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

Date: 9/1/20

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 9/1/20 9 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.

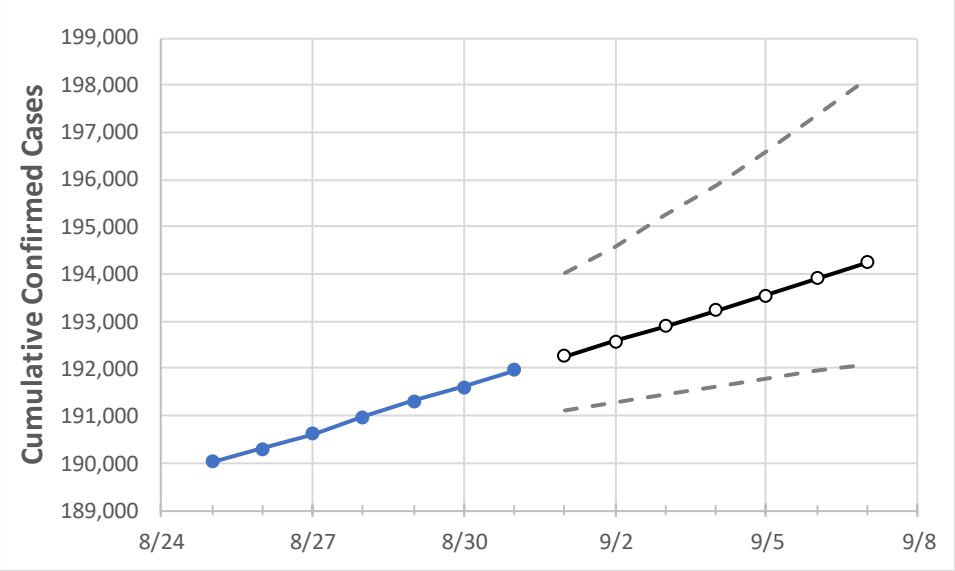
IEM's Modeling Lead

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:						
	8/28	8/29	8/30	8/31	9/1	9/2	9/3	9/4	9/5	9/6	9/7
New Jersey	190,971	191,320	191,611	191,960	192,268	192,583	192,903	193,229	193,561	193,899	194,243

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:						
	8/28	8/29	8/30	8/31	9/1	9/2	9/3	9/4	9/5	9/6	9/7
Bergen	21,474	21,520	21,557	21,600	21,621	21,641	21,662	21,682	21,702	21,722	21,742
Burlington	6,354	6,370	6,382	6,395	6,408	6,421	6,433	6,446	6,458	6,469	6,481
Camden	9,093	9,116	9,142	9,157	9,176	9,196	9,215	9,233	9,251	9,270	9,287
Essex	20,260	20,276	20,301	20,324	20,349	20,373	20,398	20,422	20,447	20,471	20,495
Gloucester	3,634	3,656	3,668	3,685	3,700	3,715	3,730	3,745	3,760	3,774	3,789
Hudson	20,100	20,116	20,131	20,144	20,154	20,164	20,174	20,183	20,191	20,199	20,207
Hunterdon	1,209	1,213	1,212	1,213	1,216	1,220	1,223	1,227	1,231	1,235	1,239
Mercer	8,310	8,315	8,326	8,333	8,340	8,348	8,355	8,362	8,368	8,375	8,382
Middlesex	18,377	18,415	18,432	18,456	18,478	18,499	18,521	18,543	18,564	18,585	18,607
Monmouth	10,669	10,700	10,710	10,734	10,746	10,758	10,769	10,780	10,791	10,802	10,812
Morris	7,455	7,466	7,474	7,491	7,499	7,507	7,515	7,522	7,530	7,537	7,544
Ocean	11,092	11,132	11,145	11,181	11,212	11,243	11,275	11,309	11,343	11,379	11,415
Passaic	18,275	18,306	18,327	18,351	18,371	18,391	18,411	18,430	18,449	18,467	18,485
Somerset	5,379	5,387	5,400	5,420	5,427	5,435	5,443	5,450	5,459	5,467	5,475
Sussex	1,386	1,392	1,394	1,399	1,402	1,406	1,409	1,413	1,417	1,421	1,425
Union	17,052	17,066	17,077	17,103	17,117	17,130	17,144	17,157	17,170	17,183	17,196
Warren	1,390	1,391	1,392	1,395	1,396	1,398	1,399	1,400	1,401	1,402	1,403

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:		
	8/28	8/29	8/30	8/31	9/2	9/4	9/6
Bergen	21,474	21,520	21,557	21,600	21,641 (4,328) [1,039] {519}	21,682 (4,336) [1,041] {520}	21,722 (4,344) [1,043] {521}
Burlington	6,354	6,370	6,382	6,395	6,421 (1,284) [308] {154}	6,446 (1,289) [309] {155}	6,469 (1,294) [311] {155}
Camden	9,093	9,116	9,142	9,157	9,196 (1,839) [441] {221}	9,233 (1,847) [443] {222}	9,270 (1,854) [445] {222}
Essex	20,260	20,276	20,301	20,324	20,373 (4,075) [978] {489}	20,422 (4,084) [980] {490}	20,471 (4,094) [983] {491}
Gloucester	3,634	3,656	3,668	3,685	3,715 (743) [178] {89}	3,745 (749) [180] {90}	3,774 (755) [181] {91}
Hudson	20,100	20,116	20,131	20,144	20,164 (4,033) [968] {484}	20,183 (4,037) [969] {484}	20,199 (4,040) [970] {485}
Hunterdon	1,209	1,213	1,212	1,213	1,220 (244) [59] {29}	1,227 (245) [59] {29}	1,235 (247) [59] {30}
Mercer	8,310	8,315	8,326	8,333	8,348 (1,670) [401] {200}	8,362 (1,672) [401] {201}	8,375 (1,675) [402] {201}
Middlesex	18,377	18,415	18,432	18,456	18,499 (3,700) [888] {444}	18,543 (3,709) [890] {445}	18,585 (3,717) [892] {446}
Monmouth	10,669	10,700	10,710	10,734	10,758 (2,152) [516] {258}	10,780 (2,156) [517] {259}	10,802 (2,160) [518] {259}
Morris	7,455	7,466	7,474	7,491	7,507 (1,501) [360] {180}	7,522 (1,504) [361] {181}	7,537 (1,507) [362] {181}
Ocean	11,092	11,132	11,145	11,181	11,243 (2,249) [540] {270}	11,309 (2,262) [543] {271}	11,379 (2,276) [546] {273}
Passaic	18,275	18,306	18,327	18,351	18,391 (3,678) [883] {441}	18,430 (3,686) [885] {442}	18,467 (3,693) [886] {443}
Somerset	5,379	5,387	5,400	5,420	5,435 (1,087) [261] {130}	5,450 (1,090) [262] {131}	5,467 (1,093) [262] {131}
Sussex	1,386	1,392	1,394	1,399	1,406 (281) [67] {34}	1,413 (283) [68] {34}	1,421 (284) [68] {34}
Union	17,052	17,066	17,077	17,103	17,130 (3,426) [822] {411}	17,157 (3,431) [824] {412}	17,183 (3,437) [825] {412}
Warren	1,390	1,391	1,392	1,395	1,398 (280) [67] {34}	1,400 (280) [67] {34}	1,402 (280) [67] {34}

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.