COVID-19: A CLINICAL PROCESS IMPACT ANALYSIS

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GLOBAL SITUATION

The Coronavirus disease (COVID-19) is a viral infection that causes severe acute respiratory syndrome. The World Health Organization (WHO) declared the COVID-19 outbreak a "pandemic" on March 11, 2020, at which point in time the rate of deaths per number of diagnosed cases had a global mean of 4.4 percent (as of March 23, 2020).

CLINICAL PROBLEM

COVID-19 is posing an unprecedented challenge to global healthcare systems and clinical processes. The impact to emergency rooms and intensive care units is directly correlated to an exponential growth rate of COVID-19 patients, compounded by routine inpatient medical and trauma cases. Admitted COVID-19 patients having severe respiratory distress require an average of two weeks on ventilator support. Such lengthy patient stays are stressing hospital bed capacity and critical resources, and will cause eventual bullwhip effects due to continued variability and regional shifts in demand.

DISCUSSION

An understanding of supply chain and process fundamentals is needed to identify the bottlenecks and drivers of variability caused by COVID-19 to manage the overwhelming demand on healthcare systems and depletion of clinical resources.

Drivers

- COVID-19 exponential growth rate
- Regional "Hot Spots"
- Forward looking uncertainty
- Hospital resource capacity (ER/OR/ICU/Labs)
- Disrupted global supply chain and logistics
- No cleared vaccine or antiviral treatment plan

Stressed Supply Chain Resources

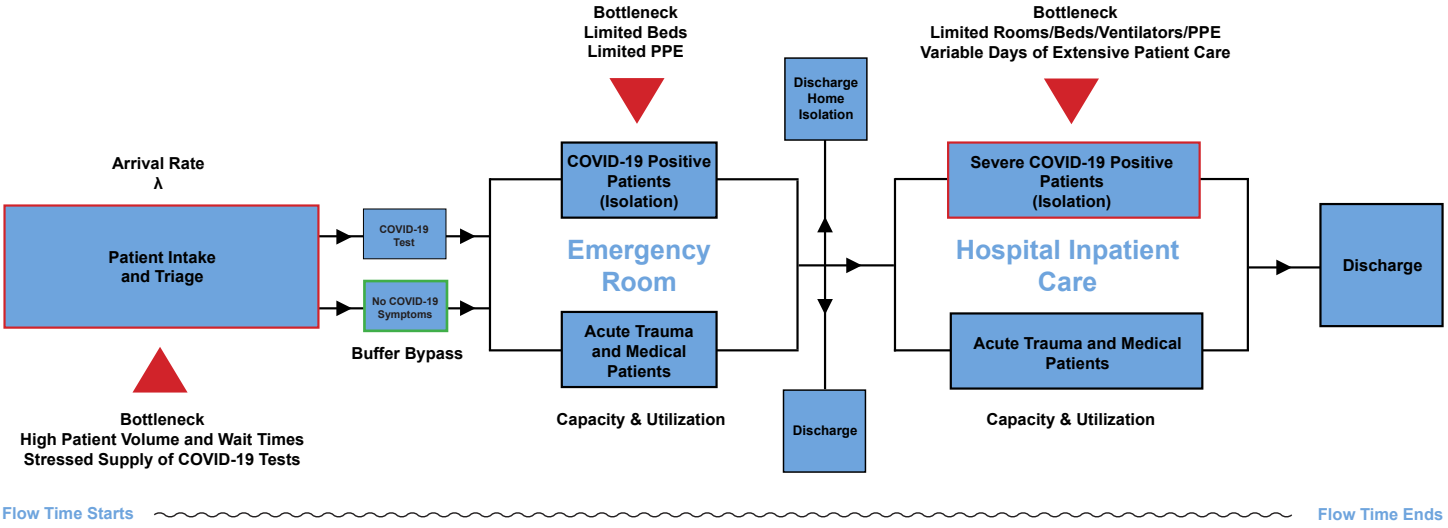
- Physicians and clinical staff
- Personal Protective Equipment (PPE)
- COVID-19 tests
- Hospital rooms/beds/ventilators

Hospital Process Objectives

- Maximize clinician utilization
- Maximize facility/equipment utilization
- Minimize patient waiting time and exposure
- Reduce inefficiencies and waste of resource

Methodology

- Improve efficiencies by identifying bottlenecks and under/over utilization in the clinical process
- Application of Little's Law to adjust for new demand



Little's Law

In a clinical scope, Little's Law states that the average number of patients in a stable system (L) is equal to the average effective arrival (patient) rate (λ), multiplied by the average time a patient spends in the system (W).

Utilization

Utilization indicates how efficiently a clinical resource is being applied within a system process. It is calculated as a percentage by dividing flow rate by capacity x 100.

Flow Rate/Time

Flow rate is the average number of units (patients) going through a clinical process per unit time. Flow time is the amount of time a unit spends in a process beginning to end.

Capacity

Capacity is the maximum amount of clinical resource output for a station within a healthcare process. This is calculated by dividing the number of station resources by processing time.

Bottlenecks

A bottleneck is a point of flow congestion that occurs at the station having the highest utilization, and is usually the stage with the highest processing time, within a clinical process. Overall process capacity is equivalent to the capacity at the bottleneck.

Buffers

A buffer allows each clinical process to operate without being constrained by a previous process.