

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

Date: 1/27/21

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 1/27/21 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.

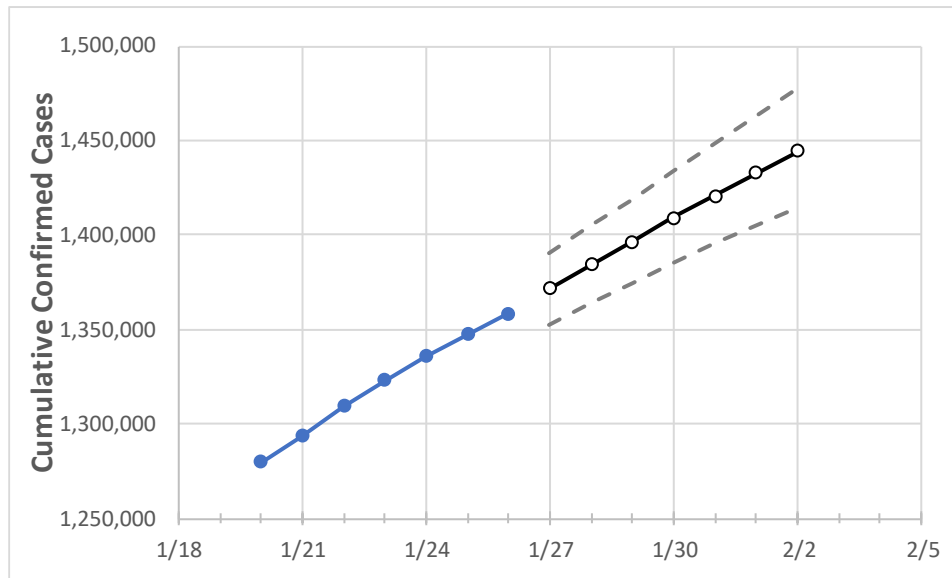
IEM's Modeling Lead

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:					
	1/23	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31	2/1	2/2
New York	1,323,312	1,335,695	1,347,667	1,358,707	1,371,520	1,384,080	1,396,612	1,408,865	1,420,841	1,432,858	1,444,562

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

New York Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	1/23	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31	2/1	2/2
Albany	17,287	17,485	17,620	17,798	18,001	18,201	18,399	18,595	18,787	18,977	19,169
Bronx	110,594	111,672	112,912	114,006	115,245	116,501	117,760	119,036	120,302	121,577	122,893
Dutchess	17,623	17,813	18,004	18,235	18,445	18,650	18,852	19,051	19,245	19,435	19,622
Erie	54,097	54,502	54,873	55,184	55,639	56,091	56,529	56,973	57,404	57,830	58,267
Kings	162,202	163,707	165,264	166,634	168,366	170,152	171,908	173,655	175,404	177,142	178,883
Monroe	45,706	46,064	46,265	46,476	46,750	47,013	47,268	47,510	47,744	47,966	48,177
Nassau	119,933	121,002	122,200	123,142	124,267	125,361	126,443	127,478	128,494	129,515	130,502
New York	79,105	79,916	80,797	81,511	82,389	83,259	84,128	85,024	85,926	86,838	87,742
Niagara	12,718	12,843	12,933	13,056	13,194	13,329	13,458	13,586	13,713	13,835	13,953
Onondaga	28,797	29,039	29,147	29,264	29,480	29,700	29,909	30,111	30,312	30,506	30,693
Orange	30,012	30,288	30,545	30,909	31,209	31,512	31,818	32,119	32,422	32,736	33,038
Putnam	6,824	6,927	7,004	7,071	7,151	7,231	7,311	7,390	7,468	7,546	7,622
Queens	165,178	166,808	168,404	169,941	171,678	173,409	175,104	176,823	178,542	180,248	181,981
Rensselaer	7,349	7,450	7,502	7,574	7,676	7,780	7,879	7,976	8,075	8,174	8,269
Richmond	46,861	47,253	47,641	47,981	48,385	48,780	49,170	49,557	49,935	50,297	50,662
Rockland	32,948	33,124	33,327	33,532	33,766	33,999	34,229	34,463	34,695	34,928	35,153
Saratoga	9,842	9,951	10,020	10,109	10,231	10,349	10,467	10,583	10,694	10,803	10,908
Schenectady	9,131	9,231	9,299	9,373	9,482	9,586	9,688	9,787	9,886	9,982	10,077
Suffolk	134,057	135,174	136,593	137,728	139,001	140,234	141,448	142,632	143,764	144,883	145,976
Sullivan	3,994	4,015	4,038	4,068	4,100	4,130	4,161	4,192	4,222	4,252	4,281
Tompkins	2,811	2,831	2,845	2,864	2,892	2,921	2,949	2,977	3,005	3,032	3,060
Ulster	8,129	8,227	8,301	8,388	8,483	8,577	8,671	8,767	8,861	8,952	9,045
Westchester	88,404	89,225	90,029	90,665	91,483	92,312	93,119	93,940	94,765	95,569	96,378

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:											
	1/23	1/24	1/25	1/26	1/28				1/30				2/1			
Albany	17,287	17,485	17,620	17,798	18,201	(3,640)	[874]	{437}	18,595	(3,719)	[893]	{446}	18,977	(3,795)	[911]	{455}
Bronx	110,594	111,672	112,912	114,006	116,501	(23,300)	[5,592]	{2,796}	119,036	(23,807)	[5,714]	{2,857}	121,577	(24,315)	[5,836]	{2,918}
Dutchess	17,623	17,813	18,004	18,235	18,650	(3,730)	[895]	{448}	19,051	(3,810)	[914]	{457}	19,435	(3,887)	[933]	{466}
Erie	54,097	54,502	54,873	55,184	56,091	(11,218)	[2,692]	{1,346}	56,973	(11,395)	[2,735]	{1,367}	57,830	(11,566)	[2,776]	{1,388}
Kings	162,202	163,707	165,264	166,634	170,152	(34,030)	[8,167]	{4,084}	173,655	(34,731)	[8,335]	{4,168}	177,142	(35,428)	[8,503]	{4,251}
Monroe	45,706	46,064	46,265	46,476	47,013	(9,403)	[2,257]	{1,128}	47,510	(9,502)	[2,280]	{1,140}	47,966	(9,593)	[2,302]	{1,151}
Nassau	119,933	121,002	122,200	123,142	125,361	(25,072)	[6,017]	{3,009}	127,478	(25,496)	[6,119]	{3,059}	129,515	(25,903)	[6,217]	{3,108}
New York	79,105	79,916	80,797	81,511	83,259	(16,652)	[3,996]	{1,998}	85,024	(17,005)	[4,081]	{2,041}	86,838	(17,368)	[4,168]	{2,084}
Niagara	12,718	12,843	12,933	13,056	13,329	(2,666)	[640]	{320}	13,586	(2,717)	[652]	{326}	13,835	(2,767)	[664]	{332}
Onondaga	28,797	29,039	29,147	29,264	29,700	(5,940)	[1,426]	{713}	30,111	(6,022)	[1,445]	{723}	30,506	(6,101)	[1,464]	{732}
Orange	30,012	30,288	30,545	30,909	31,512	(6,302)	[1,513]	{756}	32,119	(6,424)	[1,542]	{771}	32,736	(6,547)	[1,571]	{786}
Putnam	6,824	6,927	7,004	7,071	7,231	(1,446)	[347]	{174}	7,390	(1,478)	[355]	{177}	7,546	(1,509)	[362]	{181}
Queens	165,178	166,808	168,404	169,941	173,409	(34,682)	[8,324]	{4,162}	176,823	(35,365)	[8,487]	{4,244}	180,248	(36,050)	[8,652]	{4,326}
Rensselaer	7,349	7,450	7,502	7,574	7,780	(1,556)	[373]	{187}	7,976	(1,595)	[383]	{191}	8,174	(1,635)	[392]	{196}
Richmond	46,861	47,253	47,641	47,981	48,780	(9,756)	[2,341]	{1,171}	49,557	(9,911)	[2,379]	{1,189}	50,297	(10,059)	[2,414]	{1,207}
Rockland	32,948	33,124	33,327	33,532	33,999	(6,800)	[1,632]	{816}	34,463	(6,893)	[1,654]	{827}	34,928	(6,986)	[1,677]	{838}
Saratoga	9,842	9,951	10,020	10,109	10,349	(2,070)	[497]	{248}	10,583	(2,117)	[508]	{254}	10,803	(2,161)	[519]	{259}
Schenectady	9,131	9,231	9,299	9,373	9,586	(1,917)	[460]	{230}	9,787	(1,957)	[470]	{235}	9,982	(1,996)	[479]	{240}
Suffolk	134,057	135,174	136,593	137,728	140,234	(28,047)	[6,731]	{3,366}	142,632	(28,526)	[6,846]	{3,423}	144,883	(28,977)	[6,954]	{3,477}
Sullivan	3,994	4,015	4,038	4,068	4,130	(826)	[198]	{99}	4,192	(838)	[201]	{101}	4,252	(850)	[204]	{102}
Tompkins	2,811	2,831	2,845	2,864	2,921	(584)	[140]	{70}	2,977	(595)	[143]	{71}	3,032	(606)	[146]	{73}
Ulster	8,129	8,227	8,301	8,388	8,577	(1,715)	[412]	{206}	8,767	(1,753)	[421]	{210}	8,952	(1,790)	[430]	{215}
Westchester	88,404	89,225	90,029	90,665	92,312	(18,462)	[4,431]	{2,215}	93,940	(18,788)	[4,509]	{2,255}	95,569	(19,114)	[4,587]	{2,294}

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.