IEM's AI Modeling: Short-term COVID-19 Projections

Date: 8/19/20

Leveraging over 15 years of support to HHS for medical consequence modeling and our proprietary artificial intelligence (AI) models, IEM believes that our Coronavirus model outputs can be used to assist localities and their medical facilities to better prepare for an increase in hospitalizations, to better plan for and locate drive-through testing facilities, and to determine where increased levels of transmission may be occurring.

We have been refining our AI model over the past month and are confident in its ability to provide accurate 7-day projections that can be used for operational and logistical planning.

AI-based Model Background

IEM is currently using an AI model to fit data from various sources and project new cases of COVID-19. We do not assume the average number of secondary infections (R-value) stays the same over time. IEM's AI model finds the best R-value over time to evaluate how it changes over the course of the outbreak. The IEM modeling team is running ~11 million simulations to fit each state's data and using the best fit for the R-value to project new cases over the next 7 days. The AI models are executed on a daily basis to evaluate the changing dynamics of the COVID-19 pandemic. Our projections have typically been within 20%, and are often within 10%, of actual confirmed cases.

The projections shown in this document are based on data pulled in as of 8/19/20 1 p.m.

Please provide any feedback or send any questions that you might have to us. We are continually updating and improving the model, so your feedback is critical.

Also, if you have more current or refined data for your State, Commonwealth or Territory that you would like IEM to factor in, please let us know.

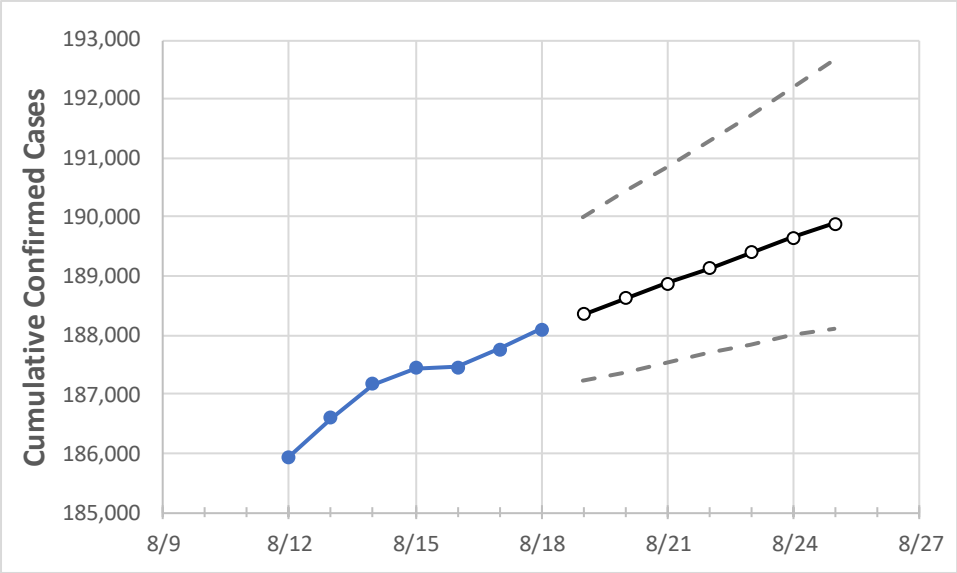
IEM's Modeling Lead

Dr. Prasith "Sid" Baccam is a **Computational Epidemiologist expert** at IEM with more than **20 years of experience in medical consequence modeling and simulation of disease outbreaks** and medical consequences following hypothetical attacks with biological agents or emerging infectious diseases. He develops key simulation models and decision support tools at IEM, specializing in public health, disaster response, and medical countermeasures (MCM) to enhance data-driven decision making and improve modeling assumptions.

Upon receiving his **Ph.D. in Applied Mathematics and Immunobiology** at Iowa State University, Dr. Baccam worked as a Postdoctoral Research Associate at Los Alamos National Laboratory where he focused on researching viral and immunological modeling. After his stint at Los Alamos, Dr. Baccam has served as Task Lead in multiple public health projects have allowed him to develop expertise as a mathematical biologist and a leader on high-performance modeling and simulation teams.

He has worked with state and local public health officials as well as Federal agencies, including **HHS**, the Centers for Disease Control and Prevention (**CDC**), and the Department of Homeland Security (**DHS**). Dr. Baccam has published numerous papers on public health response models and implications on policy and has been invited to participate in workshops and symposiums held by the Institute of Medicine (now the National Academy of Health). His modeling results have been briefed to the **Executive Office of the President** and informed two presidential policy actions.

New Jersey State Projections



	Actual Confirmed Cases On:				Projected Cases For:						
	8/15	8/16	8/17	8/18	8/19	8/20	8/21	8/22	8/23	8/24	8/25
New Jersey	187,442	187,455	187,767	188,098	188,361	188,622	188,880	189,137	189,392	189,645	189,897

Note: The State's projection shows a "best estimate" curve (the solid line with circles) and the dotted lines are the upper and lower estimates around that best estimate. Our projections have typically been within 20%, and are often within 10%, of actual confirmed cases.

New Jersey Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	8/15	8/16	8/17	8/18	8/19	8/20	8/21	8/22	8/23	8/24	8/25
Bergen	21,120	21,195	21,277	21,303	21,358	21,414	21,472	21,532	21,594	21,658	21,724
Burlington	6,128	6,145	6,159	6,175	6,194	6,213	6,231	6,250	6,269	6,288	6,306
Camden	8,774	8,793	8,820	8,845	8,874	8,903	8,933	8,962	8,992	9,022	9,052
Essex	19,911	19,927	19,938	20,001	20,027	20,053	20,080	20,107	20,135	20,163	20,191
Gloucester	3,400	3,413	3,445	3,458	3,481	3,504	3,528	3,553	3,578	3,604	3,630
Hudson	19,866	19,892	19,911	19,936	19,966	19,998	20,030	20,064	20,099	20,135	20,173
Hunterdon	1,158	1,161	1,163	1,165	1,166	1,168	1,169	1,170	1,171	1,173	1,174
Mercer	8,182	8,190	8,199	8,211	8,219	8,227	8,235	8,243	8,251	8,259	8,267
Middlesex	18,070	18,099	18,119	18,133	18,155	18,178	18,200	18,223	18,245	18,268	18,291
Monmouth	10,459	10,474	10,496	10,509	10,529	10,548	10,567	10,586	10,605	10,624	10,642
Morris	7,332	7,341	7,350	7,358	7,369	7,380	7,391	7,402	7,413	7,425	7,436
Ocean	10,740	10,752	10,763	10,805	10,822	10,839	10,857	10,874	10,891	10,907	10,924
Passaic	17,915	17,950	17,963	18,002	18,039	18,076	18,116	18,156	18,199	18,243	18,288
Somerset	5,300	5,307	5,317	5,323	5,331	5,339	5,348	5,356	5,365	5,373	5,382
Sussex	1,349	1,351	1,353	1,355	1,357	1,359	1,362	1,364	1,366	1,368	1,370
Union	16,847	16,869	16,879	16,898	16,927	16,953	16,978	17,004	17,030	17,054	17,082
Warren	1,362	1,365	1,368	1,370	1,372	1,374	1,376	1,379	1,381	1,383	1,386

Some recipients of our daily COVID-19 short-term (7 day) projections have requested projections of demand for: hospital bed, intensive care unit (ICU) beds, and mechanical ventilation. We realize that different states and localities will have different characteristics for hospital demand of COVID-19 cases, and we are presenting the best assumptions we could find for those medical demands based on scientific literature and health data reporting. Specifically:

- *Beds: For hospitalization, we use a range of 10% and 20% of cases require hospitalization based on CDC's report (MMWR, March 18, 2020) and state reports of COVID-19 cases.*
- *ICU: The CDC report found that 24% of hospitalized cases require ICU care.*
- *Ventilators: Based on clinical data from China and state reports, we assume that 50% of ICU cases require a ventilator.*

If you have other estimates for these assumptions, please share them with us as we work to refine our modeling, assumptions, and data on a daily basis.

*The medical demands shown in the table assume 20% of **cumulative** confirmed cases require hospitalization. To get the medical demand for the assumption that 10% of confirmed cases require hospitalization, simply divide the demand by 2.*

New Jersey Medical Demands by County

	Actual Confirmed Cases On:				Projected Cases (Hospitalized) [ICU] {Ventilator} For:		
	8/15	8/16	8/17	8/18	8/20	8/22	8/24
Bergen	21,120	21,195	21,277	21,303	21,414 (4,283) [1,028] {514}	21,532 (4,306) [1,034] {517}	21,658 (4,332) [1,040] {520}
Burlington	6,128	6,145	6,159	6,175	6,213 (1,243) [298] {149}	6,250 (1,250) [300] {150}	6,288 (1,258) [302] {151}
Camden	8,774	8,793	8,820	8,845	8,903 (1,781) [427] {214}	8,962 (1,792) [430] {215}	9,022 (1,804) [433] {217}
Essex	19,911	19,927	19,938	20,001	20,053 (4,011) [963] {481}	20,107 (4,021) [965] {483}	20,163 (4,033) [968] {484}
Gloucester	3,400	3,413	3,445	3,458	3,504 (701) [168] {84}	3,553 (711) [171] {85}	3,604 (721) [173] {86}
Hudson	19,866	19,892	19,911	19,936	19,998 (4,000) [960] {480}	20,064 (4,013) [963] {482}	20,135 (4,027) [967] {483}
Hunterdon	1,158	1,161	1,163	1,165	1,168 (234) [56] {28}	1,170 (234) [56] {28}	1,173 (235) [56] {28}
Mercer	8,182	8,190	8,199	8,211	8,227 (1,645) [395] {197}	8,243 (1,649) [396] {198}	8,259 (1,652) [396] {198}
Middlesex	18,070	18,099	18,119	18,133	18,178 (3,636) [873] {436}	18,223 (3,645) [875] {437}	18,268 (3,654) [877] {438}
Monmouth	10,459	10,474	10,496	10,509	10,548 (2,110) [506] {253}	10,586 (2,117) [508] {254}	10,624 (2,125) [510] {255}
Morris	7,332	7,341	7,350	7,358	7,380 (1,476) [354] {177}	7,402 (1,480) [355] {178}	7,425 (1,485) [356] {178}
Ocean	10,740	10,752	10,763	10,805	10,839 (2,168) [520] {260}	10,874 (2,175) [522] {261}	10,907 (2,181) [524] {262}
Passaic	17,915	17,950	17,963	18,002	18,076 (3,615) [868] {434}	18,156 (3,631) [872] {436}	18,243 (3,649) [876] {438}
Somerset	5,300	5,307	5,317	5,323	5,339 (1,068) [256] {128}	5,356 (1,071) [257] {129}	5,373 (1,075) [258] {129}
Sussex	1,349	1,351	1,353	1,355	1,359 (272) [65] {33}	1,364 (273) [65] {33}	1,368 (274) [66] {33}
Union	16,847	16,869	16,879	16,898	16,953 (3,391) [814] {407}	17,004 (3,401) [816] {408}	17,054 (3,411) [819] {409}
Warren	1,362	1,365	1,368	1,370	1,374 (275) [66] {33}	1,379 (276) [66] {33}	1,383 (277) [66] {33}

For additional information from IEM, please contact Bryan Koon, Vice President of Emergency Management and Homeland Security at bryan.koon@iem.com or 850-519-7966 or Stephanie Tennyson at stephanie.tennyson@iem.com or 202-309-4257.