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

Date: 8/7/20

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 8/7/20 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.

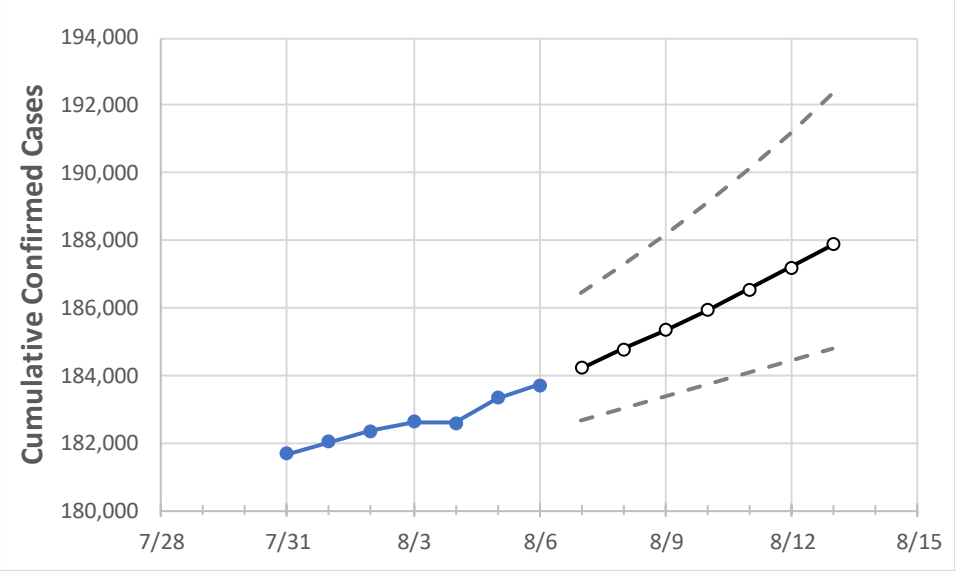
IEM's Modeling Lead

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:						
	8/3	8/4	8/5	8/6	8/7	8/8	8/9	8/10	8/11	8/12	8/13
New Jersey	182,614	182,586	183,327	183,701	184,222	184,767	185,335	185,927	186,546	187,191	187,864

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:						
	8/3	8/4	8/5	8/6	8/7	8/8	8/9	8/10	8/11	8/12	8/13
Bergen	20,552	20,596	20,639	20,669	20,710	20,752	20,795	20,840	20,886	20,934	20,983
Burlington	5,846	5,877	5,907	5,927	5,961	5,998	6,035	6,075	6,116	6,160	6,205
Camden	8,375	8,409	8,442	8,464	8,502	8,541	8,581	8,622	8,664	8,707	8,751
Essex	19,558	19,585	19,611	19,644	19,676	19,710	19,744	19,780	19,818	19,856	19,896
Gloucester	3,106	3,135	3,164	3,193	3,217	3,242	3,268	3,295	3,323	3,352	3,383
Hudson	19,528	19,546	19,564	19,580	19,597	19,614	19,632	19,650	19,668	19,687	19,706
Hunterdon	1,138	1,141	1,144	1,144	1,147	1,150	1,154	1,157	1,161	1,165	1,169
Mercer	8,051	8,064	8,076	8,087	8,103	8,119	8,135	8,153	8,170	8,188	8,207
Middlesex	17,735	17,767	17,798	17,821	17,844	17,868	17,891	17,915	17,938	17,962	17,985
Monmouth	10,137	10,165	10,192	10,227	10,262	10,297	10,333	10,371	10,409	10,448	10,488
Morris	7,167	7,181	7,195	7,209	7,222	7,235	7,248	7,261	7,275	7,289	7,303
Ocean	10,469	10,495	10,520	10,551	10,582	10,614	10,647	10,680	10,715	10,750	10,786
Passaic	17,507	17,529	17,550	17,585	17,614	17,644	17,675	17,707	17,741	17,776	17,812
Somerset	5,195	5,199	5,202	5,217	5,223	5,230	5,236	5,243	5,249	5,255	5,262
Sussex	1,310	1,313	1,316	1,320	1,324	1,328	1,332	1,337	1,341	1,346	1,351
Union	16,590	16,598	16,605	16,622	16,657	16,676	16,695	16,717	16,739	16,761	16,782
Warren	1,332	1,334	1,336	1,339	1,341	1,343	1,344	1,346	1,348	1,350	1,352

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:		
	8/3	8/4	8/5	8/6	8/8	8/10	8/12
Bergen	20,552	20,596	20,639	20,669	20,752 (4,150) [996] {498}	20,840 (4,168) [1,000] {500}	20,934 (4,187) [1,005] {502}
Burlington	5,846	5,877	5,907	5,927	5,998 (1,200) [288] {144}	6,075 (1,215) [292] {146}	6,160 (1,232) [296] {148}
Camden	8,375	8,409	8,442	8,464	8,541 (1,708) [410] {205}	8,622 (1,724) [414] {207}	8,707 (1,741) [418] {209}
Essex	19,558	19,585	19,611	19,644	19,710 (3,942) [946] {473}	19,780 (3,956) [949] {475}	19,856 (3,971) [953] {477}
Gloucester	3,106	3,135	3,164	3,193	3,242 (648) [156] {78}	3,295 (659) [158] {79}	3,352 (670) [161] {80}
Hudson	19,528	19,546	19,564	19,580	19,614 (3,923) [941] {471}	19,650 (3,930) [943] {472}	19,687 (3,937) [945] {472}
Hunterdon	1,138	1,141	1,144	1,144	1,150 (230) [55] {28}	1,157 (231) [56] {28}	1,165 (233) [56] {28}
Mercer	8,051	8,064	8,076	8,087	8,119 (1,624) [390] {195}	8,153 (1,631) [391] {196}	8,188 (1,638) [393] {197}
Middlesex	17,735	17,767	17,798	17,821	17,868 (3,574) [858] {429}	17,915 (3,583) [860] {430}	17,962 (3,592) [862] {431}
Monmouth	10,137	10,165	10,192	10,227	10,297 (2,059) [494] {247}	10,371 (2,074) [498] {249}	10,448 (2,090) [501] {251}
Morris	7,167	7,181	7,195	7,209	7,235 (1,447) [347] {174}	7,261 (1,452) [349] {174}	7,289 (1,458) [350] {175}
Ocean	10,469	10,495	10,520	10,551	10,614 (2,123) [509] {255}	10,680 (2,136) [513] {256}	10,750 (2,150) [516] {258}
Passaic	17,507	17,529	17,550	17,585	17,644 (3,529) [847] {423}	17,707 (3,541) [850] {425}	17,776 (3,555) [853] {427}
Somerset	5,195	5,199	5,202	5,217	5,230 (1,046) [251] {126}	5,243 (1,049) [252] {126}	5,255 (1,051) [252] {126}
Sussex	1,310	1,313	1,316	1,320	1,328 (266) [64] {32}	1,337 (267) [64] {32}	1,346 (269) [65] {32}
Union	16,590	16,598	16,605	16,622	16,676 (3,335) [800] {400}	16,717 (3,343) [802] {401}	16,761 (3,352) [805] {402}
Warren	1,332	1,334	1,336	1,339	1,343 (269) [64] {32}	1,346 (269) [65] {32}	1,350 (270) [65] {32}

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.