

Transition Matrix Model: A Powerful Forecast Tool

Chen Jian, Ph.D., UMD

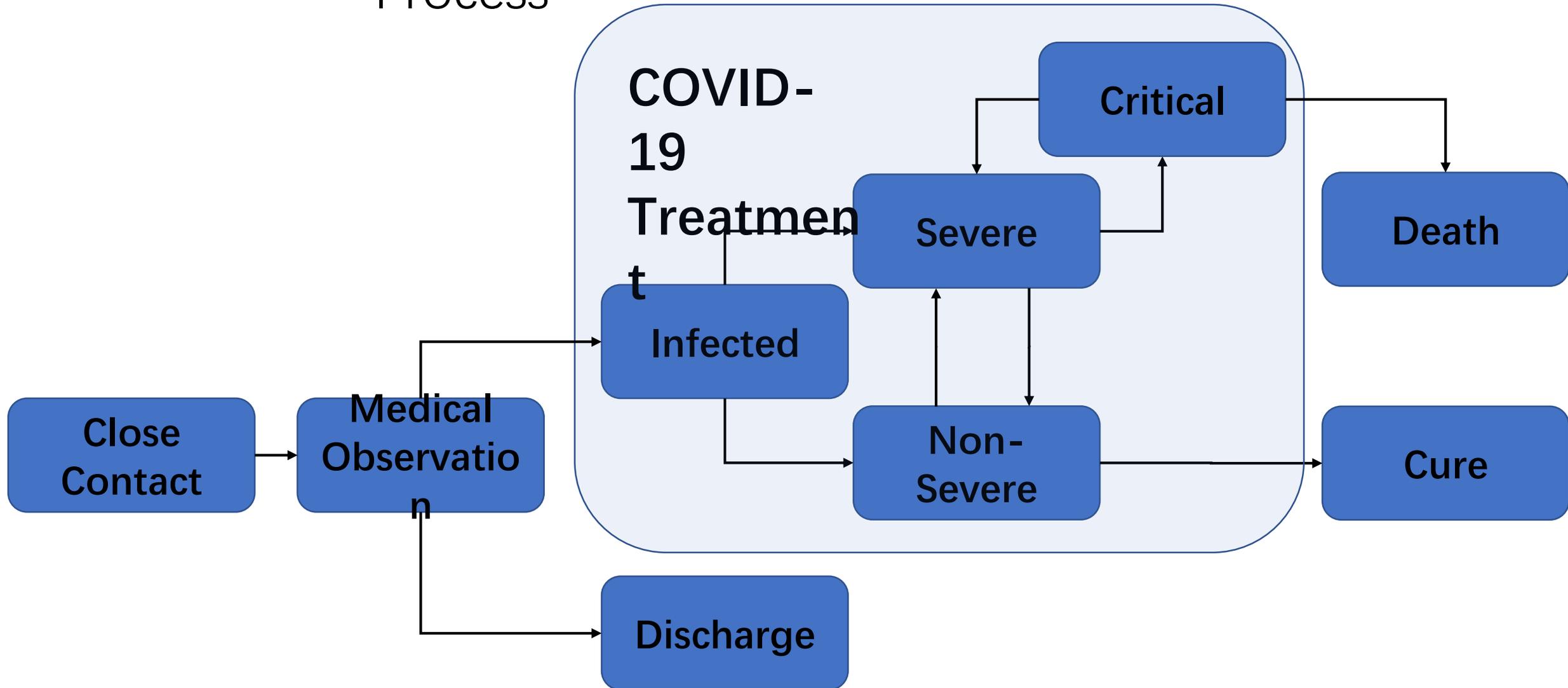
Brookings Webinar:
Fighting COVID-19: Experiences and lessons from the frontlines in Asia

April 3, 2020

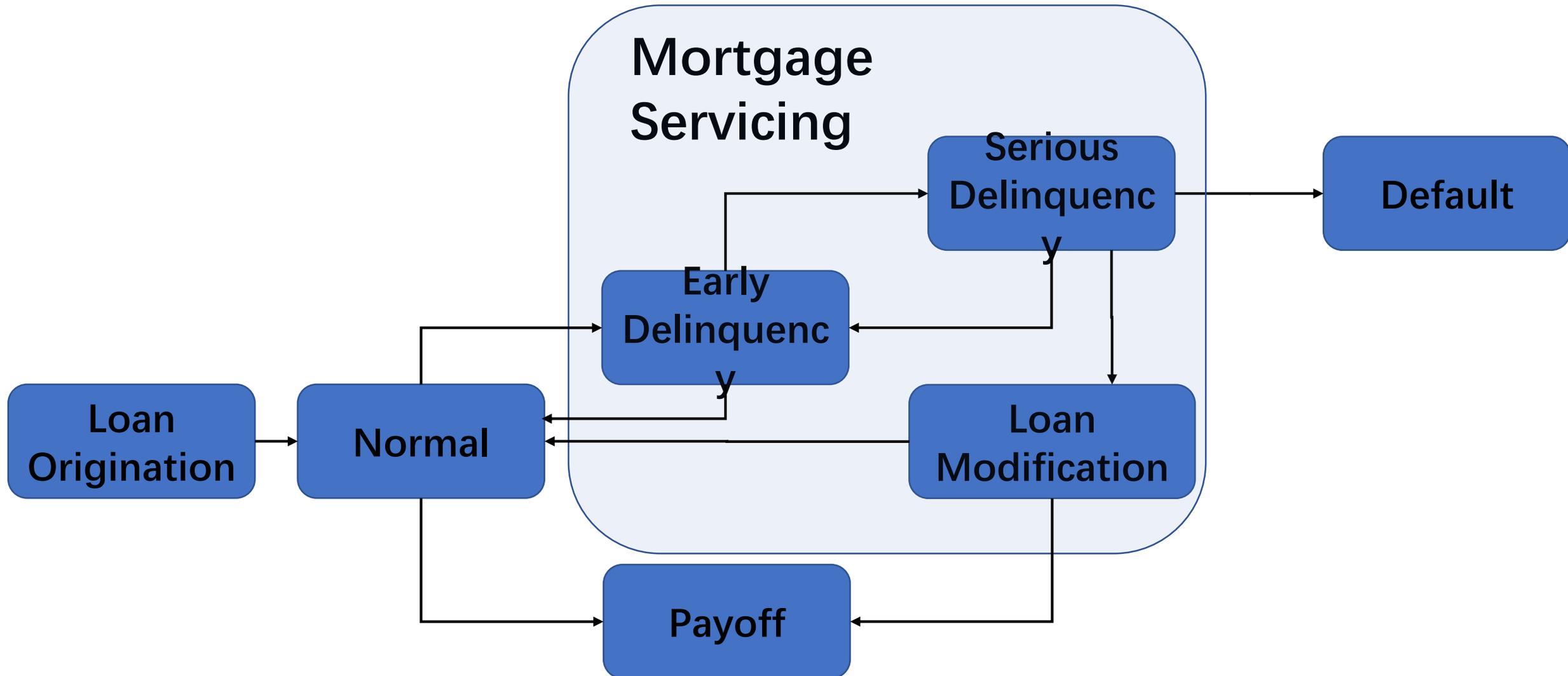
Importance of a Good Forecast Tool

- Experience with Financial Modeling: 20+ Years
- Experience with COVID-19 Forecast: 60 Days
- What is forecast? – To provide certainty in the world of uncertainty.
- With good quality forecast, we can do better planning:
 - Medical Personnel: Doctors, Nurses, Cleaning Staff, etc.
 - Medical Supply: ICU beds, Ventilators, N95 Masks, etc.
 - Biohazardous Waste Disposal Capacity
 - Government Policy/Business Practice
 - In the darkest moment, people want to know where is the end of the tunnel.
- Why can a financial model be applied to COVID-19 forecast?

State Transition Matrix of COVID-19 Treatment Process



State Transition Matrix of a Mortgage Loan



Hubei Model Performed Very Well

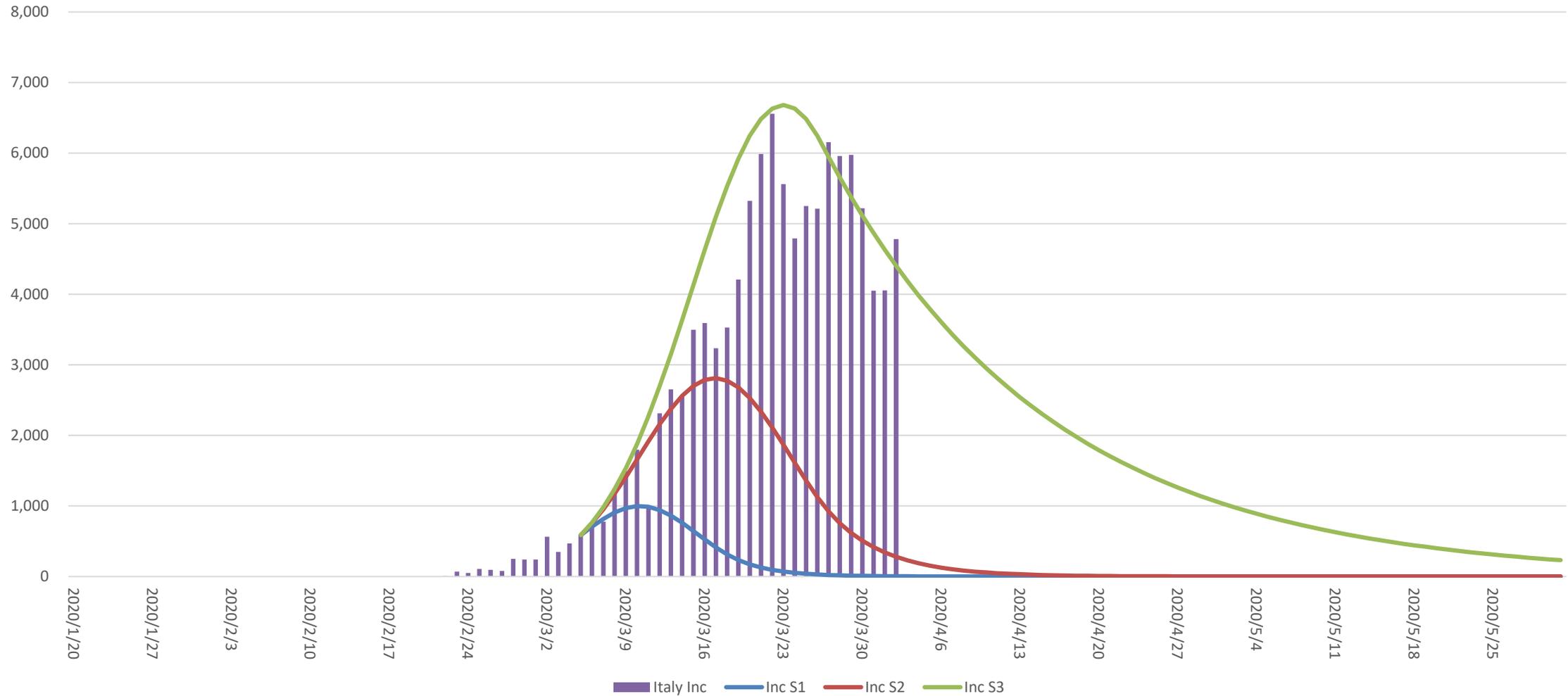
- Key performance metrics, such as peak value of critical cases, active cases, month end total cases are very close to model forecast under “cautiously optimistic” scenario, which was picked by us as the most likely scenario.

	Actual	Forecast					
Key Performance Metrics		S1: Optimistic		S2: Cautiously Optimistic		S3: Relatively Pessimistic	
NCC Decay Rate	-9.0%	-10%	-10%	-5%	-5%	-1%	-1%
MO Release Rate	16.0%	17.0%	10.50%	17.0%	10.50%	17.0%	10.50%
Peak of Active Cases	50,633	39,612	47,148	44,082	55,150	62,041	85,502
Peak Date	2020/2/16	2020/2/23	2020/2/28	2020/3/1	2020/3/7	2020/4/6	2020/4/14
Peak of Severe Cases	9,289	5,753	6,845	6,400	8,004	9,000	12,402
Peak Date	2020/2/16	2020/2/23	2020/2/28	2020/3/1	2020/3/7	2020/4/6	2020/4/14
Peak of Critical Cases	2,492	1,786	2,124	1,986	2,484	2,793	3,849
Peak Case	2020/2/21	2020/2/23	2020/2/28	2020/3/1	2020/3/7	2020/4/6	2020/4/14
Total Cases at Feb. End	66,907	54,189	64,064	60,192	71,596	68,045	81,284

Data Source: National Health Commission of China, Caixin Data , as of 2/29/2020. Forecast date: 2/9/2020.

Italy Forecast Model

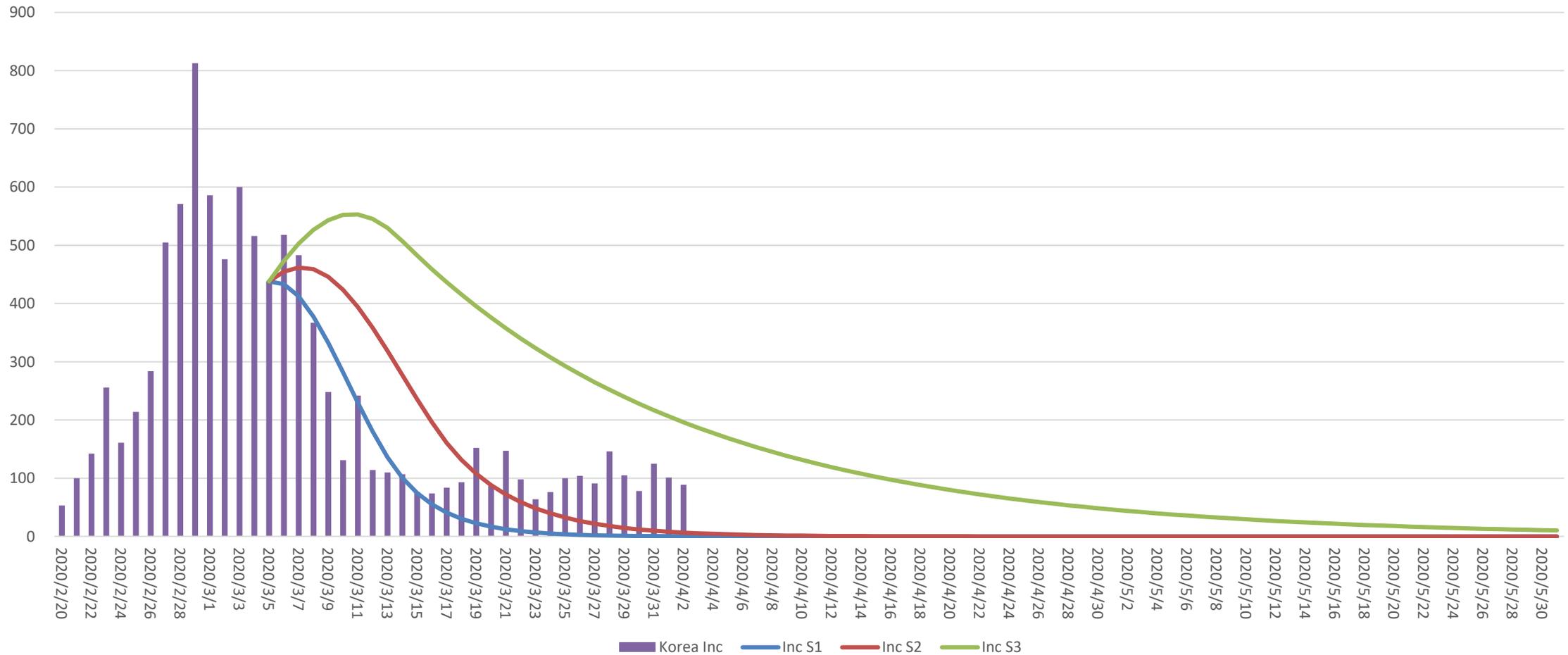
Italy: Increment of Confirmed Infection Cases



Data Source: WHO, Caixin Data, as of 4/2/2020. Forecast date: 3/9/2020.

Korea Forecast Model

Korea: Increment of Confirmed Infection Cases



Data Source: WHO, Caixin Data, as of 4/2/2020. Forecast date: 3/9/2020.

- State differences:
 - Different stage at the curve
 - Different testing policy
 - Different “Stay-at-Home” directive

State restrictions during the coronavirus outbreak

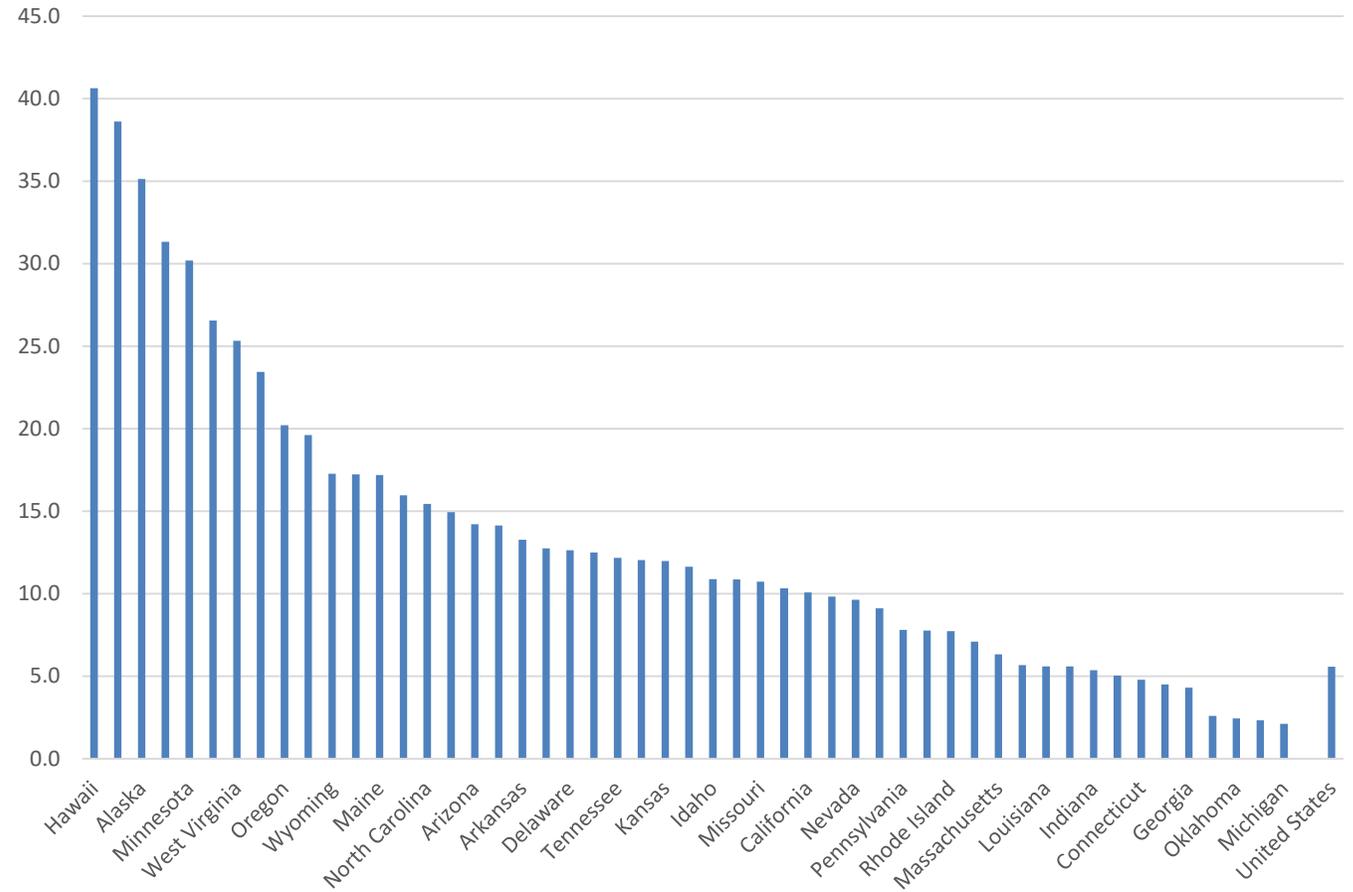


SOURCE: CNBC research. Info as of 3/26/20.

Data Source: CNBC, as of 3/26/2020

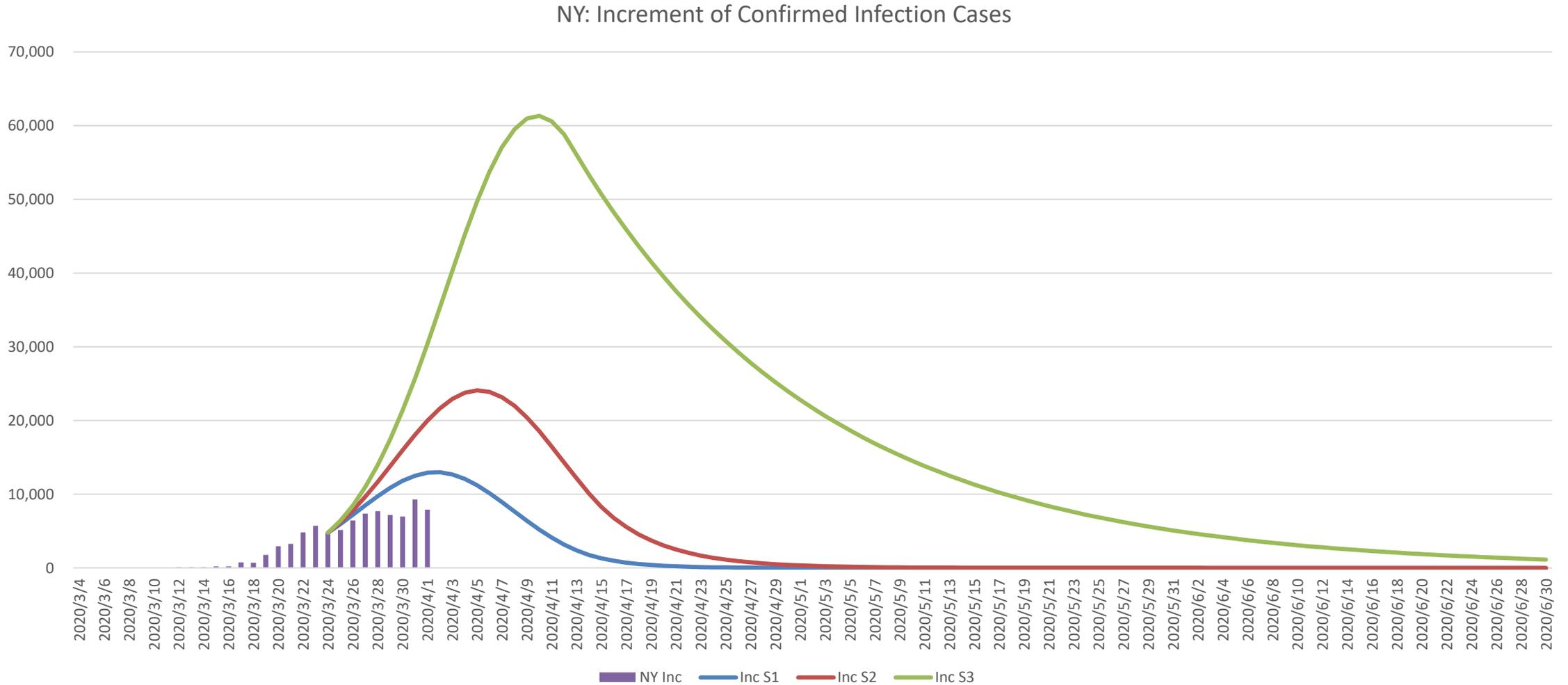


Test:Positive Ratio



Data Source: covidtracking.com, as of 4/2/2020

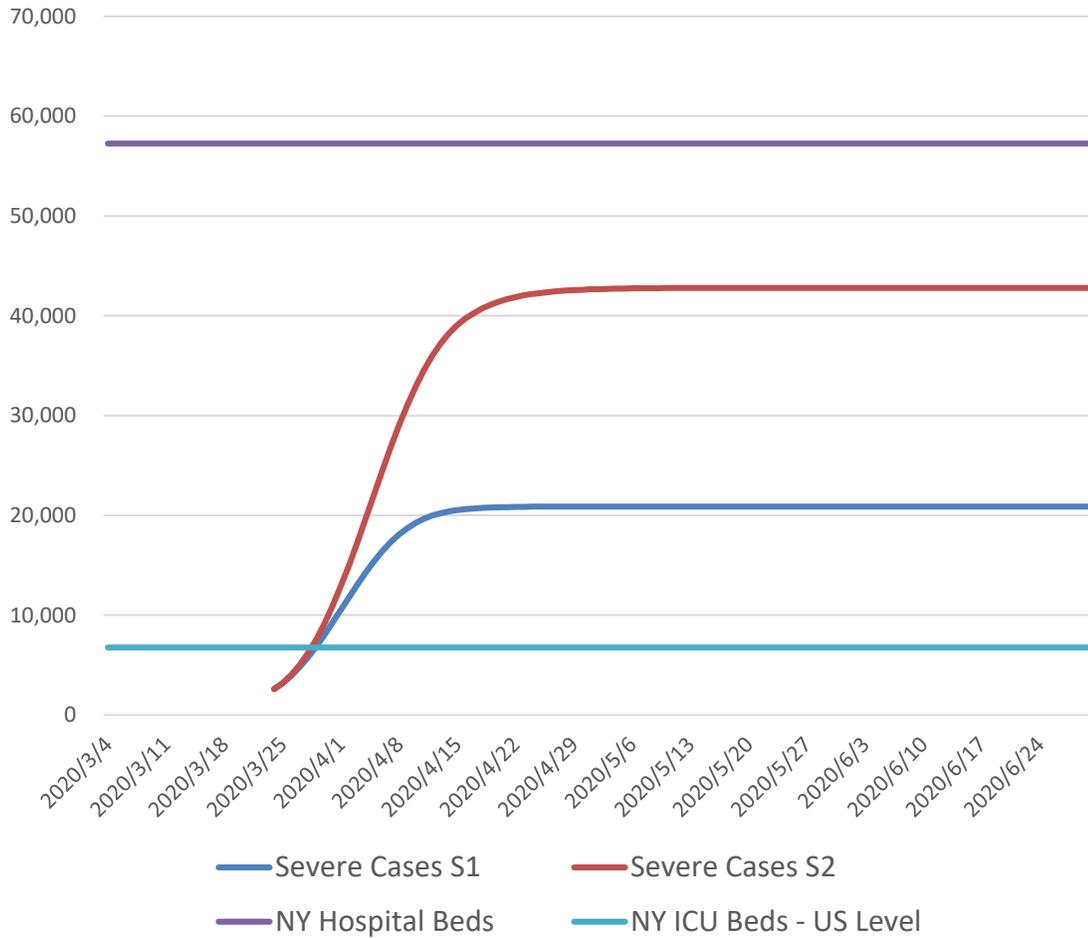
New York Forecast



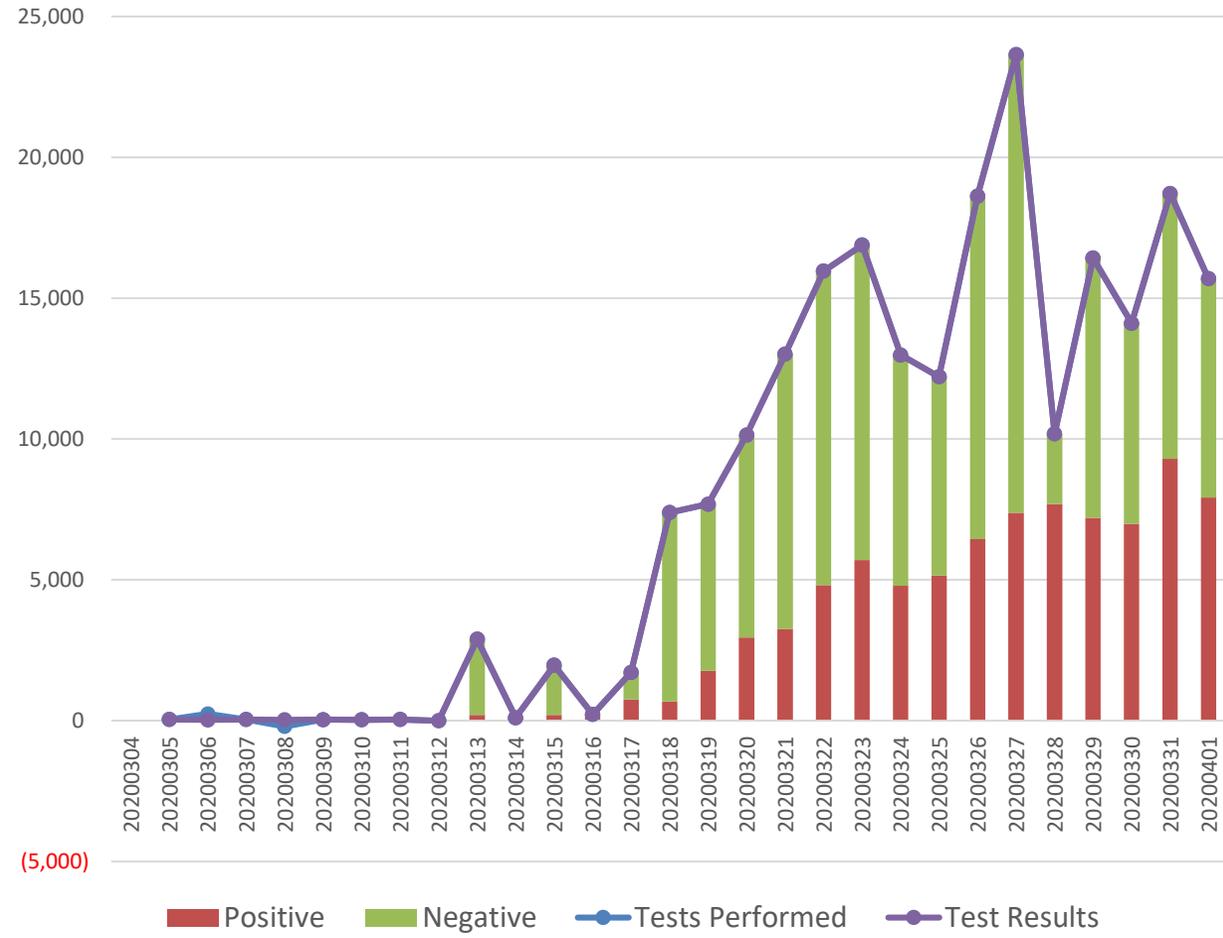
Data Source: covidtracking.com, as of 4/2/2020. Forecast date: 3/28/2020.

NY: Hospital Bed & Test Capacity

NY: Severe Cases (10.0% Ratio) vs. Hospital and ICU Beds

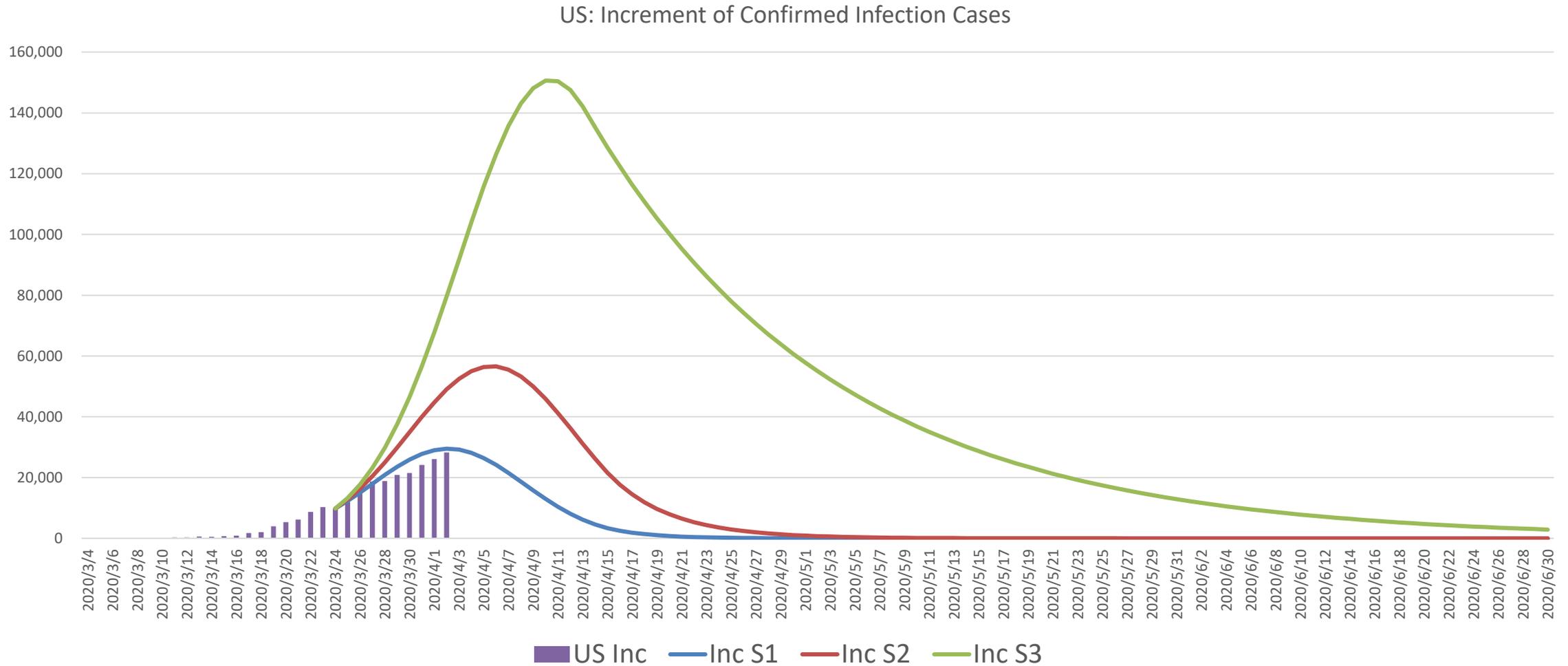


US-NY: Daily Test Statistics



Data Source: AHD.com, covidtracking.com, as of 4/2/2020. Forecast date: 3/28/2020.

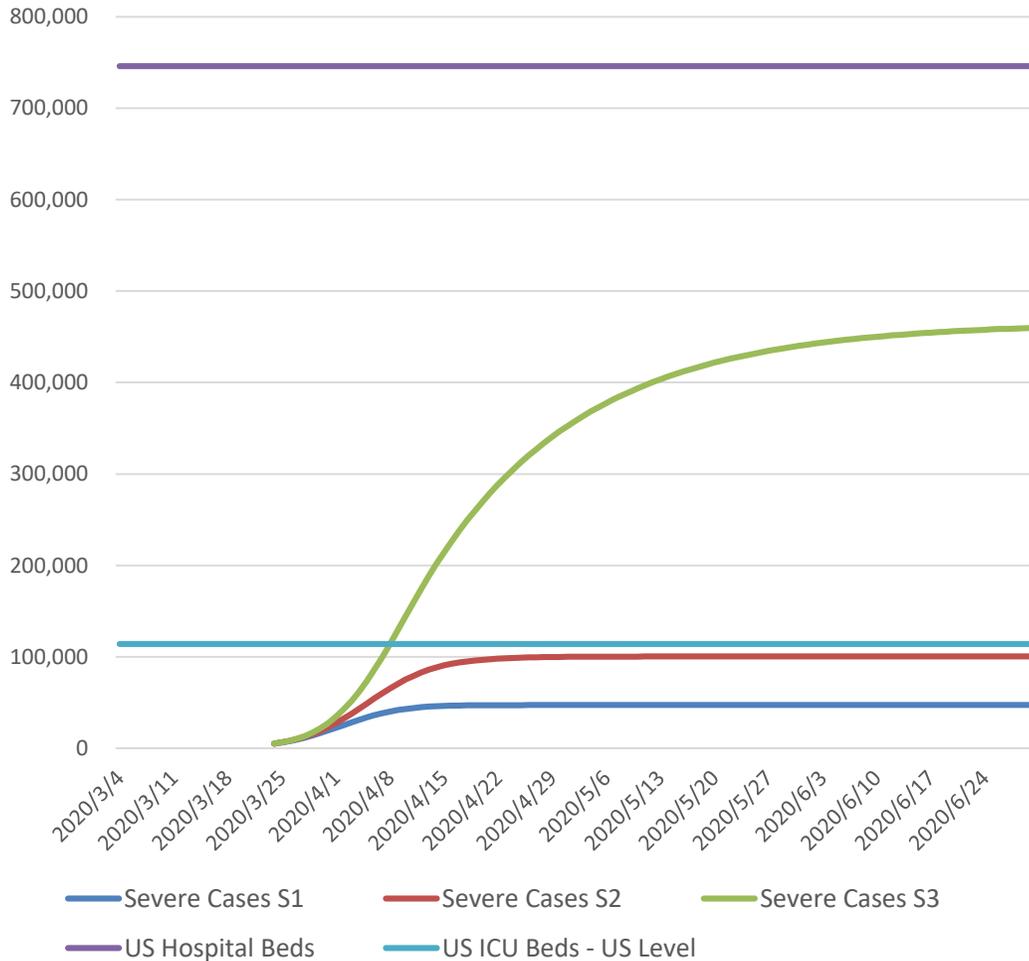
US Forecast



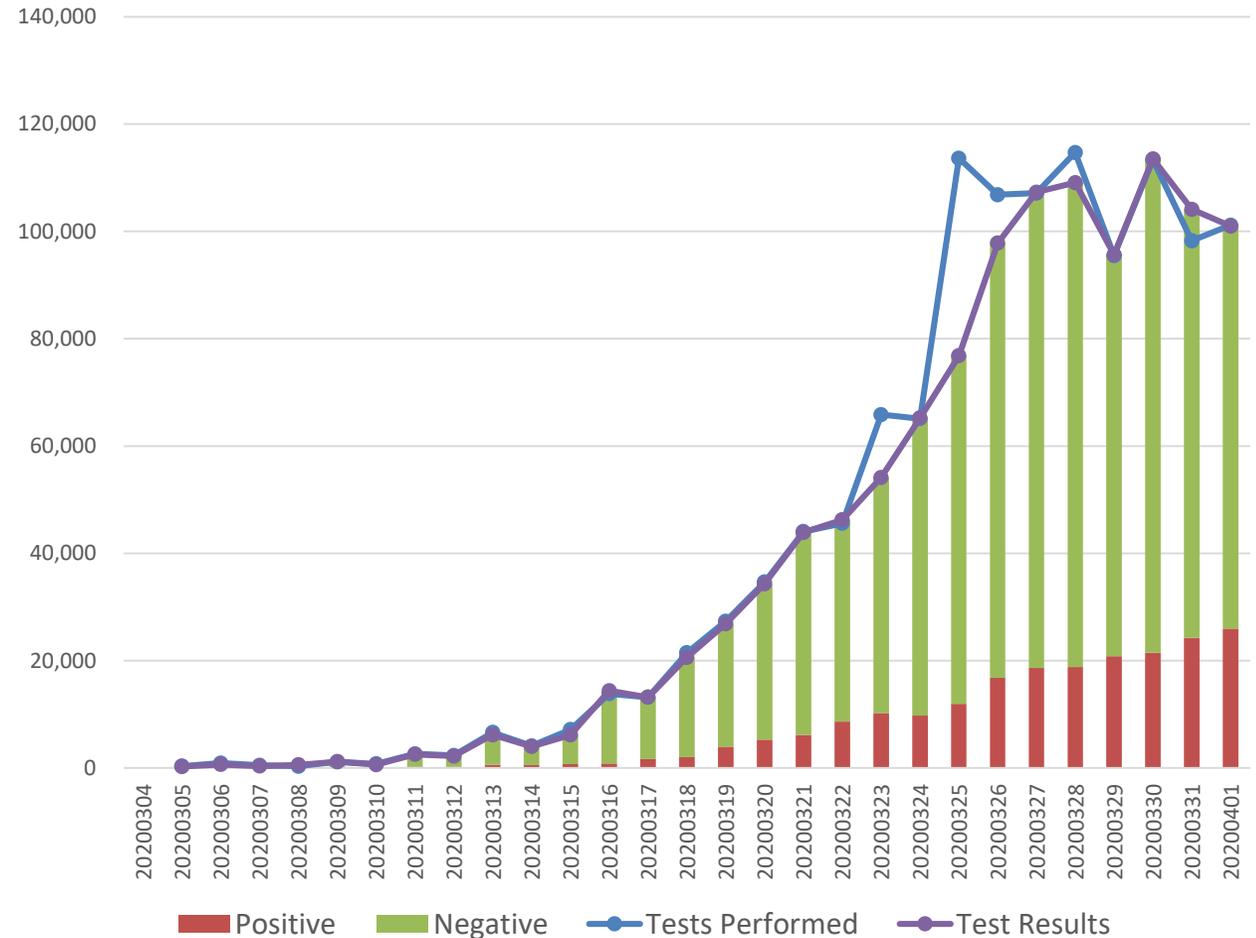
Data Source: covidtracking.com, as of 4/2/2020. Forecast date: 3/28/2020.

US: Hospital Bed & Test Capacity

US: Severe Cases (10.0% Ratio) vs. Hospital and ICU Beds



US: Daily Test Statistics



Data Source: AHD.com, covidtracking.com, as of 4/2/2020. Forecast date: 3/28/2020.

No Man Is An Island ———John Donne

No man is an island,
Entire of itself,
Every man is a piece of the continent,
A part of the main.
If a clod be washed away by the sea,
Europe is the less.
As well as if a promontory were.
As well as if a manor of thy friend's
Or of thine own were:
Any man's death diminishes me,
Because I am involved in mankind,
And therefore never send to know for whom the bell tolls;
It tolls for thee.