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

Date: 7/28/20

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 7/28/20 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.

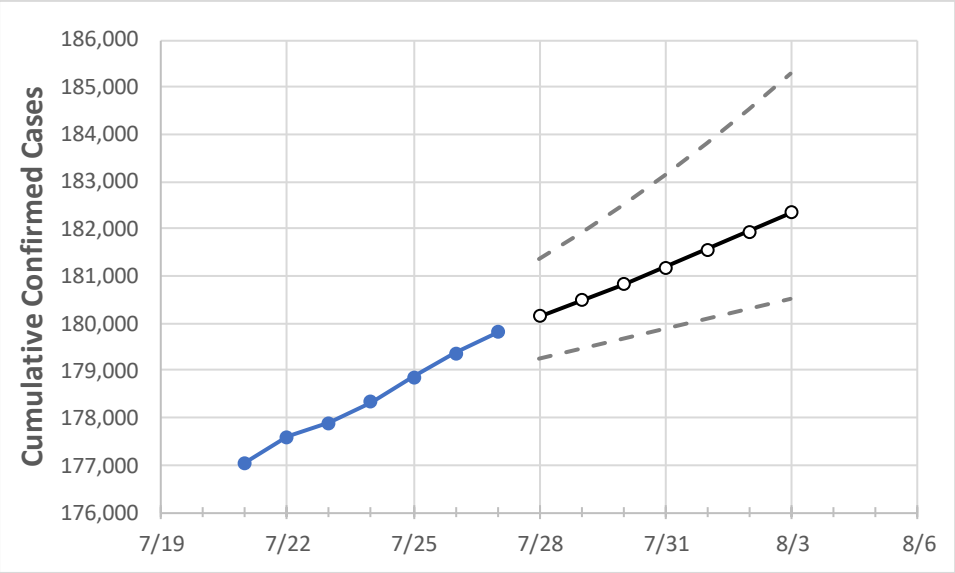
IEM's Modeling Lead

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:						
	7/24	7/25	7/26	7/27	7/28	7/29	7/30	7/31	8/1	8/2	8/3
New Jersey	178,345	178,858	179,363	179,812	180,140	180,479	180,830	181,192	181,566	181,952	182,351

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:						
	7/24	7/25	7/26	7/27	7/28	7/29	7/30	7/31	8/1	8/2	8/3
Bergen	20,162	20,192	20,226	20,280	20,307	20,334	20,362	20,390	20,418	20,447	20,477
Burlington	5,533	5,567	5,594	5,642	5,663	5,685	5,708	5,733	5,758	5,785	5,812
Camden	7,952	8,026	8,087	8,130	8,165	8,201	8,238	8,277	8,317	8,359	8,402
Essex	19,228	19,263	19,310	19,335	19,357	19,379	19,402	19,425	19,449	19,474	19,499
Gloucester	2,920	2,945	2,969	2,986	3,004	3,022	3,041	3,061	3,082	3,103	3,125
Hudson	19,313	19,329	19,363	19,387	19,403	19,419	19,436	19,452	19,469	19,486	19,503
Hunterdon	1,113	1,115	1,120	1,122	1,125	1,127	1,130	1,134	1,137	1,141	1,146
Mercer	7,879	7,899	7,917	7,934	7,947	7,959	7,973	7,986	8,001	8,015	8,030
Middlesex	17,476	17,514	17,535	17,557	17,591	17,625	17,661	17,698	17,735	17,774	17,814
Monmouth	9,791	9,822	9,857	9,908	9,935	9,963	9,991	10,020	10,050	10,080	10,111
Morris	7,035	7,052	7,065	7,076	7,089	7,103	7,117	7,131	7,146	7,161	7,177
Ocean	10,116	10,171	10,206	10,238	10,271	10,306	10,343	10,382	10,423	10,465	10,510
Passaic	17,237	17,274	17,312	17,327	17,347	17,367	17,388	17,410	17,432	17,455	17,478
Somerset	5,106	5,120	5,131	5,139	5,147	5,156	5,165	5,173	5,182	5,192	5,201
Sussex	1,264	1,271	1,277	1,285	1,291	1,296	1,303	1,309	1,316	1,324	1,332
Union	16,321	16,335	16,359	16,376	16,379	16,383	16,387	16,391	16,395	16,400	16,405
Warren	1,302	1,308	1,312	1,315	1,320	1,325	1,331	1,337	1,343	1,351	1,358

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:		
	7/24	7/25	7/26	7/27	7/29	7/31	8/2
Bergen	20,162	20,192	20,226	20,280	20,334 (4,067) [976] {488}	20,390 (4,078) [979] {489}	20,447 (4,089) [981] {491}
Burlington	5,533	5,567	5,594	5,642	5,685 (1,137) [273] {136}	5,733 (1,147) [275] {138}	5,785 (1,157) [278] {139}
Camden	7,952	8,026	8,087	8,130	8,201 (1,640) [394] {197}	8,277 (1,655) [397] {199}	8,359 (1,672) [401] {201}
Essex	19,228	19,263	19,310	19,335	19,379 (3,876) [930] {465}	19,425 (3,885) [932] {466}	19,474 (3,895) [935] {467}
Gloucester	2,920	2,945	2,969	2,986	3,022 (604) [145] {73}	3,061 (612) [147] {73}	3,103 (621) [149] {74}
Hudson	19,313	19,329	19,363	19,387	19,419 (3,884) [932] {466}	19,452 (3,890) [934] {467}	19,486 (3,897) [935] {468}
Hunterdon	1,113	1,115	1,120	1,122	1,127 (225) [54] {27}	1,134 (227) [54] {27}	1,141 (228) [55] {27}
Mercer	7,879	7,899	7,917	7,934	7,959 (1,592) [382] {191}	7,986 (1,597) [383] {192}	8,015 (1,603) [385] {192}
Middlesex	17,476	17,514	17,535	17,557	17,625 (3,525) [846] {423}	17,698 (3,540) [849] {425}	17,774 (3,555) [853] {427}
Monmouth	9,791	9,822	9,857	9,908	9,963 (1,993) [478] {239}	10,020 (2,004) [481] {240}	10,080 (2,016) [484] {242}
Morris	7,035	7,052	7,065	7,076	7,103 (1,421) [341] {170}	7,131 (1,426) [342] {171}	7,161 (1,432) [344] {172}
Ocean	10,116	10,171	10,206	10,238	10,306 (2,061) [495] {247}	10,382 (2,076) [498] {249}	10,465 (2,093) [502] {251}
Passaic	17,237	17,274	17,312	17,327	17,367 (3,473) [834] {417}	17,410 (3,482) [836] {418}	17,455 (3,491) [838] {419}
Somerset	5,106	5,120	5,131	5,139	5,156 (1,031) [247] {124}	5,173 (1,035) [248] {124}	5,192 (1,038) [249] {125}
Sussex	1,264	1,271	1,277	1,285	1,296 (259) [62] {31}	1,309 (262) [63] {31}	1,324 (265) [64] {32}
Union	16,321	16,335	16,359	16,376	16,383 (3,277) [786] {393}	16,391 (3,278) [787] {393}	16,400 (3,280) [787] {394}
Warren	1,302	1,308	1,312	1,315	1,325 (265) [64] {32}	1,337 (267) [64] {32}	1,351 (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.