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VACCINATION STATUS AND COVID-19 RELATED MORTALITY: A HOSPITAL BASED CROSS SECTIONAL STUDY IN ADMITTED PATIENTS IN SOUTHWESTERN UNIVERSITY MEDICAL CENTER FROM MAY 2021 - MAY 2022

Glenda Marie M. Manayon, MD
Department of Internal Medicine
Southwestern University Medical Center
Cebu City, Philippines
Email: glendamanayon@gmail.com

Jemer Grace S. Arellano-Compuesto, MD
Department of Internal Medicine
Southwestern University Medical Center
Cebu City, Philippines
Email: jemerarellano@gmail.com

Corresponding Author

Glenda Marie M. Manayon, MD
Department of Internal Medicine
Southwestern University Medical Center
Cebu City, Philippines
Email: glendamanayon@gmail.com

Abstract

The effectiveness of COVID-19 vaccines observed in clinical trials may differ in real-world populations. The Philippine Department of Health launched its national COVID-19 vaccination drive on March 1, 2021, yet hospital-level evidence on vaccination status and outcomes among Filipino inpatients remains limited. To describe the demographic and clinical profiles, disease severity, and vaccination status of adult patients admitted for COVID-19, and to examine how these factors were distributed across patient outcomes. A record-based cross-sectional study was conducted at Southwestern University Medical Center, a 126-bed tertiary hospital in Cebu City. All adult patients with rT-PCR-confirmed SARS-CoV-2 infection admitted from May 1, 2021 to May 2, 2022 were included (n = 65). Data on age, sex, comorbidities, oxygen support, length of stay, final disease severity, vaccination status, and outcome (improved, died, or discharged against medical advice) were extracted and analyzed using frequencies and proportions. Most patients were aged 40–59 years (38.5%) and male (52.3%); 70.8% had comorbidities and 72.3% required oxygen on admission. Two-thirds (66.2%) were unvaccinated, 15.4% were fully vaccinated, and 4.6% were partially vaccinated. Overall, 76.9% improved and 18.5% died. Recovery was more frequent among fully vaccinated patients (90.0%) than among unvaccinated (74.4%) and partially vaccinated patients (66.7%). No deaths occurred among patients without comorbidities, patients aged 18–39 years, or those with mild or moderate disease, whereas 75.0% of critically ill patients died. Full vaccination, younger age, and absence of comorbidities were descriptively associated with more favorable outcomes among hospitalized COVID-19 patients. Because of the small sample, formal inferential testing was not possible; larger multicenter studies are needed to confirm these associations.

Keywords: COVID-19 vaccine, CoronaVac, mortality, SARS-CoV-2, vaccination status, Philippines

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INTRODUCTION

Coronaviruses are enveloped RNA viruses of the family *Coronaviridae* that cause human respiratory infections ranging from the common cold to severe acute respiratory syndrome (Weiss & Navas-Martin, 2005). Within two decades, three zoonotic betacoronaviruses (SARS-CoV, MERS-CoV, and SARS-CoV-2) caused lethal outbreaks (Cui et al., 2019). SARS-CoV-2 was first identified in patients with pneumonia in Wuhan, China, in late 2019, and its genome was published in January 2020 (P. Zhou et al., 2020; Wu et al., 2020). The World Health Organization (WHO) declared the disease, named coronavirus disease 2019 (COVID-19), a public health emergency of international concern on January 30, 2020, and characterized it as a pandemic on March 11, 2020.

The clinical spectrum of COVID-19 is broad. Common symptoms include fever, cough, and myalgia, and patients may progress to severe disease, marked by dyspnea, tachypnea, and hypoxemia, or to critical disease with respiratory failure, septic shock, or multi-organ dysfunction (Huang et al., 2020; World Health Organization [WHO], 2021b). Older age and the presence of comorbidities have consistently been identified as the strongest predictors of in-hospital death (Williamson et al., 2020; F. Zhou et al., 2020).

Vaccination is the safest and most cost-effective strategy for preventing severe COVID-19 and death. Vaccine candidates were developed across multiple platforms, including inactivated, protein subunit, viral-vector, and nucleic-acid vaccines, with the spike protein serving as the principal antigenic target (Krammer, 2020). In phase 3 trials, mRNA vaccines showed high efficacy against symptomatic infection (Baden et al., 2021; Polack et al., 2020). CoronaVac (Sinovac Life Sciences, Beijing, China), an inactivated whole-virus vaccine that was widely used in the Philippines, induced neutralizing antibodies in animal models (Gao et al., 2020), demonstrated efficacy against symptomatic COVID-19 in a phase 3 trial (Tanriover et al., 2021), and was associated with substantial protection against hospitalization and death in a nationwide cohort in Chile (Jara et al., 2021). Population-level data from Israel similarly showed marked reductions in hospitalizations and deaths after mass vaccination (Haas et al., 2021).

The emergence of variants of concern, notably Omicron (B.1.1.529), designated by WHO on November 26, 2021, raised concerns about reinfection and reduced vaccine protection (Kannan et al., 2021), although available evidence supports the value of booster doses against these variants (Chenchula et al., 2022). Achieving population-level (herd) immunity was estimated to require vaccination of a large majority of the population (Fontanet & Cauchemez, 2020).

Because efficacy observed in clinical trials may not translate directly to real-world settings, local evidence is needed. In the Philippines, modeling studies have examined the dynamics of COVID-19 and the effects of public health interventions (Caldwell et al., 2021), but hospital-based data linking vaccination status to patient outcomes remain scarce, particularly in the Visayas. Such evidence can inform clinical practice and help address vaccine hesitancy in the community.

This study therefore aimed to determine the factors associated with outcomes among COVID-19 patients admitted to a tertiary hospital in Cebu City, Philippines, from May 1, 2021 to May 2, 2022. Specifically, it sought to (1) describe the demographic profile (age and sex) of admitted patients; (2) describe their clinical profile (length of stay, oxygen support on admission, and comorbidities); (3) determine the severity of COVID-19 infection (mild, moderate, severe, or critical); (4) determine vaccination status on admission (fully vaccinated, partially vaccinated, not vaccinated, or not reported); (5) determine patient outcomes (improved, died, or discharged/home against medical advice [DAMA/HAMA]); and (6) examine how demographic and clinical profiles, disease severity, and vaccination status were distributed across these outcomes. We hypothesized that vaccinated patients would have lower in-hospital mortality than unvaccinated patients.

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METHODS

Study design and setting

This was a record-based, cross-sectional study conducted at Southwestern University Medical Center, a 126-bed tertiary general hospital in Cebu City, Philippines. The study covered admissions from May 1, 2021 to May 2, 2022, a period that began two months after the start of the national vaccination campaign on March 1, 2021.

Participants

All patients aged 18 years and above with laboratory (rT-PCR)-confirmed SARS-CoV-2 infection who were admitted during the study period were included, using total enumeration (n = 65). Patients were admitted with moderate to critical illness based on the severity criteria of the Philippine Society for Microbiology and Infectious Diseases (PSMID) clinical practice guidelines as of July 20, 2020, and WHO guidance. Suspected or probable COVID-19 cases without laboratory confirmation, as well as pregnant patients, were excluded.

Definitions

Patients were classified as partially vaccinated two weeks after the first dose and as fully vaccinated two weeks after completing the primary series (two doses of a two-dose vaccine or one dose of a single-dose vaccine), consistent with the Centers for Disease Control and Prevention definition. Patients with no documented vaccination were classified as not vaccinated, and those whose status was not recorded in the chart were classified as not reported. Disease severity was classified as mild, moderate, severe, or critical according to the final COVID-19 severity recorded in the chart, following national and WHO criteria (Department of Health, 2020; WHO, 2021b). Severe disease was defined by dyspnea, respiratory rate above 30 breaths/minute, oxygen saturation below 93%, PaO2/FiO2 ratio below 300, and/or lung infiltrates above 50% within 24–48 hours; critical disease was defined by respiratory failure, septic shock, and/or multi-organ dysfunction.

Outcomes were classified as improved (discharged), died, or DAMA/HAMA. Patients were discharged at least 10 days from symptom onset after being afebrile for more than 72 hours, irrespective of rT-PCR status, with oxygen saturation above 94% on room air sustained for more than 24 hours, or upon a negative rT-PCR result with no oxygen requirement. Length of stay was measured from admission to discharge or death.

Data collection

Patient records were reviewed using a data extraction form that captured age, sex, comorbidities, vaccination status and vaccine brand, laboratory confirmation of diagnosis, dates of admission and discharge, oxygen support on admission, final COVID-19 severity, and clinical outcome.

Statistical analysis

Data were processed using IBM SPSS Statistics version 26. Frequencies and proportions were computed for all categorical variables. Length of stay was summarized using the median and range, and the median (9 days) was used to categorize stay as 1–9 days or 10 days or more. Chi-square-based measures of association (phi, Cramér's V, and the contingency coefficient) were planned; however, their assumptions (no cell with an observed count of zero and no more than 20% of cells with expected counts below 5) were not met because of the small sample, so these coefficients were not reported, and outcomes were compared using proportions. Binary logistic regression was not applicable because the outcome had three categories, and a multinomial logistic regression model was not statistically significant.

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Ethical considerations

The study was implemented after approval by the hospital's medical director. No vulnerable participants were involved. Patient identifiers were anonymized during chart review, and the dataset was stored in a password-protected computer accessible only to the researchers.

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RESULTS

Demographic profile

A total of 65 patients were included. The largest age group was 40–59 years (38.5%), followed by those aged 60 years and above (33.8%) and 18–39 years (27.7%). Slightly more than half were male (52.3%) (Table 1).

Table 1. Demographic Profile of Admitted COVID-19 Patients (n = 65)

Variable	Category	n	%
Age	18–39 years	18	27.7
	40–59 years	25	38.5
	60 years and above	22	33.8
Sex	Male	34	52.3
	Female	31	47.7

Clinical profile

Most patients had at least one comorbidity (70.8%). The most commonly encountered comorbidities were type 2 diabetes mellitus, hypertensive cardiovascular disease, chronic kidney disease, dyslipidemia, and bronchial asthma. Nearly three-quarters (72.3%) required oxygen on admission; among these, nasal cannula was most common (51.1%), followed by face mask (19.1%), non-rebreather mask (14.9%), invasive mechanical ventilation (12.8%), and non-invasive ventilation (2.1%). The median length of stay was 9 days (range, 1–56 days), with 55.4% staying 9 days or fewer (Table 2).

Table 2. Clinical Profile of Admitted COVID-19 Patients (n = 65)

Variable	Category	n	%
Comorbidities	Absent	19	29.2
	Present	46	70.8
Oxygen support on admission	Not oxygenated	18	27.7
	Oxygenated	47	72.3
	Nasal cannula	24	51.1
	Face mask	9	19.1

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	Non-rebreather mask	7	14.9
	Intubated	6	12.8
	Non-invasive ventilation	1	2.1
Length of stay	1–9 days	36	55.4
	10 days or more	29	44.6

Note. [a] Percentages computed among oxygenated patients (n = 47).

Severity of infection

Based on the final severity classification, moderate disease was most frequent (35.4%), followed by mild (24.6%), severe (21.5%), and critical disease (18.5%) (Table 3).

Table 3. Final Severity of COVID-19 Infection (n = 65)

Severity	n	%
Mild	16	24.6
Moderate	23	35.4
Severe	14	21.5
Critical	12	18.5
Total	**65**	**100.0**

Vaccination status

Two-thirds of patients were not vaccinated (66.2%), while 15.4% were fully vaccinated and 4.6% were partially vaccinated; vaccination status was not recorded for 13.8% (Table 4). Of the 13 patients with at least one dose, 5 (38.5%) received Sinovac, 3 (23.1%) AstraZeneca, 3 (23.1%) Pfizer-BioNTech, and 2 (15.4%) Moderna.

Table 4. Vaccination Status of Admitted COVID-19 Patients (n = 65)

Vaccination status	n	%
Fully vaccinated	10	15.4
Partially vaccinated	3	4.6
Not vaccinated	43	66.2

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Not reported	9	13.8
Total	**65**	**100.0**

Patient outcomes

Most patients improved and were discharged (76.9%), 18.5% died, and 4.6% went home against medical advice (Table 5).

Table 5. Outcomes of Admitted COVID-19 Patients (n = 65)

Outcome	n	%
Improved/discharged	50	76.9
Died	12	18.5
DAMA/HAMA	3	4.6
Total	**65**	**100.0**

Outcomes across patient characteristics

Table 6 summarizes outcomes across demographic and clinical profiles, disease severity, and vaccination status. Recovery was most frequent among patients aged 18–39 years (94.4%), none of whom died, compared with those aged 40–59 years (76.0%) and 60 years and above (63.6%); mortality was highest in the oldest group (31.8%) (Figure 1). Mortality was slightly higher among males than females (20.6% vs. 16.1%), and recovery was higher among females (80.6% vs. 73.5%).

Patients without comorbidities recovered more often than those with comorbidities (94.7% vs. 69.6%), and no deaths occurred among patients without comorbidities, whereas 26.1% of those with comorbidities died. All patients not requiring oxygen on admission recovered, compared with 68.1% of oxygenated patients, of whom 25.5% died. Patients admitted for 1–9 days recovered more often than those admitted for 10 days or more (83.3% vs. 69.0%), and mortality was higher among those with longer stays (27.6% vs. 11.1%).

All patients with mild or moderate disease recovered, compared with 64.3% of those with severe disease and 16.7% of those with critical disease. Mortality was 21.4% in severe and 75.0% in critical disease (Figure 2). All three patients who went home against medical advice, reportedly because of financial hardship, had severe or critical disease.

By vaccination status, the proportion who recovered was highest among fully vaccinated patients (90.0%), compared with patients who were not vaccinated (74.4%), whose status was not reported (77.8%), and who were partially vaccinated (66.7%). Mortality was 10.0% among fully vaccinated and 18.6% among unvaccinated patients (Figure 3).

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Table 6. COVID-19 Outcomes Across Patient Profiles, Severity of Infection, and Vaccination Status, n (%)

Variable	Category	Improved	Died	DAMA/HAMA
Age	18–39 years	17 (94.4)	0 (0.0)	1 (5.6)
	40–59 years	19 (76.0)	5 (20.0)	1 (4.0)
	60 years and above	14 (63.6)	7 (31.8)	1 (4.5)
Sex	Male	25 (73.5)	7 (20.6)	2 (5.9)
	Female	25 (80.6)	5 (16.1)	1 (3.2)
Comorbidities	Absent	18 (94.7)	0 (0.0)	1 (5.3)
	Present	32 (69.6)	12 (26.1)	2 (4.3)
Oxygen on admission	Not oxygenated	18 (100.0)	0 (0.0)	0 (0.0)
	Oxygenated	32 (68.1)	12 (25.5)	3 (6.4)
Length of stay	1–9 days	30 (83.3)	4 (11.1)	2 (5.6)
	10 days or more	20 (69.0)	8 (27.6)	1 (3.4)
Severity	Mild	16 (100.0)	0 (0.0)	0 (0.0)
	Moderate	23 (100.0)	0 (0.0)	0 (0.0)
	Severe	9 (64.3)	3 (21.4)	2 (14.3)
	Critical	2 (16.7)	9 (75.0)	1 (8.3)
Vaccination status	Fully vaccinated	9 (90.0)	1 (10.0)	0 (0.0)
	Partially vaccinated	2 (66.7)	1 (33.3)	0 (0.0)
	Not vaccinated	32 (74.4)	8 (18.6)	3 (7.0)
	Not reported	7 (77.8)	2 (22.2)	0 (0.0)

Note. Percentages are row percentages. DAMA/HAMA = discharged/home against medical advice.

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Figure 1. COVID-19 Outcomes by Age Group

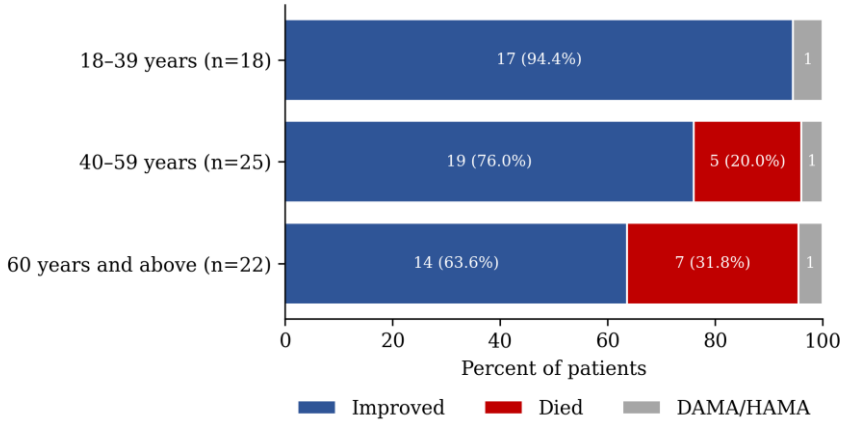


Figure 2. COVID-19 Outcomes by Final Severity of Infection

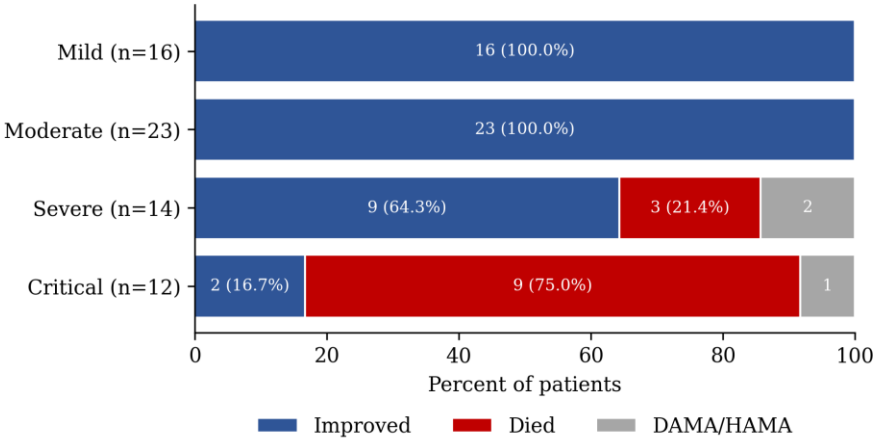
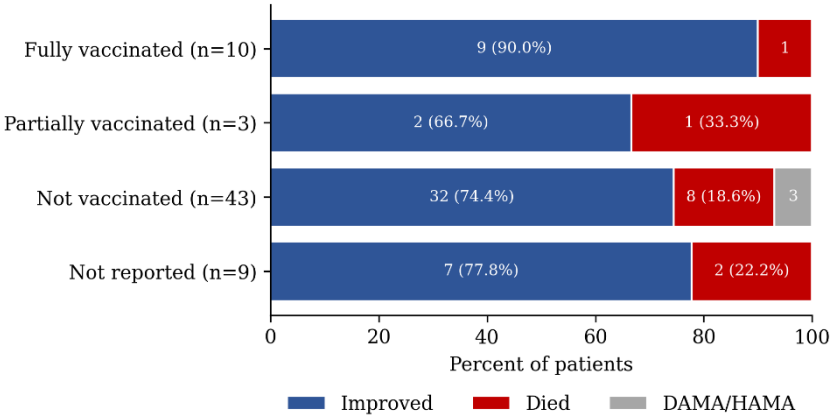


Figure 3. COVID-19 Outcomes by Vaccination Status



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DISCUSSION

This hospital-based study found that full vaccination, younger age, and the absence of comorbidities were associated with more favorable outcomes among adults hospitalized for COVID-19. Nine of ten fully vaccinated patients recovered, compared with roughly three of four unvaccinated patients, and in-hospital mortality among fully vaccinated patients was about half that of unvaccinated patients (10.0% vs. 18.6%). Mortality rose sharply with disease severity, reaching 21.4% in severe and 75.0% in critical disease.

The pattern observed for age and comorbidities is consistent with the wider literature. Large cohort studies and meta-analyses have identified older age and underlying conditions as the principal predictors of COVID-19 death (Tian et al., 2020; Williamson et al., 2020; F. Zhou et al., 2020). In the present study, mortality was highest among patients aged 60 years and above; no deaths occurred in patients without documented comorbidities, and 26.1% of patients with comorbidities died. Individual comorbidities were not analyzed separately; future studies could examine the specific contribution of diabetes, cardiovascular disease, and chronic kidney disease, which were the conditions most frequently encountered in this cohort.

The finding that vaccinated patients recovered more often is in line with evidence from trials and real-world studies showing that vaccinated individuals are less likely to develop symptomatic and severe disease or to die (Haas et al., 2021; Polack et al., 2020). It is particularly relevant that CoronaVac, the most commonly received vaccine in this cohort, was associated with strong protection against hospitalization and death in a national cohort in Chile (Jara et al., 2021). A similarly designed hospital-based study in India also reported lower mortality among fully vaccinated inpatients (Muthukrishnan et al., 2021). The poorer outcomes among the three partially vaccinated patients are consistent with the need to complete the primary series, and later evidence underscores the added value of booster doses as new variants emerged (Chenchula et al., 2022).

Markers of disease severity and inflammation have been shown to predict mortality (Tian et al., 2020; F. Zhou et al., 2020). Because this study did not assess severity scores or inflammatory markers as predictors, their inclusion would strengthen future work. The observation that all three patients who left against medical advice had severe or critical disease and cited financial hardship also suggests that economic barriers may affect outcomes and warrants further study.

Limitations

Several limitations should be noted. First, the sample was small (n = 65) and drawn from a single center, and the number of vaccinated patients was very small (10 fully and 3 partially vaccinated); the associations reported are therefore descriptive, and formal inferential testing was not possible because statistical assumptions were not met. Second, the cross-sectional design does not permit causal inference, and differences in age and comorbidity between vaccinated and unvaccinated patients could not be adjusted for. Third, vaccination status was missing for 13.8% of patients. Fourth, vaccinated patients received four different vaccine brands, precluding brand-specific conclusions. Finally, patients who were discharged or left against medical advice may have died after discharge and would not have been captured.

Recommendations for future research

Larger, multicenter studies with sufficient numbers of vaccinated patients are recommended, using analytic approaches such as exact tests or adjusted regression models to account for age, comorbidities, and disease severity. Future studies should also consider booster status, vaccine brand, the circulating variant, inflammatory markers, and post-discharge follow-up.

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CONCLUSION

In this hospital-based cross-sectional study of adults admitted with COVID-19 in Cebu City, a greater proportion of fully vaccinated patients recovered compared with partially vaccinated and unvaccinated patients, and full vaccination was accompanied by lower in-hospital mortality. Younger age and the absence of comorbidities were also linked to better outcomes, while critical illness carried very high mortality. Although these findings are descriptive and based on a small sample, they reaffirm the importance of completing COVID-19 vaccination to prevent severe complications and may support local efforts to address vaccine hesitancy.

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