Hoon Han, Seon Cheol Park & Ji Ye Jung Impact of COPD on COVID-19 prognosis: A nationwide population-based study in South Korea 12th 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 Medetalibeyoglu, Seniha Basaran, Gunseli Orhun, Halil Yazici & Aydin Turkmen COVID-19 in chronic kidney disease: a retrospective, propensity score-matched cohort study 6th Feb 2021

Anurag Mehta, Smreti Vasudevan, Anuj Parkash, Anurag Sharma, Tanu Vashist, Vidya Krishna COVID-19 mortality in cancer patients: a report from a tertiary cancer centre in India 21st Jan 2021

M Mahendra, Abhishek Nuchin, Ranjith Kumar, S Shreedhar, Padukudru Anand Mahesh Predictors of mortality in patients with severe COVID-19 pneumonia - a retrospective study 2021 10.5603/ARM.a2021.0036

Paul Novosad, corresponding author1 Radhika Jain,2 Alison Campion,3 and Sam Asher4 COVID-19 mortality effects of underlying health conditions in India: a modelling study 16th Dec 2020 10.1136/bmjopen-2020-043165

Raffaele Galiero, Pia Clara Pafundi ,Vittorio Simeon ,Luca Rinaldi,Alessandro Perrella,Erica Vetrano,Alfredo Caturano,Maria Alfano,Domenico Beccia,Riccardo Nevola Impact of chronic liver disease upon admission on COVID-19 in-hospital mortality: Findings from COVOCA study 10th Dec 2020 https://doi.org/10.1371/journal.pone.0243700

Kunchok Dorjee ,Hyunju Kim,Elizabeth Bonomo,Rinchen Dolma Prevalence and predictors of death and severe disease in patients hospitalized due to COVID-19: A comprehensive systematic review and meta-analysis of 77 studies and 38,000 patients 7th Dec 2020 https://doi.org/10.1371/journal.pone.0243191

Dinesh Jothimani Radhika Venugopal Mohammed Forhad Abedin Ilankumaran Kaliamoorthy Mohamed Rela COVID-19 and the liver 1st Nov 2020 https://doi.org/10.1016/j.jhep.2020.06.006

Manas Ranjan Behera COVID-19 pandemic and care of chronic kidney diseases patients in India 1st Sep 2020

Ron T. Gansevoort & Luuk B. Hilbrands CKD is a key risk factor for COVID-19 mortality 26th August 2020 https://doi.org/10.1038/s41586-020-2521-4

Shalimar, Anshuman Elhence, Pramod Garg Poor outcomes in patients with cirrhosis and Corona Virus Disease-19 15th August 2020

Kamal S. Sainiab Marco Tagliamentocd Matteo Lambertinicd Richard McNallya Marco Romanoa Manuela Leonea Giuseppe Curiglianoef Evandrode Azambujagh Mortality in patients with cancer and coronavirus disease 2019: A systematic review and pooled analysis of 52 studies 11th August 2020 https://doi.org/10.1016/j.ejca.2020.08.011

Manish Rathi1, Tarun Jeloka2, Narayan Prasad3, Shyam Bansal4, Sanjay Kumar Agarwal5, AK Bhalla6 Chronic kidney disease and hypertension with reference to COVID- 21st May 2020

Jaber S. Alqahtani, Tope Oyelade, Abdulelah M. Aldhahir, Saeed M. Alghamdi,Mater Almehmadi,Abdullah S. Alqahtani,Shumonta Quaderi,Swapna Mandal,John R. Hurst Prevalence, Severity and Mortality associated with COPD and Smoking in patients with COVID-19: A Rapid Systematic Review and Meta-Analysis 11th May https://doi.org/10.1371/journal.pone.0233147

Harshalkumar N. Mahajan, Smita S. Chavhan, Chinmay Gokhale, Balkrishna B. Adsul, Maharudra Kumbhar, Aniket Ingale A cross-sectional study to assess impact of COVID-19 infection amongst patients with chronic kidney disease 2020 http://dx.doi.org/10.18203/2394-6040.ijcmph20210845