

Association Between Cardiometabolic Risk Factors and Covid-19 Severity in Patients of a Rural Tertiary Hospital*

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ABSTRACT

Background: The COVID-19 pandemic has had a significant impact on the world leading to significant morbidity and mortality. The disease was caused by the SARS-CoV-2 virus and can caused severe respiratory illness, as well as a range of other complications depending on presence of cardiometabolic risks. These factors included a range of conditions such as obesity, high blood pressure, high cholesterol, and states of insulin resistance. People with these risk factors are hypothesized to more likely experience severe COVID-19 symptoms and have worse clinical outcomes.

Objective: To determine the association between cardiometabolic risk factors and the development of severe COVID-19 patients in rural tertiary hospital in Bayombong, Nueva Vizcaya.

Methods: We reviewed the medical records of patients aged 19 years or older with a real-time polymerase chain reaction (RT-PCR)-confirmed COVID-19 hospitalized at the Region II Trauma and Medical Center in Bayombong, Nueva Vizcaya. A retrospective correlation design was utilized for the study, using a review of the medical records of patients from March 2020 to December 2022. Fasting plasma glucose (FPG), Low Density Lipoprotein-Cholesterol (LDL-C) levels, Hypertension, BMI, Waist to hip ratio and demographic characteristics of the patients were recorded. A simple and multiple ordinal logistic regression was done to checked the association between COVID-19 and different independent variables. All analyses were performed using STATA SE 18.0, with a p-value of less than 0.05 as the cut-off to determine statistical significance.

Result: We enrolled 1,582 participants; most were 50 to 59 years old (24.3%), Male (57.7%) and unvaccinated. When we compared our patients' Hyperlipidemia, FBS and Hypertension directly correlate with length of stay while Myocardial Infarction, Atrial Fibrillation and waist to hip ratio inversely correlate with length of stay measured during the pandemic and the pre-pandemic period, we found a statically significant increased (<0.05). Specifically, older patients, with hyperlipidemia, those with confirmed diabetes and elevated BP had a higher probability of staying in the hospital for more than a week while those with MI, AF, and higher WHR tend to stay shorter. In- hospital mortality, COVID patients with Myocardial Infarction 27.3 times (OR: 27.3, $p<0.001$), Atrial Fibrillation 5.8 times (OR: 5, $p<0.001$), and high 2 BP 10.4 times (OR: 10.4, $p=0.007$) odds of dying compared when they don't have these conditions. Crudely, vaccination decreased the odds of having severe COVID-19, while the rest of the predictors, aside from sex, type 1 DM, and obesity increase the odds. On multiple ordinal logistic regression analysis, however, only vaccination status was associated with decreased severity of COVID-19. Specifically, a vaccinated patient has 53% less odds of having severe COVID-19.

Conclusion: This study demonstrates the consequences of Diabetes Mellitus, Hypertension, Hyperlipidemia and Cardiovascular Disease showed significant associations with mortality and Clinical Severity of patients. Moreover, Age, Male, and Co-morbidities were significant confounders for the associations of Cardiometabolic Risk Factors on COVID-19 mortality and clinical severity.

Disclosures: The author has formally acknowledged and signed a disclosure affirming the absence of any financial or other relationships (including personal connections), intellectual biases, political or religious affiliations, and institutional ties that could potentially result in a conflict of interest.

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INTRODUCTION

The COVID-19 pandemic had a significant impact on the world, affecting millions of people and leading to significant morbidity and mortality. The disease was caused by the SARS-CoV-2 virus and can cause severe respiratory illness, as well as a range of other complications, including cardiometabolic risk factors. Cardiometabolic risk factors included a range of conditions that increase the risk of heart disease, stroke, and diabetes. These risk factors included obesity, high blood pressure, high cholesterol, and insulin resistance. People with these risk factors were more likely to experience severe COVID-19 symptoms and have worse clinical outcomes. Studies have shown that obesity was one of the most significant risk factors for severe COVID-19 illness. Obese individuals have a higher risk of hospitalization, intensive care unit (ICU) admission, and death from COVID-19. Other cardiometabolic risk factors, including high blood pressure, diabetes, and cardiovascular disease, have also been associated with more severe COVID-19 illness and worse clinical outcomes.

Clinical outcomes of COVID-19 patients with cardiometabolic risk factors can vary widely, depending on the severity of the underlying condition and the severity of the COVID-19 illness. Patients with multiple risk factors are at a higher risk of developing severe COVID-19 symptoms, requiring hospitalization and ICU care, and experiencing long-term complications. It was important to note that vaccination against COVID-19 can significantly reduce the risk of severe illness and death from COVID-19, even for individuals with underlying cardiometabolic risk factors. In addition, lifestyle interventions, such as maintaining a healthy weight, exercising regularly, and managing blood pressure and blood sugar levels, can also help reduce the risk of severe illness and improved clinical outcomes for COVID-19 patients with cardiometabolic risk factors.

The prevalence, associated risk factors, and clinical outcomes of cardiometabolic risk factors among COVID-19 patients in Asia vary by country and region. However, several studies have shown that cardiometabolic risk factors prevalent among COVID-19 patients in Asia and associated with worse clinical outcomes. Obesity is a significant risk factor for severe COVID-19 illness in many Asian countries. For example, studies have shown that obese COVID-19 patients in India and Thailand are more likely to require mechanical ventilation and ICU care and have higher mortality rates compared to non-obese patients.

In addition to obesity, other cardiometabolic risk factors, including hypertension, diabetes, and cardiovascular disease, have also been associated with more severe COVID-19 illness and worse clinical outcomes in Asian countries. For example, studies in China have shown that COVID-19 patients with hypertension have a higher risk of severe illness and death compared to patients without hypertension.

Overall, it was clear that cardiometabolic risk factors are an important predictor of severe COVID-19 illness and worse clinical outcomes in Asia, as in other parts of the world. Vaccination against COVID-19, as well as lifestyle interventions to manage cardiometabolic risk factors, are important strategies to reduce the impact of COVID-19 on individuals with these conditions in Asia and elsewhere.

The prevalence, associated risk factors, and clinical outcomes of cardiometabolic risk factors among COVID-19 patients in the Philippines have been a significant concern during the COVID-19 pandemic. The Philippines has one of the highest rates of diabetes in the world, which is a significant risk factor for severe COVID-19 illness. Studies have shown that COVID-19 patients in the Philippines with underlying cardiometabolic risk factors, such as hypertension, diabetes, and obesity, have a

higher risk of severe illness and death compared to patients without these conditions. For example, a study conducted in the Philippines found that patients with diabetes were more likely to require hospitalization, ICU care, and mechanical ventilation.

The Philippine government has recognized the importance of addressing cardiometabolic risk factors as part of its COVID-19 response. The government has implemented measures to promote healthy lifestyles, such as encouraging physical activity and healthy eating. It has prioritized vaccination for individuals with underlying health conditions, including those with cardiometabolic risk factors. Overall, the situation in the Philippines regarding the prevalence, associated risk factors, and clinical outcomes of cardiometabolic risk factors among COVID-19 patients highlights the importance of addressing these risk factors to reduce the impact of COVID-19 in the country.

METHODOLOGY

Study design and population

This was a Retrospective correlational design will be utilized for the study using a review of medical records of enrolled patients from March 2020– December 2022. There will be no direct patient participation, contact, or interaction. The study will be conducted in Region 2 Trauma and Medical Center, a government tertiary hospital in Bayombong, Nueva Vizcaya. The study population will include adult patients 19 years old. A Confirmed cases of COVID-19, as determined by the real-time reverse transcription-polymerase chain reaction (RT-PCR) admitted in the isolation ward and ICU of the Internal Medicine department. Patients with COVID-19 who have moderate, severe, and critical classifications according to the Philippine Society

of Microbiology and Infectious Diseases from March 2020 to December 2022.

Operational Definition:

1. Unite for Diabetes Philippine Clinical Practice Guidelines adapted from the American Diabetes Association (ADA) criteria for Diabetes and dysglycemia are as follows:
 - a. Normal FBS was <100 mg/dL
 - b. Impaired fasting glucose was FBS 100–125 mg/dL and
 - c. Diabetes was FBS > 126 mg/dL
2. The 2001 National Cholesterol Education Program-Adult Treatment Panel III (NCEP-ATP III) guidelines on serum lipid level categories were used in this study as follows:
 - a. Total cholesterol (in mg/dL) desirable (<200), borderline high (200–239), high (>240);
 - b. LDL-c (in mg/dL) optimal (<100), near optimal/ above optimal (100–129), borderline high (130–159), high (160–189), very high (>190);
 - c.
 - d. HDL-c (in mg/dL) low (<40), borderline (50–59), desirable (>60);
 - e. Triglycerides (in mg/dL) desirable (<150), borderline (150–199), high (200–399), very high (>400).
3. Asia-Pacific Classification of BMI was adopted for this study:
 - a. Underweight: <18.5 kg/m
 - b. Normal weight: 18.5–22.9 kg/m
 - c. Overweight: 23–24.9 kg/m
 - d. Obese I: 25–29.9 kg/m
 - e. Obese II: >30 kg/m
4. Blood pressure categories in this study are based on the American College of Cardiology/American Heart Association (ACC/AHA) 2017 guidelines on Hypertension:

- a. Normal (systolic BP < 120 and Diastolic BP < 80 mmHg)
 - b. Elevated (systolic BP 120–129 and Diastolic <80 mmHg)
 - c. Stage I Hypertension (systolic BP 130–139 or diastolic 80–89 mmHg)
 - d. Stage 2 Hypertension (systolic BP > 140 or Diastolic > 90 mmHg)
5. Metabolic Syndrome is defined by the NCEP–ATP III as fulfilling at least 3 out of 5 of the following criteria:
- a. Waist circumference for males: >90 cm, females: >80 cm
 - b. Triglycerides > 150 mg/dL
 - c. HDL Cholesterol for males: <40 mg/dL, females < 50 mg/dL
 - d. Fasting Blood Sugar > 100 mg/dL
 - e. Blood pressure: 130 mmHg systolic or > 80 mmHg on antihypertensive drug treatment in a patient with hypertension.
6. Severity Classification of COVID-19 is defined by Living Recommendations for the treatment COVID-19 guidelines:
- A. Mild COVID-19
 - No pneumonia or desaturation
 - Acute onset of fever and cough or any three (3) or more of the following:
 - Fever
 - Cough
 - Coryza
 - Sore throat
 - Diarrhea
 - Anorexia/nausea/vomiting
 - Loss of sense of smell or taste
 - Generalized weakness/body malaise/fatigue
 - Headache
 - Myalgia
 - B. Moderate COVID-19
 - With pneumonia ***BUT** no difficulty of breathing or shortness of breath, RR<30

breaths/min, oxygen saturation*>94% at room air.

OR

- Without pneumonia but with risk factors for progression: elderly (60 years old and above) and/or with comorbidities.
- C. Severe COVID-19
- With pneumonia* and **ANY** one of the following:
 - Signs of respiratory distress
 - Oxygen saturation* <94% at room air
 - Respiratory rate of ≥ 30 breaths/minute
 - Requiring oxygen supplementation
- D. Critical COVID-19
- With pneumonia* and **ANY** of the following:
 - Impending respiratory failure requiring high flow oxygen, non-invasive or invasive ventilation
 - Acute respiratory distress syndrome
 - Sepsis or shock
 - Deteriorating sensorium
 - Multi-organ failure
 - Thrombosis

Statistical Analysis

Baseline parameters were presented as proportions. The association between the different clinical and cardiovascular factors, and outcomes were determined using different regression analyses. Specifically, the association between the length of stay (here defined as a categorical variable) and different predictors was determined using simple and multiple logistic regression analyses. Simple logistic regression analysis was conducted to determine the crude odds ratio per predictor variable. Significant variables were then included in the multiple logistic regression analysis to determine the adjusted odds ratio and to control the possible confounders. The same analyses were conducted to determine the association between mortality and different predictors. Since the severity of COVID 19 was an ordinal variable, a

simple and multiple ordinal logistic regression was done to check the association between COVID 19 and different independent variables. All analyses were performed using STATA SE 18.0, with a p-value of less than 0.05 as the cut off to determine statistical significance.

Ethical Issues

The study will be conducted with adherence to the principles of transparency, legitimate purpose, and proportionality in the collection, retention, and processing of personal information in the Data Privacy Act of 2012, as well as the provisions in the National Ethical Guidelines for Privacy and Health-Related Research of 2017. In the implementation of this study, the anonymity of individuals participating in the research will be ensured with the non-inclusion of the patient's name. Access to the imaging data shall be requested by the investigators from the Region II Trauma and Medical Center Internal Medicine Department, through the Department Chairperson, upon approval of the study, and the waiver of the informed consent by the Region II Trauma and Medical Center Research Ethics Board. All confidential information will be stored within secured database systems. There would be no exposure to other information that would identify participants.

RESULTS

There were 1,590 hospitalized patients with confirmed COVID-19 throughout our time period. 4 cases were excluded due to incomplete key information in the medical records. (**Figure 1**)

Figure 1

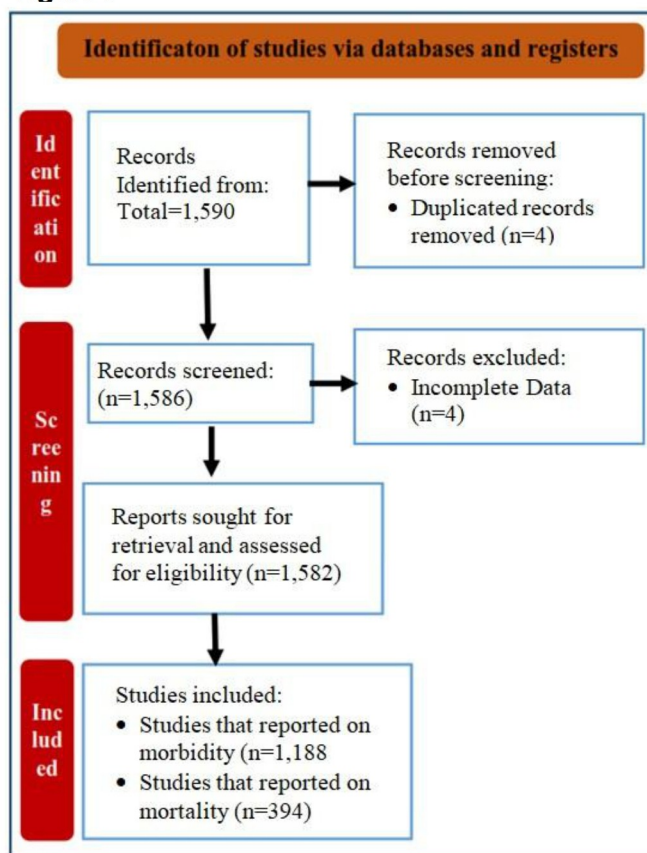


Figure 1: * Reason for exclusion may exist for each paper. *Consist of an overlap of studies reporting on both mortality and morbidity.

Characteristics of COVID-19 with Cardiometabolic risk factors

There were 1582 samples included in this study. Most were 50 to 59 years old (24.3%), male (57.7%) and unvaccinated. Cardiovascular disease (60.7%), presence of hyperlipidemia (62.5%) and hypertension (63.9%) were the most common risk factors. In terms of other ratio factors, most patients have normal BMI (78.3%), moderate WHR (78.2%), at risk LDL-cholesterol (79.0%) and high 1 BP (48.1%). Around 66% stayed more than a week in the hospital and around 25% died during admission. Most patients included had moderate COVID 19 (50%). (**See Table 1**)

Table 1: Baseline Characteristics of admitted COVID-19 patients (N=1582)

Parameter	Number (%)
Vaccinated	67 (4.23)
Age	
20-29	76 (4.80)
30-39	144 (9.10)
40-49	249 (15.74)
50-59	384 (24.27)
60-69	372 (23.51)
70 and Above	357 (22.57)
Sex (Male)	913 (57.71)
Type 1 DM	16 (1.01)
Type 2 DM	406 (25.66)
Obesity	18 (1.14)
Hypertension	1101 (63.90)
Hyperlipidemia	988 (62.45)
Cardiovascular Disease	961 (60.74)
Myocardial Infarction	128 (8.09)
Atrial Fibrillation	183 (11.57)
BMI	
Underweight	23 (1.45)
Normal	1239 (78.32)
Overweight	319 (20.16)
Obese	1 (0.000001)
Waist Hip Ratio	
Low	114 (7.21)
Moderate	1237 (78.19)
High	231 (14.6)
LDL-Cholesterol	
Healthy	102 (6.44)
At Risk	1250 (79.01)
Dangerous	230 (14.53)
FBS	
Normal	424 (26.80)
Impaired	843 (53.29)
Diabetic	315 (19.91)
BP	
Normal	503 (31.80)
Elevated	309 (19.53)
High1	761 (48.10)
High2	9 (0.00006)
More than a week in the Hospital	1041 (65.80)
Mortality	394 (24.91)
Severity of Covid	
Mild	24 (1.52)
Moderate	791 (50.00)
Severe	475 (30.03)
Critical	292 (18.46)

Association Between Different Outcomes and Cardiovascular Risk Factors in Covid Patients

A. Association Between Length of Stay and Cardiometabolic Risk Factors

Using simple logistic regression analysis, age, sex, type 2 DM, hypertension, hyperlipidemia, cardiovascular disease, myocardial infarction, atrial fibrillation, BMI, waist hip ratio and FBS crudely correlate with length of stay. Nevertheless, upon adjustment of possible confounders, age, presence of hyperlipidemia, FBS and BP directly correlate with length of stay while Myocardial Infarction, AF and WHR inversely correlate with length of stay. Specifically, older patients, hyperlipidemic, those with confirmed diabetes and elevated BP had higher probability of staying in the hospital for more than a week while those with MI, AF, and higher WHR tend to stay shorter. **(See table 2)**

B. Association Between Cardiometabolic Risk Factor and Death

Crudely, vaccination protects a patient with COVID-19 from death by as much as 55%. Increasing age, presence of type 2 DM, hypertension, hyperlipidemia, cardiovascular disease, Myocardial Infarction, Atrial fibrillation, higher FBS and BP on the other hand increase the odds of death. Nevertheless, upon control of confounders, only MI, AF and increasing BP were associated with higher odds of death. Specifically, COVID patients with MI, AF and high 2 BP have 27.3 times, 5.8 times and 10.4 times odds of dying compared when they don't have these condition. **this may explain the shorter length of stay of MI AF patients since they die faster.* **(see Table 3)**

C. Association Between Cardiometabolic Risk Factors and COVID-19 Severity

Crudely, vaccination decreases the odds of having severe covid, while the rest of the predictors, aside from sex, type 1 DM, and obesity increase the odds. On multiple ordinal logistic regression analysis however, only vaccination

status was associated with decreased severity of COVID 19. Specifically, a vaccinated patient has 43% less odds of having severe COVID 19. **(see Table 4)**

DISCUSSION

As seen in the result done at R2TMC, in comparing the age distribution of COVID-19 patients without vaccination and with vaccination, it showed that the majority were 50 to 59 years old (24.3%), male (57.7%) and unvaccinated. This was observed in all age groups. In a study Published in 2024 by Yu et. al, there were 221 incident SARS-CoV-2 infections among those with serologic evidence of vaccination (1.6%). Intermittent hypertension was associated with greater SARS-CoV-2 infections among those with serologic evidence of vaccination risk (adjusted incidence rate ratio=2.07; 95% CI=1.44, 2.96; $p<0.01$) than among participants with consistent normotension based on a multivariable Poisson regression.

A large population-based study conducted in the US showed that men all diagnosed patients, hospitalized patients were more likely to be male, older, and have a higher prevalence of cardiometabolic risk factors due to lifestyle. Based on the outline distribution done at R2TMC according to gender, the majority of the patients were male patients with no vaccination about 57.7%.

The demographic data for age corresponds with the latest report by the Journal of the American Heart Association published in 2021, which showed a much higher proportion of COVID-19 hospitalizations among older adults (aged ≥ 65 years) compared with younger ages. This indicates that among (aged ≥ 40 years) have a higher risk of COVID-19 severity and mortality. In a study published in 2021 by Yasaman et. al, due to the high majority of cardiometabolic risk factors like obesity, hypertension, diabetes, and

dyslipidemia among the population over 60 years old and higher, these cardiometabolic risk factors along with the age of these people could worsen the prognosis of the coronavirus disease of 2019 (COVID-19) and its mortality.

As of December 2022, the total cases of COVID-19 in R2TMC, age, sex, type 2 DM, hypertension, hyperlipidemia, cardiovascular disease, myocardial infarction, atrial fibrillation, BMI, waist-hip ratio and FBS crudely correlate with the length of stay This finding is consistent with the study done by Maryam et. al. (2023) which also noted that in a significant proportion higher prevalence of poor outcomes from COVID-19. The risk of COVID-19 hospitalizations was attributable to the largest proportions of Hypertension (26.2%), a much higher proportion of COVID-19 Hospitalization among older adults (aged ≥ 65 years) compared with younger ages, respectively (Meghan, 2021).

Hyperlipidemia was an extremely common metabolic comorbidity that affects the outcome of COVID-19. A study done by Ru Ying et. al. (2023) found that examining 27 systematic reviews found discordant results on the associations of hyperlipidemia with COVID-19 mortality, although the data trended towards increased mortality. Maryam et. al. (2023) noted that hyperlipidemia was associated with COVID-19 severity and mortality in a meta-analysis of 12, 995 patients as a contributor to more severe COVID-19 infection and prolong the length of hospital stay.

Table 2: Association Between Length of Stay and Cardiometabolic Risk

Factor	Simple Logistic Regression		Multiple Logistic Regression	
	Unadjusted OR	p-value	Adjusted OR	p-value
Vaccination	1.1	0.8		
Age (vs 20-29)	NA			
30-39	2.0	0.025*	2.2	0.02*
40-49	2.3	0.005*	2.4	0.01*
50-59	9.1	<0.0001*	3.5	<0.0001*
60-69	13.7	<0.0001*	3.5	0.001*
70 and Above	8.3	<0.0001*	2.0	0.07*
Being Male	0.8	0.04	0.91	0.5
Type 1 DM	1.6	0.8		
Type 2 DM	2.1	<0.0001*	0.8	0.2
Obesity	2.6	0.1		
Hypertension	6.1	<0.0001*	0.8	0.5
Hyperlipidemia	6.1	<0.0001*	2.6	0.03*
Cardiovascular Disease	5.7	<0.0001*	1.2	0.6
Myocardial Infarction	0.54	0.001*	0.2	<0.0001*
Atrial Fibrillation	1.8	0.001*	0.6	0.024*
BMI (vs UW)				
Underweight	NA			
Normal	0.27	0.04*	0.33	0.113
Overweight	0.34	0.09*	0.3	0.05
Obese	N/A			
Waist-Hip Ratio				
Low	NA			
Moderate	0.57	0.014*	0.3	<0.0001*
High	0.61	0.06*	0.2	<0.0001*
LDL-Cholesterol				
Healthy	NA			
At Risk	0.7	0.06		
Dangerous	0.9	0.62		
FBS				
Normal	NA			
Impaired	3.2	<0.0001*	1.8	0.001*
Diabetic	4.2	<0.0001*	1.7	0.03*
BP				
Normal	NA			
Elevated	10.4	<0.0001*	6.4	<0.0001*
High1	8.06	<0.0001*	4.9	<0.0001*
High2	4.02	0.05	3.0	0.15

Multivariate logistics regression analysis of prognostic factors for length of stay in COVID-19.
Abbreviations: COVID-19 = coronavirus disease 2019, OR = odds ratio, LDL = low-density lipoproteins, BMI = body mass index (calculated as weight in kilograms divided by height in meters squared), UW = underweight, DM = Diabetes Mellitus, NA = not applicable.

Table 3: Association Between Cardiometabolic Risk Factor and Death

Factor	Simple Logistic Regression		Multiple Logistic Regression	
	Unadjusted OR	p-value	Adjusted OR	p-value
Vaccination	0.45	0.03*	0.6	0.2
Age (vs 20–29)				
30–39	1.2	0.8	1.0	0.9
40–49	3.6	0.02*	2.1	0.2
50–59	4.4	0.01*	0.7	0.5
60–69	6.7	<0.0001*	1.0	0.9
70 and Above	15.1	<0.0001*	1.8	0.4
Being Male	0.9	0.2		
Type 1 DM	1.0	0.9		
Type 2 DM	3.0	<0.0001*	1.4	0.05
Obesity	1.06	0.7		
Hypertension	7.4	<0.0001*	4.4	0.001*
Hyperlipidemia	5.7	<0.0001*	0.4	0.02*
Cardiovascular Disease	4.8	<0.0001*	0.8	0.6
Myocardial Infarction	23.6	<0.0001*	27.3	<0.0001*
Atrial Fibrillation	5.6	<0.0001*	5.8	<0.0001*
BMI (vs UW)				
Underweight				
Normal	1.4	0.5		
Overweight	2.2	0.2		
Obese	1			
Waist-Hip Ratio				
Low				
Moderate	0.8	0.3		
High	1.1	0.6		
LDL-Cholesterol				
Healthy				
At Risk	0.8	0.4		
Dangerous	1.6	0.06		
FBS				
Normal				
Impaired	2.7	<0.0001*	1.0	0.9
Diabetic	5.2	<0.0001*	1.4	0.2
BP				
Normal				
Elevated	5.5	<0.0001*	2.8	0.002*
High1	9.6	<0.0001*	4.9	<0.001*
High2	32.7	<0.0001*	10.4	0.007*

Multivariate logistics regression analysis of prognostic factors for mortality in COVID-19.

Abbreviations: COVID-19 = coronavirus disease 2019, OR = odds ratio, LDL = low-density lipoproteins, BMI = body mass index (calculated as weight in kilograms divided by height in meters squared), UW = underweight, DM = Diabetes Mellitus, NA = not applicable.

Table 4: Association Between Cardiometabolic Risk Factors and COVID-19

Factor	Simple Ordinal Logistic Regression		Multiple Ordinal Logistic Regression	
	Unadjusted OR	p-value	Adjusted OR	p-value
Vaccination	0.46	0.003*	0.53	0.003*
Age (vs 20-29)				
30-39	1.7	0.1	1.1	0.9
40-49	2.5	0.002*	0.9	0.9
50-59	2.8	<0.0001*	2.3	0.2
60-69	3.8	<0.0001*	3.0	0.1
70 and Above	7.0	<0.0001*	2.9	0.2
Being Male	1.0	0.8		
Type 1 DM	1.0	0.9		
Type 2 DM	1.7	<0.0001*	0.94	0.9
Obesity	1.1	0.6		
Hypertension	3.1	<0.0001*	0.4	0.4
Hyperlipidemia	3.2	<0.0001*	0.34	0.5
Cardiovascular Disease	3.1	<0.0001*	3.8	0.4
Myocardial Infarction	11.6	<0.0001*	0.3	0.2
Atrial Fibrillation	2.8	<0.0001*	0.6	0.4
BMI (vs UW)				
Underweight				
Normal	4.2	0.003*		
Overweight	4.7	0.001*		
Obese	1.2	0.9		
Waist-Hip Ratio				
Low				
Moderate	4.5	<0.0001*		
High	6.1	<0.0001*		
LDL-Cholesterol				
Healthy				
At Risk	4.0	<0.0001*		
Dangerous	4.9	<0.0001*		
FBS				
Normal				
Impaired	2.0	<0.0001*	1.2	0.6
Diabetic	3.5	<0.0001*	2.1	0.2
BP				
Normal				
Elevated	1.5	0.005*	0.5	
High1	4.2	<0.0001*	1.4	0.3
High2	2.5	0.2	-	0.6

Multivariate logistics regression analysis of prognostic factors for Clinical Severity in COVID-19. Abbreviations: COVID-19 = coronavirus disease 2019, OR = odds ratio, LDL = low-density lipoproteins, BMI = body mass index (calculated as weight in kilograms divided by height in meters squared), UW = underweight, DM = Diabetes Mellitus, NA = not applicable.

In another retrospective study done by Barkhordarian et. al. (2022), Diabetes Mellitus is a major mediator of COVID-19 clinical outcomes. A higher prevalence of Diabetes Mellitus was seen among patients with severe COVID-19. The study done by Ru Ying Fong et. al. (2023) found that Diabetes was reported in 24 studies for mortality and was associated with a 2.85-fold significant increase in the risk of mortality compared with patients without diabetes.

The mean duration of hospitalization majority in this study was 8- $\geq$ 14 days of hospitalization noted that 996 (63 %) were not vaccinated while 45 (2.8%) were vaccinated which is longer as compared to a single-center study conducted in the US with a mean duration 5-10 days depending on the clinical severity of COVID-19. However, a 2-year single-center study in Jakarta, Indonesia (Arvin et. al, 2022) noted an average hospital stay of 14 days (range: 2 to 30 days). This is of importance because prolonged hospitalization leads to further complications and economic burdens.

Vaccination protects a patient with COVID-19 from death by as much as 55%. Increasing age, presence of type 2 DM, hypertension, hyperlipidemia, cardiovascular disease, MI, AF, higher FBS, and BP on the other hand increase the odds of death. The mortality rate among patients with cardiometabolic risk factors varies from an overall mortality rate of 9.4% in a Singaporean study (Ru et.al, 2023), 14% in a single centered in Jakarta Indonesia (Arvin et. al., 2022), 10.5% from a study in mainland China (Chan et. al., 2021).

Vaccination decreases the odds of having severe COVID-19, while the rest of the predictors, aside from sex, type 1 DM, and obesity increase the odds. On multiple ordinal logistic regression analysis, however, only vaccination status was associated with decreased severity of COVID-19. Specifically, a vaccinated patient has 53% less odds of having severe COVID-19.

Practically, knowledge of the sociodemographic and comorbidities that place COVID-19 patients at severe outcomes may aid clinicians in developing risk stratification workflows to prioritize such patients. This paper suggests that, beyond Cardiometabolic Risk Factors, age, and sex are two of the most important influential factors in mortality in patients with COVID-19. This is not surprising and it is expected that age should have a significant impact on the course of the disease. Measures taken by public health policies to protect this vulnerable group, such as prioritizing the elderly for vaccination and healthcare, were steps taken in the right direction. The health repercussions of COVID-19 aggregated in patients with Cardiometabolic Risk factors veritably remind us of the cornerstone principles in public health prevention and regular management: optimization of glycemic outcomes, management of hypertensive profiles, and adequate anti-thrombotic strategies to circumvent cardiovascular disease, especially in the elderly population.

Strengths and limitations

There were a few restrictions to our study incorporate review assortment of information from electronic and paper records, moderately couple of patients with waist to hip ratio file information accessible, and deficient development of certain patients without a still hospitalized endpoint at the hour of investigation. Additionally, we couldn't recover glycemic control information during hospitalization which related with more regrettable Coronavirus results. A few elements related erroneously glycemic control information are because of Cytokine storm pressure incite hyperglycemia, direct harm to beta cells, stress induced hyperglycemia and corticosteroids induced hyperglycemia. Notwithstanding, HbA1c may be dishonestly raised in patients with intense phase of Coronavirus because of upset hemoglobin energy brought about by SARS-CoV-2 and additionally HPLC discovery of thickly glycosylated S-proteins on the SARS-CoV-2 virion

surface. At long last, we couldn't have appraised insulin obstruction, or substitutes as FBS and LDL, in our populace, which was in many cases considered the normal soil for cardiometabolic conditions. Sadly, because of the observational review plan and the requesting not set in stone by the pandemic, we couldn't gather extra radiological examinations to test biomarkers not regularly estimated in all patients, which may all be associated with the connection between cardiometabolic dismalness and Coronavirus progression.

Qualities of this study incorporate a point by point portrayal of the clinical and biochemical highlights of patients hospitalized for Coronavirus, with and without diabetes, with great generalizability of the outcomes because of the multivariate coordinated operations relapse examination. Besides, to the best information, this was the main review surveying Coronavirus results with regards to cardiometabolic.

CONCLUSION

This study demonstrates the consequences of Diabetes Mellitus, Hypertension, Hyperlipidemia and Cardiovascular Disease showed significant associations with mortality and Clinical Severity of patients. Moreover, Age, Male, and Co-morbidities were significant confounders for the associations of Cardiometabolic Risk Factors on COVID-19 mortality and clinical severity.

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