

ORIGINAL ARTICLE

**CLINICAL AND LABORATORY PROFILE, MANAGEMENT AND OUTCOME OF PEDIATRIC PATIENTS WITH COVID-19 INFECTION ADMITTED AT THE ZAMBOANGA CITY MEDICAL CENTER**

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**ABSTRACT**

**Objective:** To determine the clinical profile, management and outcome of pediatric patients with COVID-19 infection admitted at the Zamboanga City Medical Center (ZCMC) from March 2020 to December 2022.

**Methodology:** This was a retrospective cohort study which enrolled patients 19 years old and below with SARS-CoV-2 infection admitted at the ZCMC. Charts were retrieved and uploaded on a database. Demographic and clinical information were gathered including history of exposure to COVID-19, history of COVID-19 vaccination, comorbidities, clinical manifestations, laboratory examination, medications and clinical outcome. Data were analyzed using descriptive statistics.

**Results:** There were 145 evaluable patients. The mean age was 8.4 years with 40% aged less than 5 years old. Majority were males (58.62%). Half (50.34%) had no known exposure to COVID-19. None received COVID-19 vaccine. Ninety-seven (66.90%) patients were underweight. Sixty-nine (47.59%) patients were asymptomatic, 30 (20.69%) had mild infection while 24 (16.55%) had severe to critical illness. There were 5 (3.45%) cases of multisystem inflammatory syndrome in children (MIS-C). The most common symptoms were fever, vomiting/nausea, cough and shortness of breath. The most common chest radiograph findings were bilateral lung opacities. Majority of the patients received antibiotics (68.97%). Other medications given included corticosteroids (14.48%), intravenous immunoglobulin (3.45%), remdesivir (4.83%) and tocilizumab (5.52%). The mortality rate was 11.72%.

**Conclusion:** Pediatric COVID-19 in Southwestern Mindanao affects all age groups. Majority of hospitalized patients were asymptomatic or had mild infection. Fever was the most common manifestation. Antibiotic use was high. Mortality rate was 11.72%.

**KEYWORDS:** *COVID-19, SARS-CoV-2, children, pediatric patients, clinical profile*

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## INTRODUCTION

The COVID-19 pandemic, caused by the SARS-CoV-2 virus, has significantly impacted global health systems and highlighted vulnerabilities in various populations, including pediatric patients.<sup>1-3</sup> Although children have generally experienced milder forms of COVID-19 compared to adults, they remain susceptible to infection and can suffer from severe outcomes, including Multisystem Inflammatory Syndrome in Children (MIS-C).<sup>4-5</sup>

Zamboanga City Medical Center (ZCMC), a primary government hospital in Southwestern Mindanao, has been the main referral hospital for COVID-19 in this part of the Philippines. ZCMC has managed numerous adult and pediatric COVID-19 cases throughout the pandemic. While the adult patients comprised most of the admitted cases of COVID-19, several pediatric patients were affected as well.

This study aims to provide a comprehensive retrospective analysis describing the clinical and laboratory profile, management and treatment modalities, and outcome of pediatric patients admitted with confirmed COVID-19 infection at ZCMC from March 2020 to December 2022. This study is part of a multicenter study which specifically aims to contribute valuable insights into the pediatric COVID-19 experience in the Philippines. Studying the clinical profile of pediatric COVID-19 in a resource-limited setting enhances understanding of disease patterns thereby addressing gaps in knowledge, providing epidemiological insights and informing future healthcare strategies.

## MATERIALS AND METHODS

This was a descriptive retrospective cohort study which enrolled pediatric patients confirmed to have SARS-CoV-2 infection admitted at the Zamboanga City Medical Center in Zamboanga City. Clinical and laboratory data from admission to discharge of the patients were gathered. Sampling strategy utilized total enumeration of all admitted pediatric patients 19 years old and below diagnosed

to have confirmed SARS-CoV-2 or COVID-19 infection. Confirmed COVID-19 was defined as laboratory-confirmed positive reverse transcriptase polymerase chain reaction (RT-PCR) result done at a molecular laboratory in Zamboanga City. Also included were hospitalized patients diagnosed to have Multisystem Inflammatory Syndrome in Children (MIS-C) based on the criteria set by the World Health Organization (WHO).<sup>6</sup>

Patients who came in at the emergency room or in the outpatient department were screened for the presence of COVID-19 by assessing for exposure, clinical evaluation and review of available laboratory tests. Suspected cases of COVID-19 were confirmed through RT-PCR. Nasopharyngeal swabs were collected and sent to the ZCMC molecular laboratory. Cases were diagnosed and classified based on the Pediatric Infectious Disease Society of the Philippines (PIDSP) COVID-19 guideline.<sup>7</sup> Patients diagnosed to have COVID-19 infection based on RT-PCR done in the molecular laboratory of private hospitals who were referred to and admitted at ZCMC were also included.

Charts of confirmed pediatric COVID-19 cases admitted at ZCMC from March 2020 to December 2022 were retrieved from the records section and uploaded on a database. The following pertinent demographic and clinical information were gathered: age, sex, history of exposure to someone with COVID-19, history of COVID-19 vaccination, comorbidities, clinical manifestations, laboratory examination results, and radiologic and imaging results during the entire hospital stay. All diagnostic test results were recorded including repeat examinations. All supportive management approaches as well as all medications given to the patients during the entire hospital stay were reviewed and recorded. Clinical outcome on the last hospital day was determined as to improvement, death, or discharge against medical advice. All patient information and data extracted from the medical records of patients were noted using a case report form (CRF) which was later encoded in an electronic data capture web

application. The study was mainly observational without direct manipulation of the clinical events.

Prior to the conduct of the study, the study protocol was submitted to the ZCMC Ethical Review Board (ERB) which approved the conduct of the study with strict adherence to the ethical considerations and principles required of all clinical studies. Confidentiality in the case report forms was assured by omitting all patient identification.

This was a purely descriptive study which utilized descriptive statistics (frequencies and percentages) for categorical variables and measures of central tendency (mean, median) and variance (range and standard deviation) for continuous variables.

## RESULTS

There was a total of 145 uploaded charts of confirmed COVID-19 pediatric patients aged 19 years old and below admitted at the ZCMC from March 2020 to December 2022.

**Table 1. Demographic characteristics of admitted COVID-19 patients, ZCMC**

	FREQUENCY (n=145)	%
<b>AGE (years)</b>		
<1	31	21.38
1-5	32	22.07
6-10	22	15.17
11-15	37	25.52
16-19	23	15.86
<b>SEX</b>		
Male	85	58.62
Female	60	41.38

Table 1 shows the age and sex distribution of the patients. The mean age was 8.4 years and the median age was 8 years with a range of 8 hours old to 18 years old. Over 40% were less than 5 years of age. Children less than 1 year of age comprised 21.38% and those between 1 to 5 years of age accounted for 22.07% of cases. Twenty-five per cent of the cases were 11 to 15 years of age while there were 15.86% belonging to the 16 to 19 years age group. Majority were males (58.62%).

**Table 2. Clinical characteristics of admitted pediatric patients with COVID-19, ZCMC**

CLINICAL CHARACTERISTICS	FREQUENCY (n=145)	%
<b>Exposure history</b>		
No	73	50.34
Yes	9	6.21
Unknown	63	43.45
<b>BMI</b>		
Underweight	97	66.90
Normal	37	25.52
Overweight	7	4.83
Obese	4	2.76
<b>Vaccination Status</b>		
None	145	100
<b>COVID-19 Disease Severity</b>		
Asymptomatic	69	47.59
Mild	30	20.69
Moderate	17	11.72
Severe	9	6.21
Critical	15	10.34
MIS-C	5	3.45
<b>Presenting Symptoms (n=76)</b>		
Fever	43	56.58
Vomiting/Nausea	26	34.21
Cough	22	28.95
Shortness of breath	20	26.32
Diarrhea	15	19.74
Coryza/colds	4	5.26
Seizure/s	3	3.95
Headache	3	3.95
Rash	2	2.63

The clinical characteristics of the patients are shown in Table 2. Forty-three per cent of the cases had unknown history of exposure to a COVID-19 case. Half (50.34%) denied exposure to a patient with COVID-19. Only 9 (6.21%) reported exposure to a known case of COVID-19. Ninety-seven patients were underweight and only a minority were overweight or obese. Thirty-seven patients had normal BMI. All patients had no COVID-19 vaccine.

In terms of disease severity, 69 (47.59%) were asymptomatic (Table 2). Thirty (20.69%) patients had mild COVID-19. Only 24 (16.55%) patients had severe to critical illness. There were 5 (3.45%) cases of MIS-C. Of the 76 patients with symptoms, 43 (56.58%) presented with fever, 26 (34.21%) had vomiting/nausea, 22 (28.95%) had cough and 20 (26.32%) had shortness of breath. Other less frequently reported symptoms included diarrhea, coryza, seizures, headache and rashes.

As to comorbidities, 103 out of 145 patients had no comorbidity and only 42 (28.97%) had comorbidity (Table 3). Among those with comorbidity the most frequent underlying condition was malignancy, all cases of leukemia scheduled for chemotherapy. There were 7 surgical cases (4 trauma, 1 colostomy, 2 ruptured appendicitis), 6 cases of tuberculosis, 5 cases of congenital heart disease, 4 cases of kidney disease, and a case of metabolic abnormality. There were 10 pregnancies. The pregnant teenagers had ages between 15 to 18 years. There were no reports of neurologic, cardiac, hepatic or autoimmune comorbidities.

**Table 3. Comorbidities of admitted pediatric patients with COVID-19, ZCMC**

Comorbidities or Underlying Conditions	n=145	%
No comorbidity	103	71.03
With comorbidity	42	28.97
Malignancy	9	6.21
Surgical, Traumatic	7	4.83
Congenital Anomaly	5	3.45
Tuberculosis	6	4.14
Kidney Disease	4	2.76
Metabolic	1	0.69
Pregnancy	10	6.90

Of 145 included patients, only 133 had results of complete blood count (Table 4A). CBC was not done on 12 patients. Among those with results, 49 (36.84%) were anemic with a hemoglobin of less than 110 g/L. Sixteen (12.03%) patients had leukopenia while 67 (50.37%) had leukocytosis of over  $11 \times 10^3/\mu\text{L}$ . It should be noted that normal white blood count was seen in 50 (37.59%) patients. There were 30 (22.56%) with a neutrophil count of less than 50% and 55 (41.35%) had neutrophils of more than 70%. Lymphocytosis was seen in 27 (20.3%). Thrombocytopenia was seen in 21 (15.79%) patients. Seventy-seven (57.89%) patients had normal platelet count. Thrombocytosis on the other hand was seen in 35 (26.32%).

Other ancillary laboratory tests were done in only a few patients (Table 4B). Among those who had CRP, 6 (16.22%) presented with a high value. Majority (83.78%) had normal CRP. Procalcitonin was elevated in 76.47% of cases while a high ferritin value was

found in 52.38% of those who were tested for these parameters. Of the 21 cases with ferritin level, 16 (76%) had severe to critical COVID-19, majority of whom (11 patients) had elevated results. D-dimer was done on 27 patients and all had elevated values. Similarly, all 9 patients with LDH results had elevated values. Interleukin-6 and fibrinogen levels were not requested on any patient.

**Table 4A. CBC findings among admitted pediatric patients with COVID-19, ZCMC**

COMPLETE BLOOD COUNT PARAMETERS	FREQUENCY (n=133)	%
<b>Hemoglobin</b> (mean 117.36, SD 22.15)		
<110	49	36.84
110-135	58	43.61
>135	26	19.55
<b>Hematocrit</b> (mean 0.35, SD 0.06)		
<0.31	32	24.06
0.31-0.40	80	60.15
>0.40	21	15.79
<b>White Blood Cells</b> (mean 13.73, SD 10.16)		
<4.5	16	12.03
4.5-11	50	37.59
>11	67	50.37
<b>Neutrophils</b> (mean 0.64, SD 0.18)		
<0.5	30	22.56
0.5-0.70	48	36.09
>0.70	55	41.35
<b>Lymphocytes</b> (mean 0.34, SD 0.19)		
<0.20	35	26.32
0.2-0.5	72	54.14
>0.5	27	20.30
<b>Platelet Count</b> (mean 368.55, SD 238.74)		
<150	21	15.79
150-450	77	57.89
>450	35	26.32

**Table 4B. Other laboratory findings among admitted pediatric patients with COVID-19**

LABORATORY EXAMINATIONS	FREQUENCY (n=variable)	%
<b>CRP (n=37)</b> mean 2.93, SD 2.74		
Normal <6	31	83.78
High >6	6	16.22
<b>Procalcitonin (n=34)</b> mean 15.41, SD 29.38		
Normal <0.25	8	23.53
High $\geq 0.25$	26	76.47
<b>ESR (n=19)</b> mean 33.26, SD 34.59		
Normal 0-15	8	42.11
High >15	11	57.89
<b>Ferritin (n=21)</b> mean 520.20, SD 409.34		
Low <17.9	0	0
Normal 17.9 - 464	10	47.62
High >464	11	52.38
<b>D-dimer (n=27)</b> mean 1623.59 SD 1313.88		
Normal 0-0.5	0	0.00
High >0.5	27	100
<b>LDH (n=9)</b> mean 603.67, SD 454.95		
Low <120	0	0.00
Normal 120-246	0	0.00
High >246	9	100

The findings on chest radiographs are seen in Table 5. Almost half of the patients (45.51%) had no chest radiograph done on them. Forty-one (28.27%) had normal findings on chest radiograph. The most common finding was bilateral lung opacities (17.93%). Unilateral opacities were seen in 1.37%. There were 4 patients with pleural effusion, one of whom had extensive pulmonary tuberculosis (PTB). There were 3 cases of tuberculosis: 1 case of miliary TB with cavitations and pneumothorax, 1 case of miliary TB with pneumothorax and 1 case of extensive PTB with massive pleural effusion on the right. There was 1 case of consolidation and atelectasis. Other radiographic findings included pulmonary congestion, nodular opacities which were interpreted as retrocardiac lymphadenopathies, and cardiomegaly. Chest tomography was not done on any patient.

**Table 5. Chest radiographic findings of admitted pediatric patients with COVID-19, ZCMC**

CHEST RADIOGRAPHIC FINDINGS	FREQUENCY (n=145)	%
Not done	66	45.51
Normal Chest X-ray	41	28.27
<b>Opacities</b>		
Unilateral	2	1.37
Bilateral	26	17.93
Pleural Effusion*	4	2.75
Tuberculosis**	3	2.06
Consolidation with atelectasis	1	0.68
Other findings	3	2.06

\*1 case with PTB

\*\*Miliary TB with cavitations and pneumothorax (1), miliary TB with pneumothorax (1), extensive PTB with massive right pleural effusion (1)

In terms of patient management, majority of patients received antibiotics (68.97%). The most commonly used antibiotics were ceftriaxone (46%), cefuroxime (12%) and ampicillin (11%). Corticosteroid use was seen in 21 (14.48%) patients while intravenous immunoglobulin (IVIg) was given to 5 (3.45%) patients. Remdesivir was given to 7 (4.83%) patients while tocilizumab was given to 8 (5.52%) patients. One patient received both remdesivir and tocilizumab (Table 6). Adjunctive treatment like vitamin D, vitamin C and zinc were used in 4.83%, 4.83% and 5.52%, respectively.

Enoxaparin and convalescent plasma were never used. Table 6 also shows that while 72 out of 145 patients did not require any respiratory support, the others required oxygen therapy via nasal cannula or face mask. Ten (15.86%) patients were intubated and 11 (7.59%) patients needed high flow oxygen support. Continuous positive airway pressure (CPAP) was not used in any patient.

**Table 6. Management of admitted pediatric patients with COVID-19 (n=129), ZCMC**

MANAGEMENT MODALITIES	FREQUENCY (n=145)	%
<b>Treatment / Adjunct</b>		
Antibiotics	100	68.97
Vitamin D	7	4.83
Vitamin C	7	4.83
Zinc	8	5.52
Corticosteroids	21	14.48
IVIg	5	3.45
Remdesivir*	7	4.83
Tocilizumab*	8	5.52
<b>Respiratory support</b>		
None	72	49.66
Low flow oxygen	29	6.90
Oxygen via Face mask	23	20.00
Intubation	10	15.86
High flow oxygen	11	7.59

\*One patient received both Remdesivir and Tocilizumab

**Table 7. Complications in admitted pediatric patients with COVID-19 (n=129), ZCMC**

COMPLICATIONS	FREQUENCY (n=145)	%
<b>With Complications</b>	16	11.03
Shock	6	4.14
Renal injury	4	2.76
Pleural effusion	2	1.38
Myocarditis	1	0.69
Acute respiratory distress syndrome	1	0.69
Seizure	2	1.38
<b>No Complications</b>	129	88.97

The majority of the patients (88.97%) had no complications while 11.03% developed complications which included shock, renal injury, pleural effusion, myocarditis, acute respiratory distress syndrome (ARDS) and seizure (Table 7). There was no documented case of nosocomial infection nor bleeding episodes. There were 124 (85.52%) patients who were sent home improved (Table 8). There were 4 patients who went home against medical advice. Of these, 3 were asymptomatic who just wanted to be off isolation

and 1 patient was in critical condition. The mortality rate was 11.72%.

**Table 8. Outcomes of admitted pediatric patients with COVID-19 (n=145), ZCMC**

OUTCOME	FREQUENCY (n=145)	%
Improved	124	85.52
Expired	17	11.72
Home against medical advice*	4	2.76

\*3-asymptomatic, 1-critical

## DISCUSSION

This was a retrospective cohort study which enrolled pediatric COVID-19 patients admitted at the ZCMC in Zamboanga City, a referral government hospital in the Southwestern part of Mindanao. The patients admitted in this hospital generally include those belonging to the middle- and low-income families. However, during the COVID-19 pandemic, the hospital accepted referrals even from the private hospitals because of the limited isolation facilities in the private setting. In addition, most private hospitals preferred to transfer their COVID-19 patients to a government hospital.

The study revealed male predominance as well as involvement of the younger age group. These findings are similar to the reports from other authors.<sup>8</sup> Most patients denied exposure to patients with COVID-19 infection. During the pandemic, there were asymptomatic infections which could have been the silent sources of exposures within the household.

There was no patient in this study who received COVID-19 vaccine. Data collection covered the period between March 2020 to December 2022. It should be noted that the roll out of the COVID-19 vaccine for adolescents only started in October 2021, and vaccination of children ages 5 to 11 years old commenced only in February 2022.<sup>9-10</sup> Aside from the delayed vaccine roll-out for children in Zamboanga City, vaccine hesitancy among mothers of young children was very evident during the pandemic and even before the pandemic. Vaccine hesitancy is defined as delay in acceptance or refusal of a vaccine despite having access to the vaccination

services. In the study by Moini et al., the most common reason for vaccine hesitancy is fear of vaccination side effects. The rate of COVID-19 vaccine hesitancy was about 50%.<sup>11</sup> Vaccine hesitancy has also been documented in several areas in the Philippines.<sup>12-14</sup>

This study revealed that majority of the pediatric COVID-19 patients were underweight and only a few were overweight or obese. The higher prevalence and severity of COVID-19 among underweight children have been observed in previous studies.<sup>15</sup> Underweight children are at a higher risk of contracting COVID-19 and experiencing severe outcomes due to their compromised immune systems, associated comorbidities, and socioeconomic factors. Families in lower socioeconomic brackets often live in crowded conditions, making physical distancing difficult and increasing the exposure risk to COVID-19. Undernutrition was also linked to increase disease severity.<sup>16</sup>

Almost half of the patients in this study were asymptomatic, and 20% had mild disease with just a few cases of severe to critical disease at presentation. It is a common observation that COVID-19 infection among the pediatric population is generally a mild disease.<sup>17,18</sup> Moreover, during the initial phase of the pandemic, almost all confirmed cases of COVID-19 were advised isolation in a clinical facility regardless of disease severity and there were more asymptomatic cases admitted especially among children. These may have contributed to the predominance of asymptomatic and mild cases in this study. Notably, the incidence of MIS-C during the study period was 3.45%.

Among those with symptoms, the most common presenting manifestation was fever, similar to both local and foreign reports.<sup>8,19-22</sup> Other common manifestations include respiratory and gastrointestinal symptoms. Comorbidities were reported in 26.36% of the cases. The most commonly reported comorbidity was malignancy, primarily leukemia. It should be mentioned that there is a

leukemia ward in the pediatric department of ZCMC. Almost all leukemia patients in this study were asymptomatic with only one patient presenting with moderate disease severity. The patients with leukemia who were asymptomatic came in for scheduled chemotherapy but were exposed to COVID-19 on or during admission. Majority of the pediatric COVID-19 patients included in this study had no comorbidities. This study is limited by the fact that majority of the patients were asymptomatic or had mild disease. Comorbidities are more commonly seen among those with severe disease since the presence of comorbidities increases the risk of severe disease as shown by Widjanarko et al.<sup>23</sup>

Complete Blood Count (CBC) is usually the most commonly requested laboratory examination among hospitalized patients. In this study, a great majority of patients had a CBC result. While half of the patients included in this study had a high leukocyte count, the other half had either low or normal leukocyte counts. The mean leukocyte count and mean neutrophil count in this study are higher than that reported by Hoang et al. in their systematic review.<sup>24</sup> There was quite a number of patients with a high neutrophil count which may suggest a secondary bacterial infection. However, the definition of high neutrophil count was based on a 70% cut off. In terms of platelet counts, studies have shown that thrombocytopenia is commonly seen among patients with COVID-19 infection due to thrombotic platelet consumption, direct viral invasion of bone marrow, autoimmune platelet destruction and cytokine release.<sup>25</sup> In contrast to reports of thrombocytopenia associated with COVID-19 infection, thrombocytopenia was seen in less than 20% of cases in this study. The mean platelet count of 368.55 is higher than previously reported by other authors.<sup>24</sup> This may be due to the high number of asymptomatic and mild cases in this study. Thrombocytopenia in COVID-19 is usually seen in severe to critical cases.<sup>25</sup>

Inflammatory markers, namely erythrocyte sedimentation rate (ESR), procalcitonin, D-dimer,

serum ferritin and LDH, were mostly elevated among those who had these tests performed. These inflammatory markers were observed to be elevated among those with severe disease.<sup>22,24</sup> In this study, these tests were done in only a few patients, almost all of whom had severe to critical illness. These tests were routinely requested among those with severe disease but actual test processing depended on test availability.

Almost half of the patients in this study had no chest radiography and these were the asymptomatic cases. Of those with chest radiograph, majority had normal chest findings similar to the findings of Hoang et al.<sup>24</sup> The most common abnormality seen on chest radiograph was bilateral pulmonary opacities similar to other local reports.<sup>8</sup> There were a few cases of pleural effusion and pulmonary tuberculosis. In contrast to the PGH study<sup>8</sup>, consolidation was not common.

Antibiotics were the most frequently used medication among the patients in this study (68.97%). This was perhaps due to the uncertainty of the physicians in the possible outcome of the disease. This rate of antibiotic use is lower than previously reported by Mustafa et al. in Pakistan<sup>21</sup> (85.5%) but higher than that reported by Pribić et al. in Serbia<sup>27</sup> (47.2%). In the Philippines a study done in Baguio<sup>28</sup> in 2022 showed that antibiotic use among patients with COVID-19 was 57.3% while in the Philippine General Hospital, Pagcatipunan et al.<sup>8</sup> in the same year reported a high rate of 71.7% antibiotic use among hospitalized pediatric COVID-19 patients. Among patients in ZCMC, ceftriaxone, cefuroxime and ampicillin were the most commonly used antibiotic. In contrast, in the Baguio study, azithromycin and ceftriaxone were the most frequently prescribed antibiotic.<sup>28</sup> There is indeed a great variation in the rate and type of antibiotic use in different settings coupled with significant variations in the reasons for such a practice and the type of chosen therapies.<sup>29</sup> Yock-Corrales et al. highlighted the uncertainties and lack of guidelines

for recognizing the presence of bacterial coinfections among pediatric patients with COVID-19.<sup>29</sup>

It is clear however, that there is a great mismatch between the rate of antibiotic use and the incidence of secondary bacterial infection in COVID-19. Lai et al. reported a 14.9% bacterial coinfection rate among pediatric patients with COVID-19 infection.<sup>30</sup> Mustafa et al. reported a 3.7% prevalence of bacterial co-infection and an antibiotic use rate of 85.5%.<sup>26</sup> In a systematic review by Calderon et al., the overall prevalence of bacterial co-infection in COVID-19 infection was 11% while the overall antibiotic use rate was 60%.<sup>31</sup> In the study by Dominguez et al. in Baguio City, antibiotic use was associated with factors such as having bilateral infiltrates on chest X-ray, the severity of COVID-19 infection, and high white blood cell counts.<sup>28</sup>

Adjuncts like vitamin C, vitamin D and zinc were used on a few patients. This practice might have been based on the early guidelines which included these drugs as recommended adjunctive therapy.<sup>32</sup> However, more recent guidelines have already suggested against their use either for prevention or as adjunct in the treatment of COVID-19 in children.<sup>33</sup> Corticosteroids, remdesivir and tocilizumab were rarely used in this study. Again, this may be due to a large number of asymptomatic and mild cases. In addition, the latter two drugs might not have been available for use during the early part of the pandemic. The Philippine Pediatric COVID-19 Living Clinical Practice Guidelines as of March 2022, suggest the use of corticosteroid (dexamethasone) among pediatric COVID-19 patients with severe to critical disease only.<sup>33</sup> The same CPG suggests the addition of tocilizumab to systemic steroids in patients with moderate to severe COVID-19 infection, particularly when there is evidence of systemic inflammation.<sup>33</sup> Moreover, the CPG suggests the use of remdesivir in hospitalized children with severe COVID-19 infection and in non-hospitalized children with COVID-19 infection with at least one risk factor for disease progression. The identified risk factors for disease progression include hypertension, cardiovascular or

cerebrovascular disease, diabetes mellitus, obesity, immune compromise, chronic mild or moderate kidney disease, chronic liver disease, chronic lung disease, current cancer or sickle cell disease.<sup>33</sup>

The rate of complications is low in this study. Mortality rate was 11.72% which is higher compared to the mortality rate recorded in the Philippine General Hospital (8.9%)<sup>8</sup> and the overall in-hospital mortality rate reported by Marwali et al. in 2022.<sup>34</sup> They reported that the mortality rate in low- to middle-income countries (LMIC) was higher compared to those in high-income countries (4% vs 1.7%). This difference was attributed to variations in patient demographics and intervention profile. Access to supportive and therapeutic modalities as well as the comorbidity profile also differs. These aspects could explain the variations in mortality rate in different areas of the country. The mortality rate in this study is alarmingly high and suggests severe outcomes and significant challenges in managing COVID-19 infection in the pediatric population.

This study is greatly limited by the nature of data collection which was a chart review based on the uploaded data from the medical records of ZCMC. There were charts with incomplete information and lacking entries. The evaluated laboratory tests were limited to complete blood counts, chest radiographs and inflammatory markers. In addition, the cases were limited to hospitalized patients. Those seen at the outpatient department were not included. The study was conducted in a government hospital such that the patient profile may be different from those admitted in the private setting. Limited access to laboratory examinations and medications might have also affected the clinical course and outcome of the patients in this study.

## CONCLUSION

Pediatric COVID-19 in Southwestern Mindanao was seen in all age groups with male predominance. Majority of the hospitalized patients were underweight and were asymptomatic or had mild infection with only a few cases of severe to



critical illness. Fever was the most common presenting manifestation followed by respiratory and gastrointestinal symptoms. Antibiotic use was high despite the absence of confirmed bacterial coinfection. The mortality rate was 11.72%.

## RECOMMENDATIONS

The study recommends continuous collection and comparison of clinical data on pediatric COVID-19 cases across different hospitals and healthcare settings in the Philippines. Moreover, it is important to conduct long-term follow-up studies on children who have recovered from COVID-19 to assess potential lasting effects including physical, cognitive, and psychological impact, particularly among those who experienced severe disease or MIS-C.

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## CONFLICT OF INTEREST

None declared.

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