

## Mathematical Modeling, Analysis and Simulation of COVID Transmission Epidemy Under Intensive Care Units Control Strategy Using Qualitative Causal Diagrams

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### Abstract:

The pandemic situation caused by COVID-19 has been one of the greatest problems faced by the world population in recent years. The use of mathematical models and computer simulation techniques have become very important in the study of the spread of infectious diseases. In this paper, a qualitative model of a proportional-integral-derivative (PID) control system for intensive care unit (ICU) beds occupancy in a COVID-19 epidemic situation was performed to prevent ICUs from saturation. A SIR-type (Susceptible/Infected/Recovered) qualitative model based on the causal influence diagrams is used to describe the dynamics of the pandemic adjusted to the behavior in space and time of COVID-19. The proposed control system used the demanded quantity of ICU beds as feedback signal to generate a decision policy as control action and simulation results show the practical feasibility and good performance of the proposed control system to prevent from collapse of ICUs based on social distancing and confinement.

### Keywords:

Causal Diagrams, Epidemic Control, Intensive Care Units, Qualitative Modelling.