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

Date: 7/2/20

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 7/2/20 11 a.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.

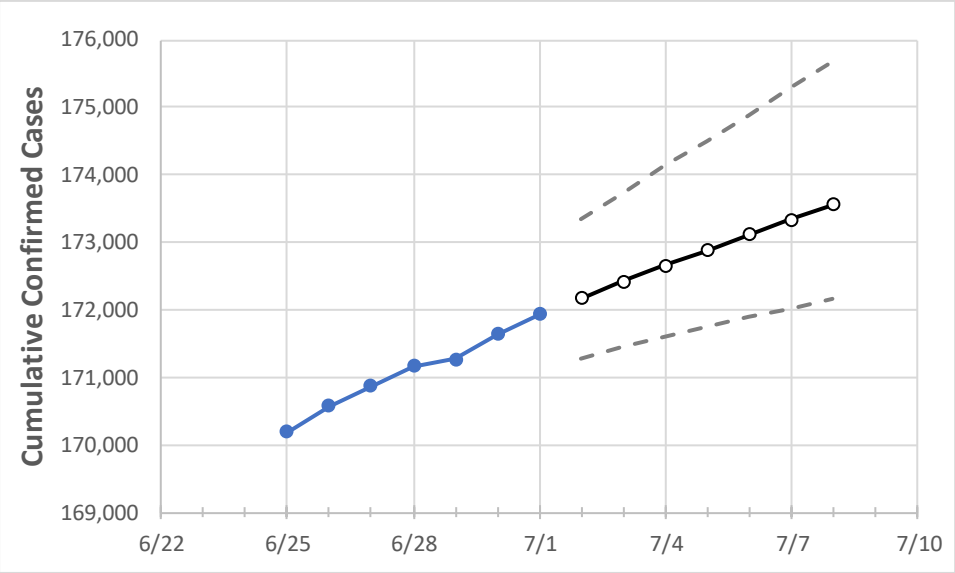
IEM's Modeling Lead

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:						
	6/28	6/29	6/30	7/1	7/2	7/3	7/4	7/5	7/6	7/7	7/8
New Jersey	171,162	171,272	171,637	171,928	172,174	172,415	172,653	172,886	173,115	173,340	173,562

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:						
	6/28	6/29	6/30	7/1	7/2	7/3	7/4	7/5	7/6	7/7	7/8
Bergen	19,354	19,375	19,423	19,445	19,481	19,517	19,554	19,591	19,629	19,668	19,707
Burlington	5,136	5,142	5,168	5,189	5,204	5,218	5,233	5,248	5,262	5,277	5,291
Camden	7,284	7,297	7,317	7,368	7,388	7,409	7,429	7,450	7,470	7,490	7,511
Essex	18,716	18,731	18,758	18,771	18,789	18,807	18,825	18,842	18,858	18,875	18,891
Gloucester	2,557	2,563	2,578	2,596	2,609	2,622	2,635	2,649	2,663	2,677	2,691
Hudson	18,834	18,838	18,841	18,842	18,845	18,849	18,852	18,855	18,858	18,861	18,864
Hunterdon	1,074	1,076	1,080	1,081	1,083	1,086	1,088	1,090	1,093	1,095	1,098
Mercer	7,626	7,634	7,659	7,676	7,687	7,698	7,708	7,718	7,727	7,736	7,745
Middlesex	16,764	16,790	16,816	16,825	16,844	16,862	16,881	16,899	16,917	16,934	16,952
Monmouth	9,108	9,110	9,140	9,163	9,178	9,193	9,207	9,221	9,235	9,247	9,260
Morris	6,730	6,735	6,738	6,757	6,763	6,768	6,774	6,780	6,786	6,792	6,797
Ocean	9,570	9,575	9,614	9,627	9,641	9,654	9,667	9,679	9,691	9,703	9,714
Passaic	16,872	16,876	16,879	16,894	16,901	16,908	16,915	16,921	16,927	16,933	16,938
Somerset	4,857	4,858	4,869	4,881	4,885	4,890	4,894	4,898	4,902	4,907	4,911
Sussex	1,189	1,190	1,192	1,197	1,199	1,200	1,202	1,204	1,205	1,207	1,209
Union	16,368	16,377	16,384	16,384	16,389	16,395	16,401	16,406	16,412	16,418	16,425
Warren	1,228	1,230	1,233	1,241	1,243	1,246	1,249	1,251	1,254	1,257	1,260

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:		
	6/28	6/29	6/30	7/1	7/3	7/5	7/7
Bergen	19,354	19,375	19,423	19,445	19,517 (3,903) [937] {468}	19,591 (3,918) [940] {470}	19,668 (3,934) [944] {472}
Burlington	5,136	5,142	5,168	5,189	5,218 (1,044) [250] {125}	5,248 (1,050) [252] {126}	5,277 (1,055) [253] {127}
Camden	7,284	7,297	7,317	7,368	7,409 (1,482) [356] {178}	7,450 (1,490) [358] {179}	7,490 (1,498) [360] {180}
Essex	18,716	18,731	18,758	18,771	18,807 (3,761) [903] {451}	18,842 (3,768) [904] {452}	18,875 (3,775) [906] {453}
Gloucester	2,557	2,563	2,578	2,596	2,622 (524) [126] {63}	2,649 (530) [127] {64}	2,677 (535) [128] {64}
Hudson	18,834	18,838	18,841	18,842	18,849 (3,770) [905] {452}	18,855 (3,771) [905] {453}	18,861 (3,772) [905] {453}
Hunterdon	1,074	1,076	1,080	1,081	1,086 (217) [52] {26}	1,090 (218) [52] {26}	1,095 (219) [53] {26}
Mercer	7,626	7,634	7,659	7,676	7,698 (1,540) [369] {185}	7,718 (1,544) [370] {185}	7,736 (1,547) [371] {186}
Middlesex	16,764	16,790	16,816	16,825	16,862 (3,372) [809] {405}	16,899 (3,380) [811] {406}	16,934 (3,387) [813] {406}
Monmouth	9,108	9,110	9,140	9,163	9,193 (1,839) [441] {221}	9,221 (1,844) [443] {221}	9,247 (1,849) [444] {222}
Morris	6,730	6,735	6,738	6,757	6,768 (1,354) [325] {162}	6,780 (1,356) [325] {163}	6,792 (1,358) [326] {163}
Ocean	9,570	9,575	9,614	9,627	9,654 (1,931) [463] {232}	9,679 (1,936) [465] {232}	9,703 (1,941) [466] {233}
Passaic	16,872	16,876	16,879	16,894	16,908 (3,382) [812] {406}	16,921 (3,384) [812] {406}	16,933 (3,387) [813] {406}
Somerset	4,857	4,858	4,869	4,881	4,890 (978) [235] {117}	4,898 (980) [235] {118}	4,907 (981) [236] {118}
Sussex	1,189	1,190	1,192	1,197	1,200 (240) [58] {29}	1,204 (241) [58] {29}	1,207 (241) [58] {29}
Union	16,368	16,377	16,384	16,384	16,395 (3,279) [787] {393}	16,406 (3,281) [788] {394}	16,418 (3,284) [788] {394}
Warren	1,228	1,230	1,233	1,241	1,246 (249) [60] {30}	1,251 (250) [60] {30}	1,257 (251) [60] {30}

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.