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

Date: 7/22/20

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 7/22/20 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.

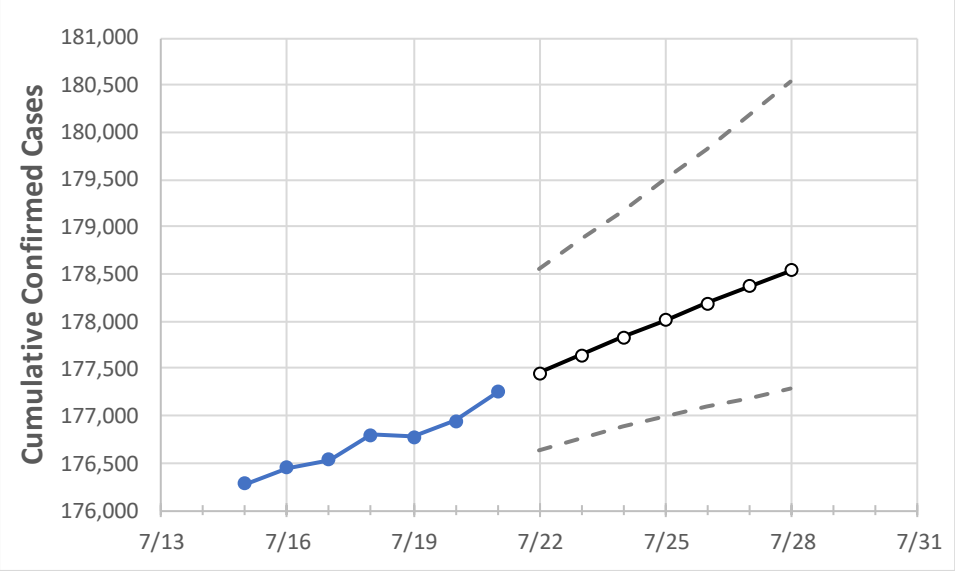
IEM's Modeling Lead

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:						
	7/18	7/19	7/20	7/21	7/22	7/23	7/24	7/25	7/26	7/27	7/28
New Jersey	176,795	176,780	176,948	177,256	177,451	177,643	177,830	178,013	178,192	178,368	178,540

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:						
	7/18	7/19	7/20	7/21	7/22	7/23	7/24	7/25	7/26	7/27	7/28
Bergen	19,979	19,980	20,034	20,052	20,065	20,077	20,089	20,100	20,111	20,121	20,131
Burlington	5,440	5,442	5,450	5,478	5,485	5,492	5,499	5,506	5,512	5,518	5,524
Camden	7,818	7,829	7,845	7,867	7,882	7,896	7,909	7,922	7,935	7,948	7,960
Essex	19,110	19,116	19,121	19,153	19,165	19,177	19,189	19,200	19,211	19,222	19,233
Gloucester	2,820	2,824	2,829	2,855	2,863	2,872	2,880	2,888	2,895	2,903	2,910
Hudson	19,261	19,248	19,263	19,267	19,283	19,300	19,316	19,333	19,351	19,369	19,387
Hunterdon	1,101	1,100	1,101	1,101	1,102	1,102	1,103	1,103	1,104	1,104	1,104
Mercer	7,844	7,825	7,828	7,839	7,845	7,850	7,856	7,861	7,866	7,871	7,876
Middlesex	17,155	17,155	17,155	17,155	17,180	17,205	17,231	17,257	17,283	17,309	17,335
Monmouth	9,649	9,659	9,672	9,683	9,698	9,713	9,727	9,741	9,754	9,767	9,780
Morris	6,952	6,958	6,967	6,990	6,999	7,007	7,016	7,025	7,034	7,043	7,052
Ocean	9,940	9,947	9,956	9,988	10,002	10,015	10,029	10,042	10,055	10,068	10,081
Passaic	17,167	17,162	17,172	17,181	17,194	17,207	17,221	17,234	17,248	17,261	17,275
Somerset	5,070	5,065	5,068	5,072	5,077	5,083	5,088	5,093	5,099	5,104	5,109
Sussex	1,243	1,246	1,250	1,253	1,256	1,258	1,261	1,264	1,267	1,270	1,273
Union	16,546	16,508	16,515	16,515	16,527	16,538	16,551	16,564	16,577	16,591	16,605
Warren	1,273	1,276	1,280	1,286	1,288	1,289	1,291	1,293	1,294	1,296	1,298

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:		
	7/18	7/19	7/20	7/21	7/23	7/25	7/27
Bergen	19,979	19,980	20,034	20,052	20,077 (4,015) [964] {482}	20,100 (4,020) [965] {482}	20,121 (4,024) [966] {483}
Burlington	5,440	5,442	5,450	5,478	5,492 (1,098) [264] {132}	5,506 (1,101) [264] {132}	5,518 (1,104) [265] {132}
Camden	7,818	7,829	7,845	7,867	7,896 (1,579) [379] {189}	7,922 (1,584) [380] {190}	7,948 (1,590) [381] {191}
Essex	19,110	19,116	19,121	19,153	19,177 (3,835) [920] {460}	19,200 (3,840) [922] {461}	19,222 (3,844) [923] {461}
Gloucester	2,820	2,824	2,829	2,855	2,872 (574) [138] {69}	2,888 (578) [139] {69}	2,903 (581) [139] {70}
Hudson	19,261	19,248	19,263	19,267	19,300 (3,860) [926] {463}	19,333 (3,867) [928] {464}	19,369 (3,874) [930] {465}
Hunterdon	1,101	1,100	1,101	1,101	1,102 (220) [53] {26}	1,103 (221) [53] {26}	1,104 (221) [53] {26}
Mercer	7,844	7,825	7,828	7,839	7,850 (1,570) [377] {188}	7,861 (1,572) [377] {189}	7,871 (1,574) [378] {189}
Middlesex	17,155	17,155	17,155	17,155	17,205 (3,441) [826] {413}	17,257 (3,451) [828] {414}	17,309 (3,462) [831] {415}
Monmouth	9,649	9,659	9,672	9,683	9,713 (1,943) [466] {233}	9,741 (1,948) [468] {234}	9,767 (1,953) [469] {234}
Morris	6,952	6,958	6,967	6,990	7,007 (1,401) [336] {168}	7,025 (1,405) [337] {169}	7,043 (1,409) [338] {169}
Ocean	9,940	9,947	9,956	9,988	10,015 (2,003) [481] {240}	10,042 (2,008) [482] {241}	10,068 (2,014) [483] {242}
Passaic	17,167	17,162	17,172	17,181	17,207 (3,441) [826] {413}	17,234 (3,447) [827] {414}	17,261 (3,452) [829] {414}
Somerset	5,070	5,065	5,068	5,072	5,083 (1,017) [244] {122}	5,093 (1,019) [244] {122}	5,104 (1,021) [245] {122}
Sussex	1,243	1,246	1,250	1,253	1,258 (252) [60] {30}	1,264 (253) [61] {30}	1,270 (254) [61] {30}
Union	16,546	16,508	16,515	16,515	16,538 (3,308) [794] {397}	16,564 (3,313) [795] {398}	16,591 (3,318) [796] {398}
Warren	1,273	1,276	1,280	1,286	1,289 (258) [62] {31}	1,293 (259) [62] {31}	1,296 (259) [62] {31}

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.