

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 5/12/21**

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 5/12/21 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.

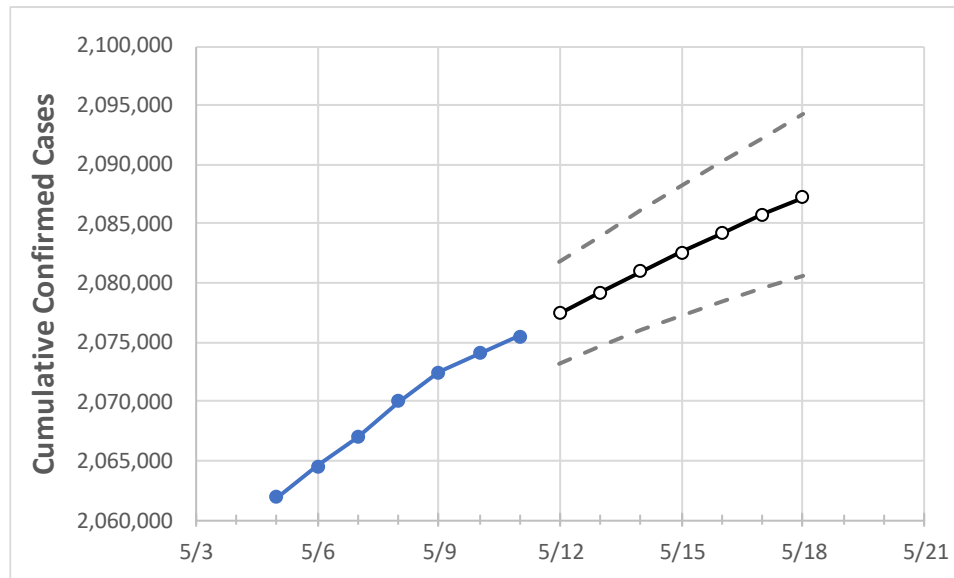
IEM's Modeling Lead

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:						
	5/8	5/9	5/10	5/11	5/12	5/13	5/14	5/15	5/16	5/17	5/18	
New York	2,070,053	2,072,426	2,074,079	2,075,539	2,077,449	2,079,238	2,080,945	2,082,608	2,084,232	2,085,759	2,087,205	

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:						
	5/8	5/9	5/10	5/11	5/12	5/13	5/14	5/15	5/16	5/17	5/18
Albany	24,302	24,321	24,334	24,349	24,363	24,377	24,389	24,401	24,412	24,423	24,433
Bronx	180,326	180,491	180,623	180,697	180,831	180,956	181,077	181,192	181,302	181,411	181,513
Dutchess	28,975	29,009	29,038	29,064	29,095	29,125	29,154	29,181	29,207	29,234	29,258
Erie	87,569	87,702	87,790	87,877	87,994	88,104	88,206	88,305	88,399	88,488	88,571
Kings	275,507	275,850	276,081	276,228	276,480	276,720	276,936	277,156	277,359	277,549	277,733
Monroe	65,417	65,639	65,791	65,936	66,118	66,297	66,475	66,650	66,823	66,997	67,166
Nassau	181,553	181,639	181,727	181,804	181,895	181,979	182,058	182,135	182,207	182,275	182,342
New York	136,149	136,253	136,330	136,399	136,490	136,580	136,661	136,743	136,820	136,893	136,964
Niagara	19,458	19,506	19,527	19,556	19,592	19,627	19,660	19,692	19,723	19,752	19,780
Onondaga	37,609	37,714	37,744	37,769	37,823	37,875	37,925	37,973	38,020	38,069	38,112
Orange	47,615	47,654	47,682	47,706	47,742	47,776	47,807	47,837	47,866	47,893	47,920
Putnam	10,504	10,512	10,516	10,521	10,527	10,533	10,539	10,544	10,549	10,554	10,559
Queens	272,594	272,871	273,084	273,237	273,448	273,643	273,830	274,004	274,168	274,325	274,476
Rensselaer	11,011	11,026	11,037	11,049	11,058	11,066	11,074	11,082	11,090	11,097	11,104
Richmond	73,536	73,594	73,682	73,733	73,796	73,855	73,910	73,964	74,014	74,063	74,107
Rockland	46,532	46,545	46,553	46,564	46,583	46,600	46,616	46,631	46,645	46,658	46,670
Saratoga	14,948	14,976	14,994	15,014	15,033	15,051	15,070	15,088	15,105	15,122	15,139
Schenectady	12,872	12,888	12,909	12,924	12,944	12,963	12,981	13,000	13,018	13,036	13,054
Suffolk	198,574	198,695	198,802	198,906	199,027	199,141	199,247	199,352	199,451	199,540	199,625
Sullivan	6,488	6,503	6,508	6,517	6,525	6,532	6,539	6,546	6,552	6,558	6,563
Tompkins	4,200	4,209	4,210	4,214	4,220	4,226	4,232	4,237	4,243	4,249	4,254
Ulster	13,663	13,679	13,691	13,705	13,720	13,735	13,749	13,763	13,775	13,787	13,799
Westchester	128,412	128,474	128,531	128,584	128,641	128,696	128,747	128,796	128,841	128,883	128,925

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:											
	5/8	5/9	5/10	5/11	5/13				5/15				5/17			
Albany	24,302	24,321	24,334	24,349	24,377	(4,875)	[1,170]	{585}	24,401	(4,880)	[1,171]	{586}	24,423	(4,885)	[1,172]	{586}
Bronx	180,326	180,491	180,623	180,697	180,956	(36,191)	[8,686]	{4,343}	181,192	(36,238)	[8,697]	{4,349}	181,411	(36,282)	[8,708]	{4,354}
Dutchess	28,975	29,009	29,038	29,064	29,125	(5,825)	[1,398]	{699}	29,181	(5,836)	[1,401]	{700}	29,234	(5,847)	[1,403]	{702}
Erie	87,569	87,702	87,790	87,877	88,104	(17,621)	[4,229]	{2,115}	88,305	(17,661)	[4,239]	{2,119}	88,488	(17,698)	[4,247]	{2,124}
Kings	275,507	275,850	276,081	276,228	276,720	(55,344)	[13,283]	{6,641}	277,156	(55,431)	[13,303]	{6,652}	277,549	(55,510)	[13,322]	{6,661}
Monroe	65,417	65,639	65,791	65,936	66,297	(13,259)	[3,182]	{1,591}	66,650	(13,330)	[3,199]	{1,600}	66,997	(13,399)	[3,216]	{1,608}
Nassau	181,553	181,639	181,727	181,804	181,979	(36,396)	[8,735]	{4,367}	182,135	(36,427)	[8,742]	{4,371}	182,275	(36,455)	[8,749]	{4,375}
New York	136,149	136,253	136,330	136,399	136,580	(27,316)	[6,556]	{3,278}	136,743	(27,349)	[6,564]	{3,282}	136,893	(27,379)	[6,571]	{3,285}
Niagara	19,458	19,506	19,527	19,556	19,627	(3,925)	[942]	{471}	19,692	(3,938)	[945]	{473}	19,752	(3,950)	[948]	{474}
Onondaga	37,609	37,714	37,744	37,769	37,875	(7,575)	[1,818]	{909}	37,973	(7,595)	[1,823]	{911}	38,069	(7,614)	[1,827]	{914}
Orange	47,615	47,654	47,682	47,706	47,776	(9,555)	[2,293]	{1,147}	47,837	(9,567)	[2,296]	{1,148}	47,893	(9,579)	[2,299]	{1,149}
Putnam	10,504	10,512	10,516	10,521	10,533	(2,107)	[506]	{253}	10,544	(2,109)	[506]	{253}	10,554	(2,111)	[507]	{253}
Queens	272,594	272,871	273,084	273,237	273,643	(54,729)	[13,135]	{6,567}	274,004	(54,801)	[13,152]	{6,576}	274,325	(54,865)	[13,168]	{6,584}
Rensselaer	11,011	11,026	11,037	11,049	11,066	(2,213)	[531]	{266}	11,082	(2,216)	[532]	{266}	11,097	(2,219)	[533]	{266}
Richmond	73,536	73,594	73,682	73,733	73,855	(14,771)	[3,545]	{1,773}	73,964	(14,793)	[3,550]	{1,775}	74,063	(14,813)	[3,555]	{1,778}
Rockland	46,532	46,545	46,553	46,564	46,600	(9,320)	[2,237]	{1,118}	46,631	(9,326)	[2,238]	{1,119}	46,658	(9,332)	[2,240]	{1,120}
Saratoga	14,948	14,976	14,994	15,014	15,051	(3,010)	[722]	{361}	15,088	(3,018)	[724]	{362}	15,122	(3,024)	[726]	{363}
Schenectady	12,872	12,888	12,909	12,924	12,963	(2,593)	[622]	{311}	13,000	(2,600)	[624]	{312}	13,036	(2,607)	[626]	{313}
Suffolk	198,574	198,695	198,802	198,906	199,141	(39,828)	[9,559]	{4,779}	199,352	(39,870)	[9,569]	{4,784}	199,540	(39,908)	[9,578]	{4,789}
Sullivan	6,488	6,503	6,508	6,517	6,532	(1,306)	[314]	{157}	6,546	(1,309)	[314]	{157}	6,558	(1,312)	[315]	{157}
Tompkins	4,200	4,209	4,210	4,214	4,226	(845)	[203]	{101}	4,237	(847)	[203]	{102}	4,249	(850)	[204]	{102}
Ulster	13,663	13,679	13,691	13,705	13,735	(2,747)	[659]	{330}	13,763	(2,753)	[661]	{330}	13,787	(2,757)	[662]	{331}
Westchester	128,412	128,474	128,531	128,584	128,696	(25,739)	[6,177]	{3,089}	128,796	(25,759)	[6,182]	{3,091}	128,883	(25,777)	[6,186]	{3,093}

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.