

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

Date: 7/2/21

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 10%, and are often within 5%, of actual confirmed cases.

The projections shown in this document are based on data pulled in as of 7/2/21 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.

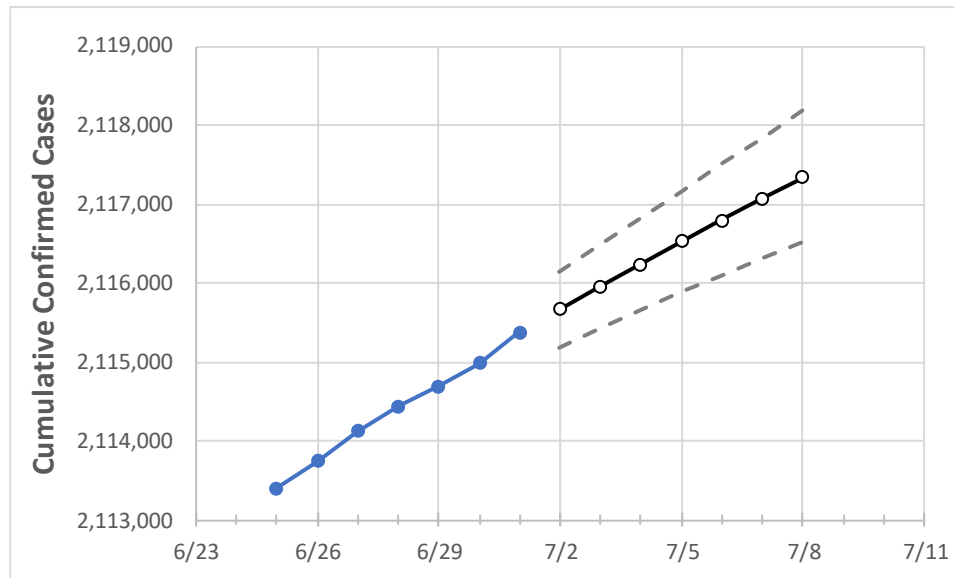
IEM's Modeling Lead

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 York State Projections



	Actual Confirmed Cases On:				Projected Cases For:						
	6/28	6/29	6/30	7/1	7/2	7/3	7/4	7/5	7/6	7/7	7/8
New York	2,114,434	2,114,686	2,114,986	2,115,377	2,115,666	2,115,957	2,116,237	2,116,522	2,116,798	2,117,070	2,117,343

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 10%, and are often within 5%, of actual confirmed cases.

New York Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	6/28	6/29	6/30	7/1	7/2	7/3	7/4	7/5	7/6	7/7	7/8
Albany	24,733	24,734	24,734	24,735	24,736	24,738	24,739	24,740	24,742	24,743	24,744
Bronx	183,936	183,952	183,969	184,007	184,027	184,046	184,063	184,081	184,097	184,113	184,128
Dutchess	29,507	29,508	29,512	29,514	29,516	29,518	29,519	29,521	29,523	29,524	29,526
Erie	89,660	89,665	89,668	89,678	89,682	89,685	89,688	89,691	89,694	89,697	89,700
Kings	281,282	281,332	281,368	281,420	281,470	281,520	281,570	281,619	281,669	281,717	281,768
Monroe	69,146	69,152	69,163	69,178	69,185	69,191	69,197	69,203	69,208	69,213	69,218
Nassau	183,948	183,963	183,980	184,017	184,037	184,057	184,076	184,095	184,115	184,134	184,153
New York	138,674	138,698	138,742	138,773	138,803	138,832	138,862	138,891	138,921	138,950	138,979
Niagara	20,057	20,058	20,059	20,059	20,060	20,061	20,062	20,063	20,063	20,064	20,065
Onondaga	39,024	39,030	39,035	39,044	39,048	39,052	39,056	39,060	39,063	39,066	39,070
Orange	48,405	48,409	48,417	48,424	48,430	48,436	48,441	48,447	48,452	48,457	48,463
Putnam	10,628	10,629	10,630	10,631	10,632	10,633	10,634	10,634	10,635	10,636	10,637
Queens	277,911	277,942	277,974	278,029	278,071	278,113	278,154	278,195	278,236	278,276	278,316
Rensselaer	11,248	11,248	11,249	11,251	11,252	11,253	11,254	11,255	11,256	11,257	11,258
Richmond	75,298	75,326	75,364	75,404	75,437	75,471	75,507	75,543	75,581	75,620	75,659
Rockland	47,014	47,017	47,022	47,027	47,032	47,037	47,042	47,046	47,051	47,055	47,060
Saratoga	15,404	15,409	15,412	15,414	15,416	15,418	15,420	15,421	15,423	15,425	15,427
Schenectady	13,217	13,217	13,217	13,217	13,218	13,218	13,219	13,220	13,220	13,221	13,221
Suffolk	201,398	201,418	201,431	201,456	201,476	201,496	201,514	201,533	201,551	201,568	201,585
Sullivan	6,691	6,692	6,692	6,693	6,694	6,695	6,696	6,697	6,697	6,698	6,699
Tompkins	4,358	4,359	4,359	4,359	4,360	4,360	4,361	4,362	4,362	4,363	4,363
Ulster	13,927	13,927	13,928	13,929	13,930	13,931	13,932	13,932	13,933	13,934	13,935
Westchester	129,835	129,849	129,866	129,888	129,900	129,911	129,923	129,934	129,945	129,956	129,967

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 York Medical Demands by County

	Actual Confirmed Cases On:				Projected Cases (Hospitalized) [ICU] {Ventilator} For:											
	6/28	6/29	6/30	7/1	7/3			7/5			7/7					
Albany	24,733	24,734	24,734	24,735	24,738	(4,948)	[1,187]	{594}	24,740	(4,948)	[1,188]	{594}	24,743	(4,949)	[1,188]	{594}
Bronx	183,936	183,952	183,969	184,007	184,046	(36,809)	[8,834]	{4,417}	184,081	(36,816)	[8,836]	{4,418}	184,113	(36,823)	[8,837]	{4,419}
Dutchess	29,507	29,508	29,512	29,514	29,518	(5,904)	[1,417]	{708}	29,521	(5,904)	[1,417]	{709}	29,524	(5,905)	[1,417]	{709}
Erie	89,660	89,665	89,668	89,678	89,685	(17,937)	[4,305]	{2,152}	89,691	(17,938)	[4,305]	{2,153}	89,697	(17,939)	[4,305]	{2,153}
Kings	281,282	281,332	281,368	281,420	281,520	(56,304)	[13,513]	{6,756}	281,619	(56,324)	[13,518]	{6,759}	281,717	(56,343)	[13,522]	{6,761}
Monroe	69,146	69,152	69,163	69,178	69,191	(13,838)	[3,321]	{1,661}	69,203	(13,841)	[3,322]	{1,661}	69,213	(13,843)	[3,322]	{1,661}
Nassau	183,948	183,963	183,980	184,017	184,057	(36,811)	[8,835]	{4,417}	184,095	(36,819)	[8,837]	{4,418}	184,134	(36,827)	[8,838]	{4,419}
New York	138,674	138,698	138,742	138,773	138,832	(27,766)	[6,664]	{3,332}	138,891	(27,778)	[6,667]	{3,333}	138,950	(27,790)	[6,670]	{3,335}
Niagara	20,057	20,058	20,059	20,059	20,061	(4,012)	[963]	{481}	20,063	(4,013)	[963]	{482}	20,064	(4,013)	[963]	{482}
Onondaga	39,024	39,030	39,035	39,044	39,052	(7,810)	[1,875]	{937}	39,060	(7,812)	[1,875]	{937}	39,066	(7,813)	[1,875]	{938}
Orange	48,405	48,409	48,417	48,424	48,436	(9,687)	[2,325]	{1,162}	48,447	(9,689)	[2,325]	{1,163}	48,457	(9,691)	[2,326]	{1,163}
Putnam	10,628	10,629	10,630	10,631	10,633	(2,127)	[510]	{255}	10,634	(2,127)	[510]	{255}	10,636	(2,127)	[511]	{255}
Queens	277,911	277,942	277,974	278,029	278,113	(55,623)	[13,349]	{6,675}	278,195	(55,639)	[13,353]	{6,677}	278,276	(55,655)	[13,357]	{6,679}
Rensselaer	11,248	11,248	11,249	11,251	11,253	(2,251)	[540]	{270}	11,255	(2,251)	[540]	{270}	11,257	(2,251)	[540]	{270}
Richmond	75,298	75,326	75,364	75,404	75,471	(15,094)	[3,623]	{1,811}	75,543	(15,109)	[3,626]	{1,813}	75,620	(15,124)	[3,630]	{1,815}
Rockland	47,014	47,017	47,022	47,027	47,037	(9,407)	[2,258]	{1,129}	47,046	(9,409)	[2,258]	{1,129}	47,055	(9,411)	[2,259]	{1,129}
Saratoga	15,404	15,409	15,412	15,414	15,418	(3,084)	[740]	{370}	15,421	(3,084)	[740]	{370}	15,425	(3,085)	[740]	{370}
Schenectady	13,217	13,217	13,217	13,217	13,218	(2,644)	[634]	{317}	13,220	(2,644)	[635]	{317}	13,221	(2,644)	[635]	{317}
Suffolk	201,398	201,418	201,431	201,456	201,496	(40,299)	[9,672]	{4,836}	201,533	(40,307)	[9,674]	{4,837}	201,568	(40,314)	[9,675]	{4,838}
Sullivan	6,691	6,692	6,692	6,693	6,695	(1,339)	[321]	{161}	6,697	(1,339)	[321]	{161}	6,698	(1,340)	[322]	{161}
Tompkins	4,358	4,359	4,359	4,359	4,360	(872)	[209]	{105}	4,362	(872)	[209]	{105}	4,363	(873)	[209]	{105}
Ulster	13,927	13,927	13,928	13,929	13,931	(2,786)	[669]	{334}	13,932	(2,786)	[669]	{334}	13,934	(2,787)	[669]	{334}
Westchester	129,835	129,849	129,866	129,888	129,911	(25,982)	[6,236]	{3,118}	129,934	(25,987)	[6,237]	{3,118}	129,956	(25,991)	[6,238]	{3,119}

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.