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

Date: 8/13/20

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 8/13/20 12 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.

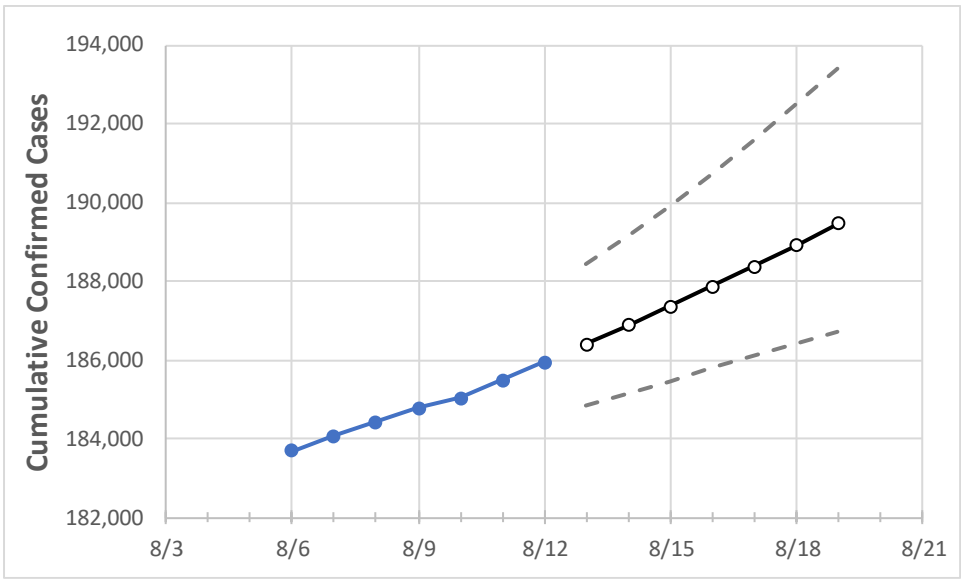
IEM's Modeling Lead

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:						
	8/9	8/10	8/11	8/12	8/13	8/14	8/15	8/16	8/17	8/18	8/19
New Jersey	184,773	185,031	185,475	185,938	186,399	186,873	187,361	187,862	188,376	188,905	189,449

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:						
	8/9	8/10	8/11	8/12	8/13	8/14	8/15	8/16	8/17	8/18	8/19
Bergen	20,794	20,825	20,864	20,899	20,940	20,981	21,024	21,068	21,113	21,159	21,207
Burlington	6,007	6,025	6,042	6,069	6,097	6,127	6,157	6,188	6,220	6,253	6,287
Camden	8,562	8,580	8,614	8,645	8,675	8,706	8,737	8,769	8,801	8,833	8,865
Essex	19,728	19,747	19,776	19,813	19,843	19,873	19,904	19,936	19,970	20,003	20,038
Gloucester	3,248	3,258	3,283	3,310	3,332	3,355	3,379	3,403	3,428	3,453	3,480
Hudson	19,671	19,683	19,717	19,749	19,771	19,793	19,815	19,839	19,863	19,888	19,914
Hunterdon	1,149	1,149	1,150	1,150	1,151	1,152	1,153	1,154	1,155	1,156	1,157
Mercer	8,119	8,127	8,139	8,143	8,153	8,163	8,173	8,183	8,193	8,203	8,213
Middlesex	17,919	17,932	17,959	17,988	18,012	18,036	18,060	18,085	18,109	18,134	18,159
Monmouth	10,302	10,326	10,348	10,368	10,394	10,420	10,447	10,474	10,501	10,528	10,555
Morris	7,248	7,261	7,273	7,286	7,299	7,312	7,325	7,338	7,352	7,366	7,380
Ocean	10,596	10,603	10,640	10,652	10,671	10,689	10,708	10,726	10,745	10,763	10,782
Passaic	17,642	17,665	17,705	17,748	17,777	17,807	17,837	17,869	17,902	17,936	17,970
Somerset	5,245	5,253	5,265	5,275	5,283	5,291	5,299	5,307	5,315	5,323	5,332
Sussex	1,330	1,333	1,336	1,341	1,345	1,348	1,352	1,356	1,360	1,364	1,369
Union	16,695	16,725	16,749	16,780	16,808	16,842	16,877	16,907	16,936	16,966	16,998
Warren	1,345	1,346	1,347	1,347	1,348	1,350	1,351	1,352	1,353	1,355	1,356

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:		
	8/9	8/10	8/11	8/12	8/14	8/16	8/18
Bergen	20,794	20,825	20,864	20,899	20,981 (4,196) [1,007] {504}	21,068 (4,214) [1,011] {506}	21,159 (4,232) [1,016] {508}
Burlington	6,007	6,025	6,042	6,069	6,127 (1,225) [294] {147}	6,188 (1,238) [297] {149}	6,253 (1,251) [300] {150}
Camden	8,562	8,580	8,614	8,645	8,706 (1,741) [418] {209}	8,769 (1,754) [421] {210}	8,833 (1,767) [424] {212}
Essex	19,728	19,747	19,776	19,813	19,873 (3,975) [954] {477}	19,936 (3,987) [957] {478}	20,003 (4,001) [960] {480}
Gloucester	3,248	3,258	3,283	3,310	3,355 (671) [161] {81}	3,403 (681) [163] {82}	3,453 (691) [166] {83}
Hudson	19,671	19,683	19,717	19,749	19,793 (3,959) [950] {475}	19,839 (3,968) [952] {476}	19,888 (3,978) [955] {477}
Hunterdon	1,149	1,149	1,150	1,150	1,152 (230) [55] {28}	1,154 (231) [55] {28}	1,156 (231) [55] {28}
Mercer	8,119	8,127	8,139	8,143	8,163 (1,633) [392] {196}	8,183 (1,637) [393] {196}	8,203 (1,641) [394] {197}
Middlesex	17,919	17,932	17,959	17,988	18,036 (3,607) [866] {433}	18,085 (3,617) [868] {434}	18,134 (3,627) [870] {435}
Monmouth	10,302	10,326	10,348	10,368	10,420 (2,084) [500] {250}	10,474 (2,095) [503] {251}	10,528 (2,106) [505] {253}
Morris	7,248	7,261	7,273	7,286	7,312 (1,462) [351] {175}	7,338 (1,468) [352] {176}	7,366 (1,473) [354] {177}
Ocean	10,596	10,603	10,640	10,652	10,689 (2,138) [513] {257}	10,726 (2,145) [515] {257}	10,763 (2,153) [517] {258}
Passaic	17,642	17,665	17,705	17,748	17,807 (3,561) [855] {427}	17,869 (3,574) [858] {429}	17,936 (3,587) [861] {430}
Somerset	5,245	5,253	5,265	5,275	5,291 (1,058) [254] {127}	5,307 (1,061) [255] {127}	5,323 (1,065) [256] {128}
Sussex	1,330	1,333	1,336	1,341	1,348 (270) [65] {32}	1,356 (271) [65] {33}	1,364 (273) [65] {33}
Union	16,695	16,725	16,749	16,780	16,842 (3,368) [808] {404}	16,907 (3,381) [812] {406}	16,966 (3,393) [814] {407}
Warren	1,345	1,346	1,347	1,347	1,350 (270) [65] {32}	1,352 (270) [65] {32}	1,355 (271) [65] {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.