The Supply Side of Covid-19 Patient Management in Hospitals

A tool for hospital managers faced with scaling up their ICU capacity to handle Covid-19 cases.

Early in the war against the coronavirus, public health authorities introduced rafts of measures to reduce the number of infections. With most epidemiological models suggesting a dire picture if the pandemic was not controlled, the public was instructed to adopt social-distancing measures, including staying home, in a bid to "flatten the curve". In the absence of a vaccine or a cure, we all had – and must continue – to do our part to mitigate the influx of sick people needing hospital care.

While the fight focuses on reducing the *demand* for healthcare, on the ground, multiple dilemmas remain in terms of *supply*. In Italy, doctors had to figure out how to best allocate **respirators that were in insufficient number**. In many other locales, hospital managers are continually assessing how to handle the sustained increase in intensive care unit (ICU) demand for Covid-19 patients, all the while maintaining acceptable service levels to other ICU patients.

Indeed, the ability of healthcare systems to confront the Covid-19 outbreak is a question of effective matching of the supply of resources with the demand of care, including that for ICUs. Postponing every non-urgent care demand can convert existing capacity, as might the creative use of discharge from ICU patients to other **flexible resources** when deemed appropriate.

Working with the intensive care unit, infectious disease, and medical informatics group of the Amsterdam UMC (location AMC), the Dutch medical school, we have developed a tool to model the number of Covid-19 and non-Covid-19 patients that can be served for a given ICU capacity. Meant as a complement to the demand-side epidemiological models, our simulation tool may guide hospital managers as they make expansion decisions during the pandemic.

A simulation tool for hospital bed planning

For the last four years, the **INSEAD Healthcare Management Initiative** has been involved with a research consortium for sepsis diagnosis and treatment, the **European Sepsis Academy**. When the coronavirus crisis started, we were able to carry one of the subprojects' **work** over to a practical and simple tool to support hospital managers make decisions about the number of beds to allocate for Covid-19 and non-Covid-19 patients, in the presence of ongoing random arrivals of urgent, unplanned ICU patients.

We applied this model with data for the Amsterdam UMC (location AMC). Then we created an online tool, available via Github, which can be adapted with data for other hospital ICUs. Users just need to fill in values for a few parameters for Covid and non-Covid patients:

- Arrival rate to the ICU
- Length of stay distribution
- Number of ICU beds currently allocated to Covid-19 and non-Covid-19 patients

After clicking the 'Simulate' button, users can then observe the simulation results (which may take a minute to appear).

Users can then obtain the number of Covid-19 patients per day who can be handled in ICU, given the input parameters. One can thereby deduce the rate of patients that must be referred elsewhere by subtracting the demand from the amount of patients who can be treated.

Quick start instructions, the full user manual and the source code for the tool are available on our dedicated **Github page**.

Leadership and adaptation

Rapidly reconfiguring a critical section of a hospital to adapt to the coronavirus situation requires agility, analysis and leadership, which are exactly the skills taught at INSEAD. An example of agility, the tool we have devised represents an iteration of the joint work on sepsis diagnosis and treatment by INSEAD and University Medical Center Amsterdam (location AMC). In addition, it builds on the work we did to improve innovation and efficiency in intensive care units – itself an important extension of an MBA Independent Study Project (subsequently **published**) that one of our simulation tool co-authors, Dr Alexander Vlaar (INSEAD MBA J12), did with Professor Chick.

Dr Vlaar, an intensivist at the Academic Medical Center, Amsterdam, said, "Hospitals need to prepare themselves for the Covid-19 outbreak. Our research paper shows you need to plan well in advance, not only because you need to shut down your elective programme to create admission capacity, but more importantly you need to train the personnel who will switch to an ICU environment. The latter takes the most time but results in the largest increase in admission capacity."

Details of our model have been described in an **article published in *Intensive Care Medicine***, one of the leading journals in the area of critical care. Our co-authors at the University of Amsterdam are Dave A. Dongelmans; Alexander Vlaar; Danielle Sent; Alexander F. van der Sluijs and W. Joost Wiersinga.

***Stephen Chick** is a Professor of Technology and Operations Management and the Academic Director of the **Healthcare Management Initiative** at INSEAD. He directs the **Middle East Health Leadership Programme**, a partner programme in INSEAD's*

Executive Education.

***Andres Alban** is a PhD Student in Technology and Operations Management at INSEAD.*

*Don't miss our latest content. Download the free **INSEAD Knowledge app** today.*

*Follow INSEAD Knowledge on **Twitter** and **Facebook**.*

Find article at
https://knowledge.insead.edu/operations/the-supply-side-of-covid-19-patient-management-in-hospitals-14346

Download the Knowledge app for free