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

Date: 8/27/20

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 8/27/20 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.

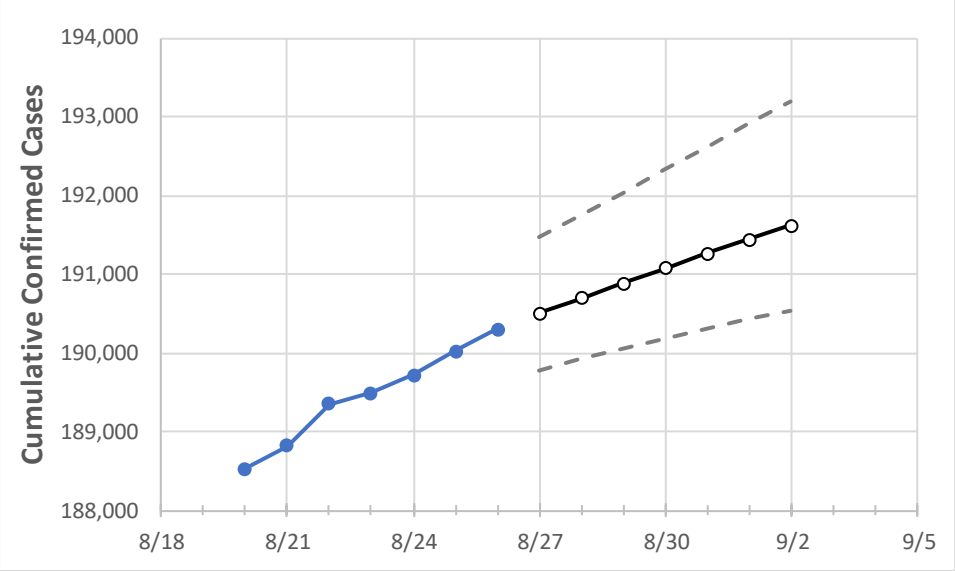
IEM's Modeling Lead

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:						
	8/23	8/24	8/25	8/26	8/27	8/28	8/29	8/30	8/31	9/1	9/2
New Jersey	189,494	189,719	190,021	190,306	190,504	190,697	190,888	191,075	191,258	191,438	191,615

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:						
	8/23	8/24	8/25	8/26	8/27	8/28	8/29	8/30	8/31	9/1	9/2
Bergen	21,326	21,352	21,395	21,436	21,463	21,489	21,515	21,541	21,566	21,591	21,616
Burlington	6,274	6,287	6,304	6,314	6,327	6,341	6,353	6,366	6,378	6,391	6,402
Camden	8,961	8,979	9,001	9,020	9,041	9,061	9,081	9,100	9,120	9,139	9,158
Essex	20,112	20,131	20,159	20,183	20,208	20,232	20,257	20,282	20,307	20,332	20,357
Gloucester	3,557	3,568	3,579	3,592	3,608	3,623	3,639	3,654	3,670	3,685	3,700
Hudson	20,042	20,052	20,058	20,068	20,083	20,097	20,112	20,126	20,140	20,154	20,167
Hunterdon	1,192	1,196	1,197	1,202	1,206	1,209	1,213	1,218	1,222	1,227	1,232
Mercer	8,264	8,267	8,274	8,288	8,296	8,303	8,311	8,318	8,325	8,332	8,339
Middlesex	18,275	18,293	18,319	18,348	18,372	18,396	18,420	18,444	18,468	18,493	18,517
Monmouth	10,589	10,594	10,607	10,628	10,639	10,650	10,660	10,670	10,680	10,689	10,698
Morris	7,411	7,427	7,439	7,442	7,450	7,459	7,467	7,475	7,482	7,490	7,498
Ocean	10,926	10,946	10,997	11,036	11,060	11,084	11,109	11,133	11,159	11,184	11,211
Passaic	18,173	18,187	18,206	18,223	18,252	18,280	18,309	18,338	18,367	18,396	18,425
Somerset	5,346	5,351	5,358	5,364	5,369	5,374	5,378	5,383	5,388	5,392	5,397
Sussex	1,366	1,369	1,380	1,380	1,382	1,384	1,387	1,389	1,391	1,393	1,395
Union	16,978	16,992	17,010	17,023	17,036	17,050	17,063	17,076	17,088	17,101	17,113
Warren	1,381	1,383	1,384	1,384	1,386	1,388	1,390	1,392	1,394	1,396	1,398

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:		
	8/23	8/24	8/25	8/26	8/28	8/30	9/1
Bergen	21,326	21,352	21,395	21,436	21,489 (4,298) [1,031] {516}	21,541 (4,308) [1,034] {517}	21,591 (4,318) [1,036] {518}
Burlington	6,274	6,287	6,304	6,314	6,341 (1,268) [304] {152}	6,366 (1,273) [306] {153}	6,391 (1,278) [307] {153}
Camden	8,961	8,979	9,001	9,020	9,061 (1,812) [435] {217}	9,100 (1,820) [437] {218}	9,139 (1,828) [439] {219}
Essex	20,112	20,131	20,159	20,183	20,232 (4,046) [971] {486}	20,282 (4,056) [974] {487}	20,332 (4,066) [976] {488}
Gloucester	3,557	3,568	3,579	3,592	3,623 (725) [174] {87}	3,654 (731) [175] {88}	3,685 (737) [177] {88}
Hudson	20,042	20,052	20,058	20,068	20,097 (4,019) [965] {482}	20,126 (4,025) [966] {483}	20,154 (4,031) [967] {484}
Hunterdon	1,192	1,196	1,197	1,202	1,209 (242) [58] {29}	1,218 (244) [58] {29}	1,227 (245) [59] {29}
Mercer	8,264	8,267	8,274	8,288	8,303 (1,661) [399] {199}	8,318 (1,664) [399] {200}	8,332 (1,666) [400] {200}
Middlesex	18,275	18,293	18,319	18,348	18,396 (3,679) [883] {442}	18,444 (3,689) [885] {443}	18,493 (3,699) [888] {444}
Monmouth	10,589	10,594	10,607	10,628	10,650 (2,130) [511] {256}	10,670 (2,134) [512] {256}	10,689 (2,138) [513] {257}
Morris	7,411	7,427	7,439	7,442	7,459 (1,492) [358] {179}	7,475 (1,495) [359] {179}	7,490 (1,498) [360] {180}
Ocean	10,926	10,946	10,997	11,036	11,084 (2,217) [532] {266}	11,133 (2,227) [534] {267}	11,184 (2,237) [537] {268}
Passaic	18,173	18,187	18,206	18,223	18,280 (3,656) [877] {439}	18,338 (3,668) [880] {440}	18,396 (3,679) [883] {441}
Somerset	5,346	5,351	5,358	5,364	5,374 (1,075) [258] {129}	5,383 (1,077) [258] {129}	5,392 (1,078) [259] {129}
Sussex	1,366	1,369	1,380	1,380	1,384 (277) [66] {33}	1,389 (278) [67] {33}	1,393 (279) [67] {33}
Union	16,978	16,992	17,010	17,023	17,050 (3,410) [818] {409}	17,076 (3,415) [820] {410}	17,101 (3,420) [821] {410}
Warren	1,381	1,383	1,384	1,384	1,388 (278) [67] {33}	1,392 (278) [67] {33}	1,396 (279) [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.