Technical Brief Special Series
PRESCRIPTIONS
COVID-19 Study Group
EpiMetrics
11 May 2021. Vol 2. Issue 3.

Increasing the Sensitivity of the COVID19 Hospital Surge Capacity Indicators

Key Message

The current COVID-19 hospital utilization indicators have been insensitive to the stress and strain on hospital capacity as COVID-19 cases surged, emergency departments (ED) filled up, and healthcare workers experienced burnout. Indicators that measure **human resources for health (HRH) and emergency department (ED) occupancy** should be developed and integrated into the current community quarantine decision framework.

Recommendations

- Collect the following HRH indicators:
  - Doctor-to-patient ratio for the Emergency Department
  - Nurse-to-patient ratio for the Emergency Department
  - Doctor-to-patient ratio for the Intensive Care Unit
  - Nurse-to-patient ratio for the Intensive Care Unit
- There is an urgent need to **measure the capacity and utilization of the hospital emergency departments (EDs)**. Percent ED occupancy should be measured.
- The development and addition of these indicators should **include thresholds that can be used for interpretation and decision-making**.

Introduction

Since the beginning of 2021, the Philippine economy has continued to open up, personal mitigation compliance has lagged, new variants have emerged, and testing-tracing-isolation efficiency has remained low. This confluence of events most likely caused the current surge which started in mid-February 2021. Although the government declared a series of lockdowns of varying intensity in the greater Metro Manila area in an attempt to curb the surge of COVID-19 cases, hospital admissions continued to rise. However, days before the lockdown, several hospitals had already declared full occupancy within their respective Emergency Departments. This was later followed by full occupancies of their dedicated COVID-19 wards and Intensive Care Units (ICU). Despite these declarations, the Department of Health (DOH) hospital tracker continued to report utilization rates below critical thresholds later. It was only days later that this tracker eventually reported that hospitals were indeed reaching full capacities. This suggests the current indicator set is insufficiently sensitive to detecting early signals of hospital strain. Therefore, there is an urgent need not only to improve the hospital utilization data collection and reporting system but also to develop and include surge indicators that provide earlier signals.

Rationale

As of this writing (March 2021), the DOH COVID-19 tracker publicly reports hospital capacity and utilization according to ICU Beds, Mechanical Ventilators, Ward Beds, and Isolation Beds. Currently, no indicator measures utilization at the ED level; staffing capacity is also not measured. In most if not all institutions, emergency departments serve as the screening areas and entry points for COVID-19 suspects and all other non-COVID patients seeking acute and emergency care. ED

occupancy is an early predictor of eventual hospital occupancy. In addition, no indicator has been collected to determine staffing capacity or Human Resources for Health (HRH). Without the appropriate staffing, additional beds or ventilators cannot be monitored and patients cannot be managed adequately. Free beds without the appropriate staff cannot be utilized.

Methods

A rapid review and key informant interviews were done to determine candidate indicators. Consultations were also conducted with hospitalists and the DOH to understand the current data collection and reporting system and to determine the feasibility and appropriateness of the candidate hospital capacity indicators.

Results & Discussion

The following indicators were identified as key to measuring hospital capacity in the context of COVID19.

Table 1. Indicators measuring ED capacity and HRH

Indicator Name	Definition	Numerator	Denominator	Possible Reporting Aggregate
Hospital indicators				
% Emergency Department Occupancy	The percentage of beds in the ED that is occupied	Total number of patients (regardless if suspect or confirmed COVID19) occupying the ED.	Total number of ED beds	% of hospitals with ED occupancy of greater than 90%
HRH Indicators				
ED Doctor to Patient Ratio *ex. 1 doctor to 60 patients seen per 24 hours (AAME ratio) alternatively 1 doctor to 10 patients (IFEM)***	The ratio of doctors to patients at the end of 24 hours*	Total number of Doctors who reported for duty in the ED at the end of the day	Total number of Patients in the ED at the end of the day	% of hospitals with critical levels of ED doctor staffing (i.e., Doctor-Patient ratio exceeding recommended thresholds of 0.016 to 0.10 or greater**)
ED Nurse to Patient Ratio *ex. 1 nurse to 3 patients per 8 hour shift **or** 1 nurse to 9 patients per 24 hours***	The ratio of nurses to patients at the end of 24 hours*	Total number of nurses who reported for duty in the ED at the end of the day	Total number of Patients in the ED at the end of the day	% of hospitals with critical levels of ED nurse staffing (i.e., Nurse-Patient ratio exceeding recommended thresholds of 0.11 or greater**)
ICU Doctor to Patient Ratio *ex. 1 doctor to 8 patients per 12 hour shift **or** 1 doctor to 16 per 24 hours **	The ratio of doctor to patients in the ICU at the end of24 hours*	Total number of doctors who reported for duty in the ICU at the end of the day	Total number of patients in the ICU at the end of the day	% of hospitals with critical levels of ICU doctor staffing (i.e Doctor-Patient ratio exceeding recommended thresholds of 0.06 or greater**)

ICU Nurse to Patient Ratio *ex. 1 nurse to 1 patient per 8 hour shift **or** 1 nurse to 3 patients per 24 hours*[**]	The ratio of nurses to patient in the ICU at the end of 24 hours[*]	Total number of nurses who reported for duty in the ED at the end of the day	Total number of Patients in the ICU at the end of the day	% of hospitals with critical levels of ICU nurse staffing (i.e., Nurse- Patient ratio exceeding recommended thresholds of 0.33 or greater) [**]

**end of the day cutt off need to be determined and set and agreed upon by hospitals and policy makers. Ex. 4pm cut off periods may be defined depending on acceptable policy.*

***ratios and thresholds should be determined and agreed upon by hospitals and policy makers. These ratios are set based on duty shifts. For ED HRH ratios AAME and IFEM recommended values have been provided for reference in deliberations.*

Discussion

A. Human Resources for Health (HRH) as Part of Hospital Capacity

HRH are an integral component of any healthcare system. In relation to COVID-19, measuring bed occupancy is an insufficient measure of hospital capacity. Despite the availability of beds or mechanical ventilators, if staff is unavailable, these beds cannot be properly utilized. As such, measuring staffing is critical in determining healthcare capacity for COVID-19 patients. When hospitals experience staff shortages, burnout is a potential consequence. As such, HRH should be measured and addressed accordingly.

There are different approaches to measuring hospital HRH[1]; however the simplest measure would be staff-to-patient ratios. Given varying patient acuity and different health quality standards, staffing tends to be a dynamic measure; this is specially so in the emergency department. In the United States, some institutions recommend that a ratio of 1 nurse to 2 patients be provided for non-COVID-19 ICU patients while a 1.25 patient-to-nurse ratio is to be provided for COVID-19 ICU patients.[2][3] For physicians, a ratio 1 doctor for every 8-11 COVID-19 patients per patient may be a standard.[4] For the emergency department, the American Academy of Emergency Medicine recommends an average 1 nurse for every 3 patients in the middle of the COVID-19 pandemic.[5] Because of the dynamic nature of ED consultations, staffing for doctors are measured in terms of a doctor to patient seen per hour. The American Academy of Emergency Medicine (AAEM) recommends that ED doctors see an average of 2.5 patients per hour.[6] This is roughly 1 ED doctor seeing a total of 60 patients every 24 hours. Correspondence with the International Federation for Emergency Medicine (IFEM) has revealed that in recent practice, Taiwan follows a 1 doctor per 10 patient every 24 hours. These ratios are not necessarily in the context of a COVID19 pandemic.

[1] Kalisch, B. J., Friese, C. R., Choi, S. H., & Rochman, M. (2011). Hospital nurse staffing: choice of measure matters. *Medical care*, *49*(8), 775–779. https://doi.org/10.1097/MLR.0b013e318222a6df

[2] Teriakidis, Adrianna.(2021)COVID-19 Impact on Nurse Staffing and ICU Beds.https://ehrn.org/articles/covid-19-impact-on-nurse-staffing-and-icu-beds.

[3] (2016) https://www.wolterskluwer.com/en/expert-insights/the-importance-of-the-optimal-nursetopatient-ratio

[4] Bhatla, A., & Ryskina, K. L. (2020). Hospital and ICU patient volume per physician at peak of COVID pandemic: State-level estimates. *Healthcare (Amsterdam, Netherlands)*, *8*(4), 100489. https://doi.org/10.1016/j.hjdsi.2020.100489

[5] Eales, Tommy.(2019)Unsafe Nursing Ratios Incapacitate EDs, Endangers Patients .http://www.emra.org/emresident/article/nursing-ratios/

[6] (2001)American Academy of Emergency Medicine.Position Statement on Emergency Physician-to-Patient ED Staffing Ratios. https://www.aaem.org/resources/statements/position/emergency-physician-to-patient-ed-staffing-ratios.

B. Measuring Emergency Department Capacity and Utilization

In the context of the COVID-19 pandemic, the ED is a common entry point for most patients. As such, properly measuring its utilization will be an early indicator and predictor of overall hospital utilization and occupancy. EDs are very dynamic when it comes to patient mobilization. Staffing, too, is quite fluid and is very dependent on patient acuity. However, despite this, measuring ED occupancy at a given point in time may provide a picture of eventual hospital capacity as more patients entering the ED are likely to be admitted, filling up COVID-19 hospital beds. Measuring ED occupancy may also detect overcrowding. When cross-referenced with other occupancy indicators, it may provide decision makers a clearer picture of how patients behave and approach the pandemic. For example, if the ED is deemed to be fully occupied while the hospital wards and ICUs are still available, it may indicate that patients are unnecessarily proceeding to the Emergency Department.

Recommendations

1. There is an urgent need to improve the healthcare system's current hospital capacity indicators, especially as COVID-19 cases increase and healthcare workers experience burnout. **It is recommended that data for the following HRH indicators be collected**:
    a. Doctor-to-patient ratio for the ED
    b. Nurse-to-patient ratio for the ED
    c. Doctor-to-patient ratio for the ICU
    d. Nurse-to-patient ratio for the ICU

    These indicators, once collected, should be aggregated to determine if the hospital system is at critical condition in terms of HRH. This aggregated data will allow decision makers to determine how many hospitals are struggling with their current HRH in relation to the COVID-19 pandemic.

2. There is also an urgent need to **measure the capacity and utilization of the hospital Emergency Departments**. It is recommended that ED bed occupancy be measured and interpreted similarly to other bed occupancies for COVID-19. Measuring percent occupancy ED beds should be considered.

3. The development and addition of these indicators **should include thresholds that can be used for interpretation and decision-making**. As the Philippines has its own set of baseline figures for HRH, these should be used to determine acceptable thresholds and validated as soon as possible. Data sources for these new indicators should be deliberated and agreed upon by relevant stakeholders not only in government but also in the private sector as well.

Conclusion

There are different indicators to measure healthcare utilization in the context of COVID19. The inclusion of ED indicators such as % occupancy and HRH indicators utilizing doctor/nurse patient ratios are necessary and straightforward in increasing the sensitivity of COVID19 hospital surge capacity indicators.

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Acknowledgments

We would like to acknowledge the following individuals who have supported us in the creation of this technical brief:

- Leopoldo Vega, MD, FPCS, FPATACSI, MBA-H, Undersecretary, Department of Health, One Hospital Comand
- Leovie Fernandez, DOH One Hospital Command
- Jonnaus Bautista, DOH One Hospital Command

Design & Layout Carlo Emmanuel Yao MD, MBA