COVID-19 and Hospital Capacity Planning

Michael Becker & Hugo Bowne-Anderson

DataCamp
Flattening the curve

Without measures to slow the spread of infection

Capacity of health care system

With measures to slow the spread of infection

Days after initial outbreak

SOURCE: CDC
Why it is so important to act early on COVID-19

- Badly treated patients (high mortality)
- Well treated patients (low mortality)
- Cases without action
- Cases with delay
- Treatment capacity without action
- Treatment capacity with delay

Medical research (and organizational learning) expands treatment capacity

Medical staff gets ill in large numbers
$15.1B total economic impact

Improving our region’s economic health

$208.6M total annual tax revenue

ECONOMIC IMPACT by State and City:

$13.7B total impact in Pennsylvania
70,790 jobs supported in Pennsylvania

$9.3B impact in Philadelphia
40,490 jobs supported in Philadelphia

$1.4B impact in New Jersey
9,200 jobs supported in New Jersey
Overview

- Forecast the number and rate of COVID-19 cases and resulting hospitalizations, ICU stays, and ventilated patients

- Use best estimates of current conditions, spread rates, intensity, and market size of Penn Medicine within the region

- Customize standard CDC approach to epidemic dynamics to local context and connect predictions to project potential system-level impacts

- Explore scenarios from best to worst case to guide planning efforts
Current COVID-19 Conditions - March 20, 2020

- Doubling time: 6 days (1)
- Social Distancing factor: 23% to 30% (6)
- Hospitalization: 5% (1)
- ICU Care: 1.5% (1)(6)
- Recovery time: 14 days (1)
- Hospitalization: 8 days (6)
- ICU LOS: 16 days (6 vented days + 10 ICU days) (6)

(1) AHA Webinar, Feb 26, James Lawler, MD, an associate professor University of Nebraska Medical Center, What Healthcare Leaders Need To Know: Preparing for the COVID-19,
(3) Internal Estimate based on evidence, Dr. George Anesi
(4) PA Dept of Health, NJ Dept of Health, Philadelphia, Delaware, Montgomery, Bucks, Lancaster, Chester, Mercer (NJ)
(5) PCCM Sit rep, LGH Reported by K. Dubesky
(6) http://predictivehealthcare.pennmedicine.org/2020/03/14/compare-chime.html
## Region 1 Scenarios

**Low spread:** Social Contact reduction by 40%

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**High spread:** Social Contact reduction by 30%

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### Admitted Patients (Census)

Projected census of COVID-19 patients, accounting for arrivals and discharges at Penn hospitals.

Hospitalized Census peaks at 655 on day Jun 23
ICU Census peaks at 384 on day Jun 27

Hospitalized Census peaks at 910 on day Jun 05
ICU Census peaks at 524 on day Jun 09
SIR models

Susceptible $S$ \(\xrightarrow{\beta IS}\) Infectious $I$ \(\xrightarrow{\gamma I}\) Recovered $R$
COVID-19 Hospital Impact Model for Epidemics

This tool was developed by the Predictive Healthcare team at Penn Medicine. For questions and comments please see our contact page. If you see any error messages please reload the page.

- [ ] Show more info about this tool

Number of days to project

30

60

200

New Admissions

Projected number of daily COVID-19 admissions at Penn hospitals
Thank you!

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