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COVID-19 Pandemic vs. Pre-Pandemic Period: Changes in Hospital Admission Rates, Length of Stay, and In-Hospital Mortality of Common Neurologic Conditions

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Abstract

Background and Objective: COVID-19 pandemic caused massive adjustments to healthcare systems in the country. This study determined the change in hospital admission rates, length of hospital stay and in-hospital mortality of common (non-COVID related) neurologic conditions during the COVID-19 pandemic and pre-pandemic period. **Methods:** The study utilized a retrospective cross-sectional study of patients admitted under the Department of Neurology at Jose R. Reyes Memorial Medical Center from the period of March 2019 to March 2020 (pre-pandemic group), and April 2020 to April 2021 (COVID-19 pandemic). Admission rates, length of stay and in-hospital mortality were calculated for cerebrovascular diseases, CNS infections, CNS neoplasms and Seizure disorders. **Results:** There were 1090 admissions from April 2019 to March 2020 and 393 admissions from April 2020 to March 2021 with an over-all decline of 63%. During the pandemic, the duration of hospital stay was longer for CNS neoplasms. Duration of hospital stay for cerebrovascular disease, CNS infection, and seizure disorders were not significantly different. There was an increase in over-all in hospital mortality from 22.75% to 26.46% with significant increase in the case fatality rate of cerebrovascular diseases. **Conclusion:** We observed a large decline in the over-all admission rate and longer hospital stays. The over-all in-hospital mortality rate also increased during the pandemic period.

Keywords: COVID-19, Admission Rate, Length of Stay, Mortality Rate, Cerebrovascular Diseases, CNS Infection, CNS Neoplasm, Seizure Disorders

1. Introduction

Coronavirus Disease 2019 (COVID-19) is caused by a novel strain of coronavirus (SARS-CoV 2) and first emerged in Wuhan, China in December 2019. Since then, it has affected millions of people worldwide and on

March 11, 2020, the World Health Organization declared the disease outbreak as a pandemic (WHO announces COVID-19 outbreak a pandemic, 2020). COVID-19 has been associated with various clinical manifestations with a wide spectrum of severity. SARS-CoV-2 primarily attacks the lower respiratory system causing viral pneumonia, but it may also affect the heart, gastrointestinal system, liver, kidney, and central nervous system (Zhang, et al., 2020).

The first case of COVID-19 in the Philippines was reported on January 30, 2020 and as of March 7, 2020, there were already reports on local transmission of the disease. Luzon was placed under a state of enhanced community quarantine on March 16, 2020 and travel was restricted for most people except for healthcare workers, security services, and those involved in essential goods and services (COVID-19 in the Philippines, 2021). By the end of January 2021, the total number of confirmed cases in the country reached 525,618 where approximately 40% of these cases came from the National Capital Region (NCR) (COVID-19 pandemic: Latest situation in the Philippines – June 2021, 2021).

The imposition of lockdown and quarantine measures throughout the country not only has economic and political implications but also greatly affected the healthcare delivery systems. This unprecedented situation has led to immense pressure to re-organize and adapt quickly to the growing pandemic. Hospitals constructed isolation rooms, rolled out safety measures for healthcare workers and patients - including but not limited to social distancing and the use of personal protective equipment. However, the risk of health systems being overwhelmed poses a great concern to low and middle income countries with limited capacities.

Predicting hospital bed demand and understanding how long each patient may require hospitalization, may provide evidence for decision-making, contingency planning and allocation of resources. This requires an estimate of the number of patients requiring hospitalization and an estimate of how long each person will require hospital care in order to use and manage the limited resources our health systems have (Rivera-Rodriguez & Urdinola, 2020). Therefore, this study aims to determine if there is a significant change between the rates of admission, length of hospital stay and in-hospital mortality of common neurologic conditions (non-COVID related) requiring immediate care such as CNS infections, cerebrovascular diseases, seizures, and CNS neoplastic diseases.

2. Methods

2.1 Study design and data collection

The study utilized a retrospective cross-sectional study of patients admitted under the Department of Neurology of Jose R. Reyes Memorial Medical Center from the period of March 2019 to March 2020 to represent the pre-COVID pandemic group, and patients admitted from April 2020 to April 2021 to represent the COVID pandemic group. Jose R. Reyes Memorial Medical Center is a DOH-retained tertiary hospital that has been one of the country's brain centers, catering to thousands of patients with neurologic diseases annually.

The subjects were composed of non-COVID patients admitted and diagnosed with CNS infections, cerebrovascular diseases, seizures and CNS neoplasm from the period of April 2019 to March 2020 to represent the pre-pandemic group, and patients admitted from April 2020 to March 2021 to represent the COVID group. The total number of cases included in the study is based on the total number of admissions under the Neurology Department for the covered time period.

2.2 Statistical analyses and outcomes

Descriptive statistics were used to summarize the general and clinical characteristics of the participants. Frequency and proportion were used for categorical variables. Shapiro-Wilk test was used to determine the normality distribution of continuous variables. Continuous quantitative data that met the normality assumption was summarized using mean and standard deviation (SD), while those that do not were described using median and range. Continuous variables were compared using the Mann-Whitney U test. For categorical variables, chi-square test was used to compare the outcomes. All valid data were included in the analysis. Null hypothesis

was rejected at 0.05 α -level of significance. STATA 15.0 (StataCorp SE, College Station, TX, USA) was used for data analysis.

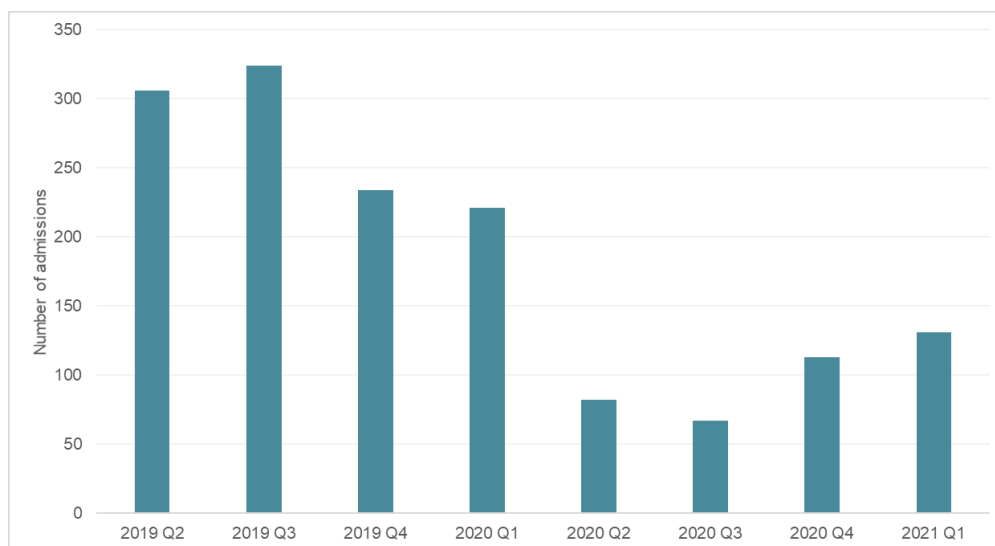
2.3 Ethical Approval

This study was reviewed and approved by the Institutional Review Board at Jose R. Reyes Memorial Medical Center (IRB No. 2021-084).

3. Results

There were 1090 admissions from April 2019 to March 2020 (pre-pandemic period) and 393 admissions from April 2020 to March 2021 (pandemic period) with an over-all decline of 63%. The census of patient admissions was lower during the four quarters of the COVID-19 pandemic period compared to corresponding quarters of the pre-pandemic period. The greatest differences were with the corresponding 2nd and 3rd quarters of the two durations (Figure 1).

A)



b)

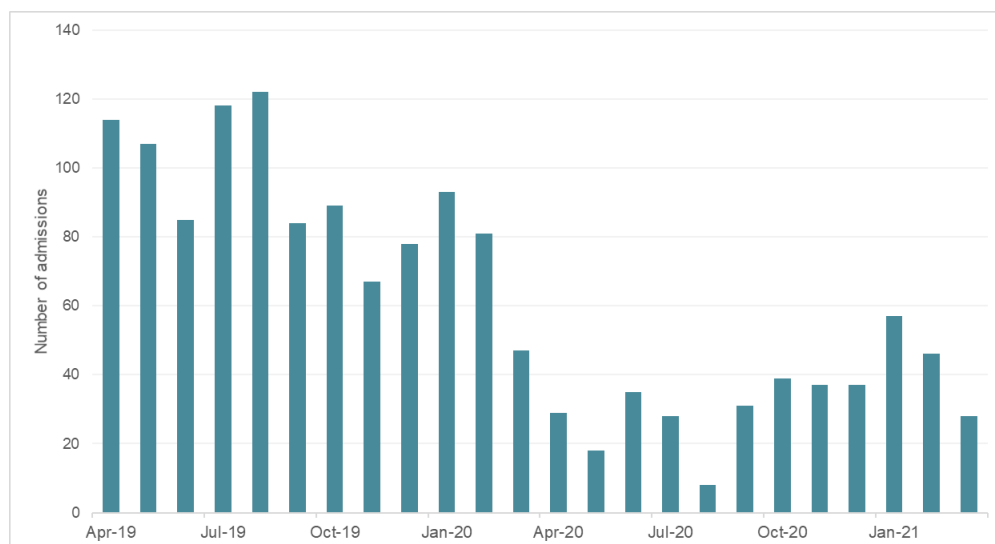


Figure 1: Census of neurology department admissions: a) quarterly; b) monthly.

Patients' characteristics of age (median [range]: 54 [20-97] years vs. 54 [19-91] years), male composition (61% vs. 58%), prevalence of cerebrovascular disease (87% vs. 88%) or CNS infection (4% vs. 5%) as primary

diagnosis, and total length of stay (median [range]: 6 [0-165] days vs. 6 [0-110] days) were not found to significantly differ between the two considered durations (Table 1). On the other hand, there were significantly less CNS neoplasms (3% vs. 6%) and more seizure disorders (5% vs. 3%) diagnosed after the onset of COVID-19 pandemic.

Table 1: Demographic and clinical profile of patients

	All (n=1483)	Pre-COVID-19 (n=1090)	COVID-19 Period (n=393)	P
	Median (Range); Frequency (%)			
Age, years	54 (19-97)	54 (20-97)	54 (19-91)	.243*
Sex				.346†
Male	890 (60.01)	662 (60.73)	228 (58.02)	
Female	593 (39.99)	428 (39.27)	165 (41.98)	
Primary neurologic diagnosis				
Cerebrovascular disease	1297 (87.46)	953 (87.43)	344 (87.53)	.959†
CNS infection	65 (4.38)	46 (4.22)	19 (4.83)	.610†
CNS neoplasm	74 (4.99)	63 (5.78)	11 (2.80)	.020†
Seizure disorder	47 (3.17)	28 (2.57)	19 (4.83)	.028†
Hospital stay, days	6 (0-165)	6 (0-165)	6 (0-110)	.501*

The pre COVID-19 period includes April 2019 to March 2020, while the COVID-19 period covers April 2020 to March 2021.

Statistical tests used: * - Mann-Whitney U test; † - Chi-square test.

Lengths of hospital stay of patients admitted primarily for cerebrovascular disease, CNS infection, or seizure disorder were comparable during the pre-COVID-19 and COVID-19 pandemic times (Figure 2, Table 1.1). Hospital stay among cases with CNS neoplasm appeared to be longer during the pandemic period than prior to it.

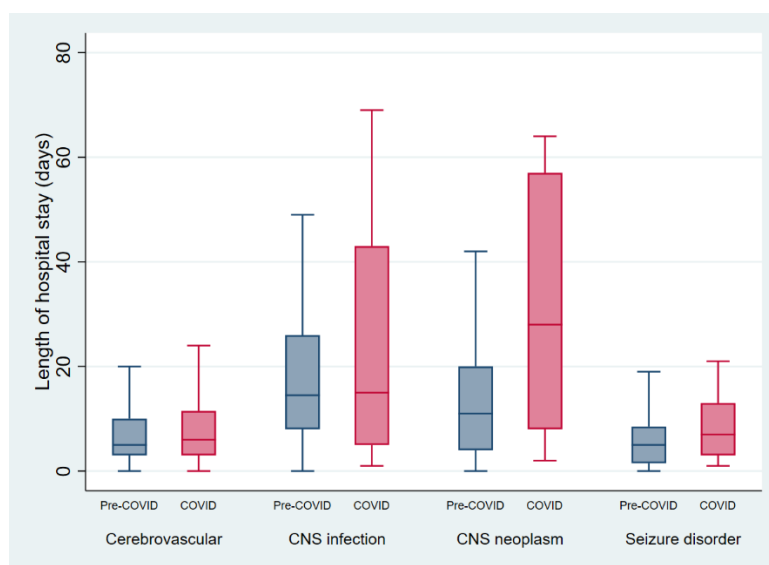


Figure 2: Lengths of hospital stay before and during COVID-19 pandemic, by primary neurologic diagnosis.

The median length of hospital stay per neurologic disease class is in Table 1.1. During the pandemic, the median duration of hospital stay was longer for CNS neoplasms (28 versus 11 days, $p = 0.028$). The duration of hospital stay for cerebrovascular disease, CNS infection, and seizure disorder were not significantly different for the two periods (Table 1.1).

Table 1.1: Length of hospital stay per neurologic disease

	Pre-COVID-19	COVID-19 Period	<i>P</i>
	Median (Range)		
Length of hospital stay, days			
Cerebrovascular disease	5 (0-165)	6 (0-75)	.626
CNS infection	14.5 (0-94)	15 (1-110)	.863
CNS neoplasm	11 (0-92)	28 (2-64)	.028
Seizure disorder	5 (0-20)	7 (1-21)	.333

Statistical test used: Mann-Whitney U test

In-patient mortality rate was higher among neurologic admissions after onset of COVID-19 pandemic (26.46%) than before it (22.75%), although this was not significantly different between the two groups (Table 2). This increase in mortality was driven by the rise in case fatality rate for cerebrovascular diseases (from 20.88% to 27.62%), even though death rates for CNS infections (from 39.13% to 31.58%), CNS neoplasms (42.86% to 18.18%), and seizure disorders (from 14.29% to 5.26%) were lower during the COVID-19 pandemic than at pre-pandemic. The case fatality rate for cerebrovascular disease was markedly higher during the pandemic, at 27.62% (95% CI 22.96 to 32.67%, $p = 0.013$).

Table 2: Case fatality rate, by primary neurologic disease

	All	Pre-COVID-19	COVID-19 Period	<i>P</i>
	Frequency; Case fatality in % [95% CI]			
Total (n=1483)	352; 23.74 [21.59–25.99]	248; 22.75 [20.29–25.36]	104; 26.46 [22.17–31.12]	.147
Cerebrovascular disease (n=1297)	294; 22.67 [20.41–25.05]	199; 20.88 [18.34–23.60]	95; 27.62 [22.96–32.67]	.013
CNS infection (n=65)	24; 36.92 [25.28–49.80]	18; 39.13 [25.09–54.63]	6; 31.58 [12.58–56.55]	.778
CNS neoplasm (n=74)	29; 39.19 [28.04–51.23]	27; 42.86 [30.46–55.95]	2; 18.18 [2.28–51.78]	.183
Seizure disorder (n=47)	5; 10.64 [3.55–23.10]	4; 14.29 [4.03–32.67]	1; 5.26 [0.13–26.03]	.635

4. Discussion

The pandemic has caused a serious strain on the healthcare system not only in the Philippines but also worldwide. Since the detection of the first case of COVID-19 in the Philippines, the healthcare system adjusted its resources to cater to both COVID-19 patients and other diseases. However, this resulted to postponement of elective procedures, out-patient department closure, shift from face-to-face out-patient clinic to teleconsultation and reducing the over-all bed capacity to follow the imposed health protocols.

A large decline in admissions was noted during pandemic period and one reason could be the reduced bed capacity. As hospitals dedicate certain wards as isolation wards and to ensure adequate spacing between beds, the number of beds was markedly reduced. This was similar to other medical conditions and hospitals as reported in other countries. In one study done in Qatar, there was a decline of 5% to 75% drop in their over-all admissions, together with a drop in the number of elective and non-elective cases. Also, about 9%–58% decline was observed in admissions for acute appendicitis, acute coronary syndrome, stroke, bone fractures, cancer, and live births (Baum & Schwartz, 2020). In the United States, a significant decline of 42% in over-all admissions were noted in the Department of Veterans affairs hospitals (Butt et al., 2020).

Other possible reasons could be the imposition of lockdowns and limited transportation options, and fear of going to hospitals due to fear of contracting the virus.

The decrease in the number of over-all admissions were accompanied by longer hospital stay duration. Possible reason could be the imposition of lockdowns on certain wards or extension of quarantine period when exposed to COVID-19 patients. A significant decrease in the number of CNS neoplasm admissions was seen, but the length of hospital stay was markedly increased for admitted patients during the pandemic period compared to pre-pandemic period. This is primarily because of the postponement of elective surgeries in the hospital during the pandemic period, and limiting the use of operating rooms for emergency cases. However, despite longer hospital stay for CNS neoplasms, the over-all case fatality rate for the disease remained non-significant both pre-pandemic and during the pandemic period.

Over-all in-hospital mortality rate for all 4 neurologic conditions increased significantly from 22.75% to 26.46% during the pandemic period. This was brought about by the higher case fatality rate of cerebrovascular illnesses, however, reasons for the higher case fatality rate were not explored and one of the limitations of the scope of this study.

These findings must be taken into consideration for future pandemic planning and response but no causal relationship must be inferred from these results. Follow-up studies must be performed in order to see and infer causality and to explore other factors that might have contributed to the findings discussed.

5. Conclusion

In summary, as the pandemic unfolded, we observed a decline in the number of over-all admissions in the hospital and longer hospital stays. The over-all in-hospital mortality rate also increased during the pandemic period with significant increase in the case fatality of cerebrovascular diseases.

Acknowledgment

None to declare

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