IEM's AI Modeling: Short-term COVID-19 Projections
Date: 8/17/20

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 <u>not</u> 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 8/17/20 12 p.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
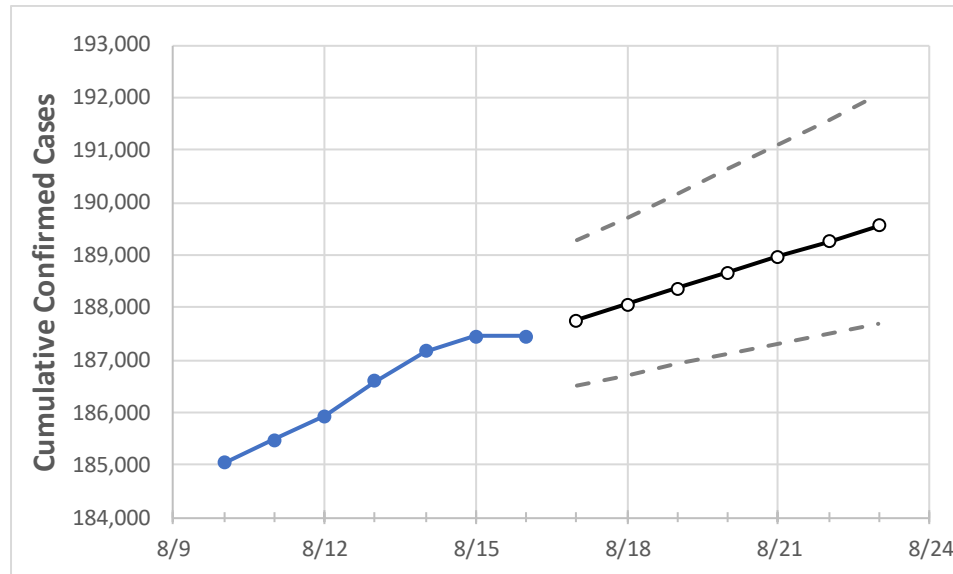
	Actual Confirmed Cases On:				Projected Cases For:						
	8/13	8/14	8/15	8/16	8/17	8/18	8/19	8/20	8/21	8/22	8/23
New Jersey	186,594	187,164	187,442	187,455	187,756	188,057	188,358	188,659	188,960	189,261	189,562

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:						
	8/13	8/14	8/15	8/16	8/17	8/18	8/19	8/20	8/21	8/22	8/23
Bergen	20,940	21,058	21,120	21,195	21,251	21,309	21,369	21,432	21,497	21,564	21,634
Burlington	6,094	6,108	6,128	6,145	6,169	6,193	6,218	6,243	6,269	6,295	6,321
Camden	8,689	8,733	8,774	8,793	8,825	8,858	8,891	8,925	8,959	8,993	9,028
Essex	19,840	19,870	19,911	19,927	19,956	19,985	20,014	20,045	20,076	20,107	20,139
Gloucester	3,339	3,368	3,400	3,413	3,437	3,461	3,486	3,512	3,539	3,566	3,594
Hudson	19,792	19,830	19,866	19,892	19,921	19,950	19,981	20,013	20,046	20,081	20,117
Hunterdon	1,151	1,154	1,158	1,161	1,162	1,164	1,165	1,166	1,168	1,169	1,170
Mercer	8,164	8,169	8,182	8,190	8,199	8,209	8,218	8,228	8,238	8,247	8,257
Middlesex	18,015	18,045	18,070	18,099	18,124	18,149	18,175	18,200	18,225	18,251	18,276
Monmouth	10,407	10,434	10,459	10,474	10,498	10,523	10,548	10,572	10,597	10,622	10,647
Morris	7,304	7,315	7,332	7,341	7,353	7,366	7,379	7,392	7,405	7,418	7,432
Ocean	10,668	10,708	10,740	10,752	10,770	10,788	10,806	10,824	10,842	10,860	10,877
Passaic	17,801	17,858	17,915	17,950	17,988	18,028	18,070	18,113	18,158	18,206	18,255
Somerset	5,282	5,291	5,300	5,307	5,315	5,323	5,331	5,339	5,348	5,356	5,365
Sussex	1,343	1,344	1,349	1,351	1,354	1,357	1,359	1,362	1,365	1,368	1,370
Union	16,812	16,827	16,847	16,869	16,909	16,935	16,964	16,990	17,021	17,047	17,078
Warren	1,352	1,355	1,362	1,365	1,367	1,369	1,372	1,374	1,376	1,378	1,381

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:		
	8/13	8/14	8/15	8/16	8/18	8/20	8/22
Bergen	20,940	21,058	21,120	21,195	21,309 (4,262) [1,023] {511}	21,432 (4,286) [1,029] {514}	21,564 (4,313) [1,035] {518}
Burlington	6,094	6,108	6,128	6,145	6,193 (1,239) [297] {149}	6,243 (1,249) [300] {150}	6,295 (1,259) [302] {151}
Camden	8,689	8,733	8,774	8,793	8,858 (1,772) [425] {213}	8,925 (1,785) [428] {214}	8,993 (1,799) [432] {216}
Essex	19,840	19,870	19,911	19,927	19,985 (3,997) [959] {480}	20,045 (4,009) [962] {481}	20,107 (4,021) [965] {483}
Gloucester	3,339	3,368	3,400	3,413	3,461 (692) [166] {83}	3,512 (702) [169] {84}	3,566 (713) [171] {86}
Hudson	19,792	19,830	19,866	19,892	19,950 (3,990) [958] {479}	20,013 (4,003) [961] {480}	20,081 (4,016) [964] {482}
Hunterdon	1,151	1,154	1,158	1,161	1,164 (233) [56] {28}	1,166 (233) [56] {28}	1,169 (234) [56] {28}
Mercer	8,164	8,169	8,182	8,190	8,209 (1,642) [394] {197}	8,228 (1,646) [395] {197}	8,247 (1,649) [396] {198}
Middlesex	18,015	18,045	18,070	18,099	18,149 (3,630) [871] {436}	18,200 (3,640) [874] {437}	18,251 (3,650) [876] {438}
Monmouth	10,407	10,434	10,459	10,474	10,523 (2,105) [505] {253}	10,572 (2,114) [507] {254}	10,622 (2,124) [510] {255}
Morris	7,304	7,315	7,332	7,341	7,366 (1,473) [354] {177}	7,392 (1,478) [355] {177}	7,418 (1,484) [356] {178}
Ocean	10,668	10,708	10,740	10,752	10,788 (2,158) [518] {259}	10,824 (2,165) [520] {260}	10,860 (2,172) [521] {261}
Passaic	17,801	17,858	17,915	17,950	18,028 (3,606) [865] {433}	18,113 (3,623) [869] {435}	18,206 (3,641) [874] {437}
Somerset	5,282	5,291	5,300	5,307	5,323 (1,065) [255] {128}	5,339 (1,068) [256] {128}	5,356 (1,071) [257] {129}
Sussex	1,343	1,344	1,349	1,351	1,357 (271) [65] {33}	1,362 (272) [65] {33}	1,368 (274) [66] {33}
Union	16,812	16,827	16,847	16,869	16,935 (3,387) [813] {406}	16,990 (3,398) [816] {408}	17,047 (3,409) [818] {409}
Warren	1,352	1,355	1,362	1,365	1,369 (274) [66] {33}	1,374 (275) [66] {33}	1,378 (276) [66] {33}

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.