

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

Date: 2/18/22

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 2/18/22 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.

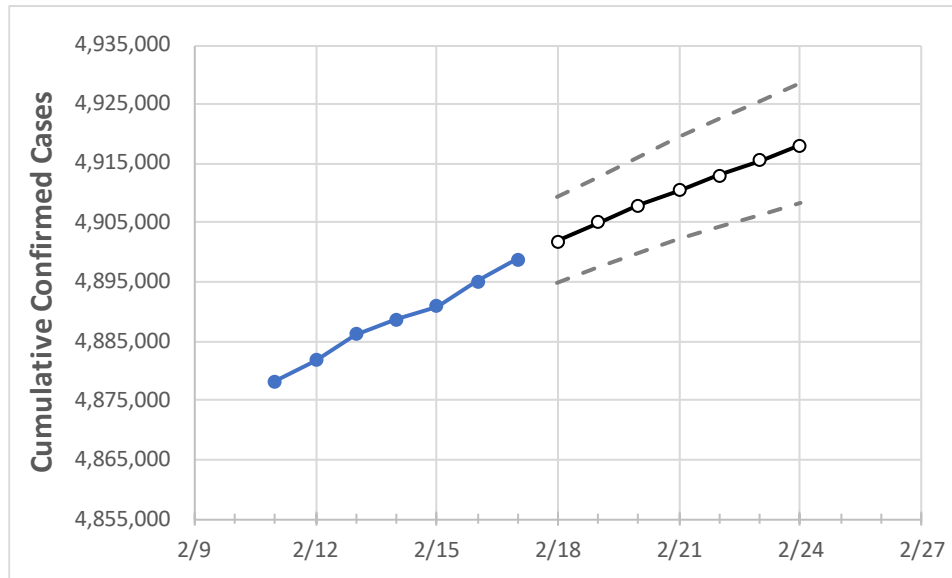
IEM's Modeling Lead

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:							
	2/14	2/15	2/16	2/17	2/18	2/19	2/20	2/21	2/22	2/23	2/24	
New York	4,888,634	4,890,903	4,895,155	4,898,887	4,901,940	4,905,024	4,907,926	4,910,546	4,913,088	4,915,610	4,918,079	

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:						
	2/14	2/15	2/16	2/17	2/18	2/19	2/20	2/21	2/22	2/23	2/24
Albany	57,334	57,381	57,454	57,516	57,594	57,669	57,734	57,803	57,872	57,931	57,997
Bronx	402,723	402,795	402,912	403,042	403,164	403,286	403,401	403,511	403,607	403,708	403,796
Dutchess	62,749	62,776	62,804	62,853	62,894	62,932	62,968	63,005	63,037	63,069	63,098
Erie	204,072	204,219	204,352	204,513	204,655	204,788	204,915	205,036	205,147	205,258	205,359
Kings	681,826	682,070	682,323	682,708	683,041	683,347	683,628	683,901	684,155	684,406	684,630
Monroe	148,153	148,218	148,316	148,455	148,559	148,659	148,750	148,841	148,928	149,012	149,089
Nassau	396,250	396,418	396,617	396,845	397,039	397,218	397,383	397,546	397,709	397,862	397,998
New York	398,597	398,762	399,013	399,369	399,608	399,830	400,057	400,257	400,453	400,656	400,819
Niagara	46,803	46,840	46,862	46,899	46,932	46,962	46,991	47,017	47,044	47,068	47,093
Onondaga	105,492	105,589	105,776	105,917	106,052	106,179	106,310	106,427	106,539	106,650	106,754
Orange	107,943	108,038	108,134	108,212	108,284	108,350	108,411	108,473	108,529	108,587	108,638
Putnam	23,131	23,140	23,154	23,163	23,174	23,185	23,195	23,204	23,214	23,223	23,231
Queens	631,620	631,785	632,026	632,278	632,575	632,843	633,105	633,349	633,571	633,835	634,013
Rensselaer	30,375	30,406	30,439	30,476	30,514	30,550	30,585	30,620	30,650	30,682	30,712
Richmond	163,250	163,316	163,390	163,469	163,538	163,601	163,667	163,725	163,781	163,834	163,883
Rockland	90,758	90,802	90,841	90,885	90,928	90,972	91,011	91,051	91,089	91,124	91,158
Saratoga	44,496	44,526	44,577	44,651	44,709	44,759	44,809	44,859	44,905	44,950	44,990
Schenectady	31,958	31,973	32,005	32,055	32,089	32,123	32,154	32,185	32,214	32,244	32,269
Suffolk	420,599	420,752	420,923	421,124	421,298	421,466	421,615	421,767	421,904	422,040	422,161
Sullivan	18,002	18,013	18,032	18,047	18,062	18,076	18,090	18,103	18,115	18,127	18,138
Tompkins	17,011	17,034	17,062	17,100	17,128	17,156	17,182	17,208	17,230	17,258	17,280
Ulster	30,409	30,426	30,457	30,503	30,530	30,559	30,585	30,611	30,635	30,658	30,681
Westchester	245,086	245,173	245,290	245,430	245,552	245,662	245,764	245,871	245,968	246,062	246,149

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:											
	2/14	2/15	2/16	2/17	2/19				2/21				2/23			
Albany	57,334	57,381	57,454	57,516	57,669	(11,534)	[2,768]	{1,384}	57,803	(11,561)	[2,775]	{1,387}	57,931	(11,586)	[2,781]	{1,390}
Bronx	402,723	402,795	402,912	403,042	403,286	(80,657)	[19,358]	{9,679}	403,511	(80,702)	[19,369]	{9,684}	403,708	(80,742)	[19,378]	{9,689}
Dutchess	62,749	62,776	62,804	62,853	62,932	(12,586)	[3,021]	{1,510}	63,005	(12,601)	[3,024]	{1,512}	63,069	(12,614)	[3,027]	{1,514}
Erie	204,072	204,219	204,352	204,513	204,788	(40,958)	[9,830]	{4,915}	205,036	(41,007)	[9,842]	{4,921}	205,258	(41,052)	[9,852]	{4,926}
Kings	681,826	682,070	682,323	682,708	683,347	(136,669)	[32,801]	{16,400}	683,901	(136,780)	[32,827]	{16,414}	684,406	(136,881)	[32,851]	{16,426}
Monroe	148,153	148,218	148,316	148,455	148,659	(29,732)	[7,136]	{3,568}	148,841	(29,768)	[7,144]	{3,572}	149,012	(29,802)	[7,153]	{3,576}
Nassau	396,250	396,418	396,617	396,845	397,218	(79,444)	[19,066]	{9,533}	397,546	(79,509)	[19,082]	{9,541}	397,862	(79,572)	[19,097]	{9,549}
New York	398,597	398,762	399,013	399,369	399,830	(79,966)	[19,192]	{9,596}	400,257	(80,051)	[19,212]	{9,606}	400,656	(80,131)	[19,231]	{9,616}
Niagara	46,803	46,840	46,862	46,899	46,962	(9,392)	[2,254]	{1,127}	47,017	(9,403)	[2,257]	{1,128}	47,068	(9,414)	[2,259]	{1,130}
Onondaga	105,492	105,589	105,776	105,917	106,179	(21,236)	[5,097]	{2,548}	106,427	(21,285)	[5,108]	{2,554}	106,650	(21,330)	[5,119]	{2,560}
Orange	107,943	108,038	108,134	108,212	108,350	(21,670)	[5,201]	{2,600}	108,473	(21,695)	[5,207]	{2,603}	108,587	(21,717)	[5,212]	{2,606}
Putnam	23,131	23,140	23,154	23,163	23,185	(4,637)	[1,113]	{556}	23,204	(4,641)	[1,114]	{557}	23,223	(4,645)	[1,115]	{557}
Queens	631,620	631,785	632,026	632,278	632,843	(126,569)	[30,376]	{15,188}	633,349	(126,670)	[30,401]	{15,200}	633,835	(126,767)	[30,424]	{15,212}
Rensselaer	30,375	30,406	30,439	30,476	30,550	(6,110)	[1,466]	{733}	30,620	(6,124)	[1,470]	{735}	30,682	(6,136)	[1,473]	{736}
Richmond	163,250	163,316	163,390	163,469	163,601	(32,720)	[7,853]	{3,926}	163,725	(32,745)	[7,859]	{3,929}	163,834	(32,767)	[7,864]	{3,932}
Rockland	90,758	90,802	90,841	90,885	90,972	(18,194)	[4,367]	{2,183}	91,051	(18,210)	[4,370]	{2,185}	91,124	(18,225)	[4,374]	{2,187}
Saratoga	44,496	44,526	44,577	44,651	44,759	(8,952)	[2,148]	{1,074}	44,859	(8,972)	[2,153]	{1,077}	44,950	(8,990)	[2,158]	{1,079}
Schenectady	31,958	31,973	32,005	32,055	32,123	(6,425)	[1,542]	{771}	32,185	(6,437)	[1,545]	{772}	32,244	(6,449)	[1,548]	{774}
Suffolk	420,599	420,752	420,923	421,124	421,466	(84,293)	[20,230]	{10,115}	421,767	(84,353)	[20,245]	{10,122}	422,040	(84,408)	[20,258]	{10,129}
Sullivan	18,002	18,013	18,032	18,047	18,076	(3,615)	[868]	{434}	18,103	(3,621)	[869]	{434}	18,127	(3,625)	[870]	{435}
Tompkins	17,011	17,034	17,062	17,100	17,156	(3,431)	[823]	{412}	17,208	(3,442)	[826]	{413}	17,258	(3,452)	[828]	{414}
Ulster	30,409	30,426	30,457	30,503	30,559	(6,112)	[1,467]	{733}	30,611	(6,122)	[1,469]	{735}	30,658	(6,132)	[1,472]	{736}
Westchester	245,086	245,173	245,290	245,430	245,662	(49,132)	[11,792]	{5,896}	245,871	(49,174)	[11,802]	{5,901}	246,062	(49,212)	[11,811]	{5,905}

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.