

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

Date: 1/25/21

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 1/25/21 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.

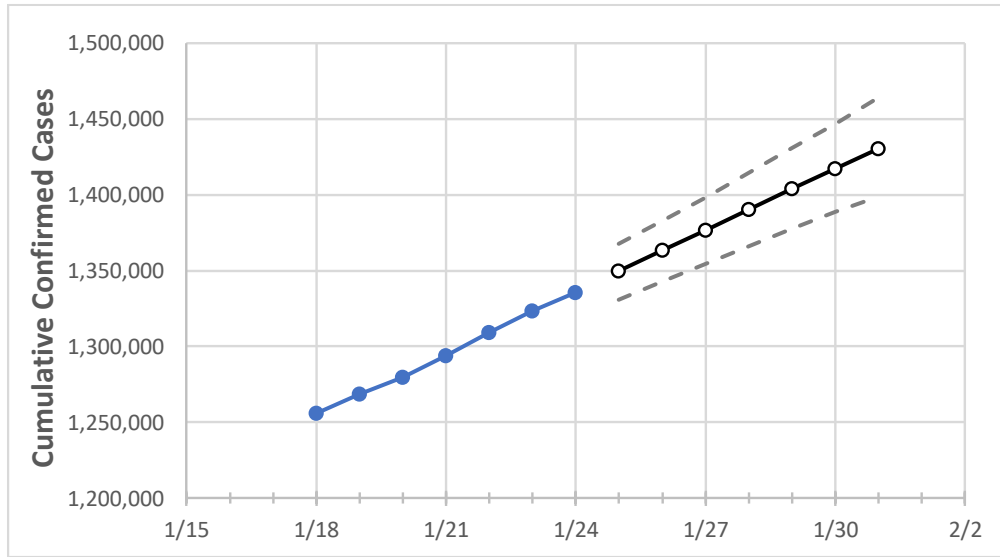
IEM's Modeling Lead

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:						
	1/21	1/22	1/23	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31
New York	1,293,719	1,309,403	1,323,312	1,335,695	1,349,607	1,363,200	1,376,845	1,390,387	1,403,893	1,417,241	1,430,590

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:						
	1/21	1/22	1/23	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31
Albany	16,788	17,045	17,287	17,485	17,706	17,925	18,138	18,351	18,563	18,774	18,981
Bronx	107,879	109,290	110,594	111,672	112,905	114,143	115,405	116,684	117,954	119,254	120,555
Dutchess	17,182	17,424	17,623	17,813	18,031	18,246	18,456	18,667	18,873	19,077	19,276
Erie	53,064	53,605	54,097	54,502	55,008	55,497	55,982	56,474	56,959	57,446	57,934
Kings	158,534	160,572	162,202	163,707	165,556	167,427	169,336	171,235	173,139	175,063	177,006
Monroe	45,002	45,400	45,706	46,064	46,409	46,750	47,074	47,398	47,705	48,014	48,318
Nassau	117,371	118,735	119,933	121,002	122,183	123,341	124,486	125,622	126,726	127,813	128,883
New York	77,267	78,198	79,105	79,916	80,803	81,698	82,608	83,517	84,430	85,331	86,288
Niagara	12,410	12,602	12,718	12,843	12,998	13,148	13,301	13,446	13,599	13,744	13,888
Onondaga	28,226	28,476	28,797	29,039	29,293	29,542	29,793	30,036	30,277	30,506	30,738
Orange	29,406	29,753	30,012	30,288	30,580	30,889	31,194	31,498	31,803	32,104	32,405
Putnam	6,670	6,748	6,824	6,927	7,011	7,094	7,177	7,260	7,340	7,422	7,505
Queens	161,507	163,464	165,178	166,808	168,599	170,385	172,181	173,991	175,817	177,631	179,426
Rensselaer	7,112	7,262	7,349	7,450	7,569	7,687	7,804	7,920	8,035	8,144	8,258
Richmond	45,939	46,442	46,861	47,253	47,694	48,136	48,581	49,016	49,446	49,872	50,302
Rockland	32,407	32,660	32,948	33,124	33,368	33,610	33,849	34,092	34,336	34,583	34,829
Saratoga	9,527	9,689	9,842	9,951	10,088	10,221	10,353	10,482	10,610	10,734	10,858
Schenectady	8,869	9,021	9,131	9,231	9,351	9,470	9,585	9,700	9,817	9,932	10,041
Suffolk	131,309	132,748	134,057	135,174	136,502	137,793	139,051	140,284	141,488	142,656	143,829
Sullivan	3,923	3,954	3,994	4,015	4,050	4,085	4,120	4,155	4,189	4,223	4,258
Tompkins	2,752	2,779	2,811	2,831	2,864	2,898	2,932	2,967	3,002	3,037	3,073
Ulster	7,901	8,017	8,129	8,227	8,329	8,433	8,536	8,639	8,739	8,842	8,944
Westchester	86,646	87,570	88,404	89,225	90,079	90,937	91,798	92,655	93,524	94,400	95,271

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:											
	1/21	1/22	1/23	1/24	1/26		1/28		1/30							
Albany	16,788	17,045	17,287	17,485	17,925	(3,585)	[860]	{430}	18,351	(3,670)	[881]	{440}	18,774	(3,755)	[901]	{451}
Bronx	107,879	109,290	110,594	111,672	114,143	(22,829)	[5,479]	{2,739}	116,684	(23,337)	[5,601]	{2,800}	119,254	(23,851)	[5,724]	{2,862}
Dutchess	17,182	17,424	17,623	17,813	18,246	(3,649)	[876]	{438}	18,667	(3,733)	[896]	{448}	19,077	(3,815)	[916]	{458}
Erie	53,064	53,605	54,097	54,502	55,497	(11,099)	[2,664]	{1,332}	56,474	(11,295)	[2,711]	{1,355}	57,446	(11,489)	[2,757]	{1,379}
Kings	158,534	160,572	162,202	163,707	167,427	(33,485)	[8,037]	{4,018}	171,235	(34,247)	[8,219]	{4,110}	175,063	(35,013)	[8,403]	{4,202}
Monroe	45,002	45,400	45,706	46,064	46,750	(9,350)	[2,244]	{1,122}	47,398	(9,480)	[2,275]	{1,138}	48,014	(9,603)	[2,305]	{1,152}
Nassau	117,371	118,735	119,933	121,002	123,341	(24,668)	[5,920]	{2,960}	125,622	(25,124)	[6,030]	{3,015}	127,813	(25,563)	[6,135]	{3,068}
New York	77,267	78,198	79,105	79,916	81,698	(16,340)	[3,922]	{1,961}	83,517	(16,703)	[4,009]	{2,004}	85,331	(17,066)	[4,096]	{2,048}
Niagara	12,410	12,602	12,718	12,843	13,148	(2,630)	[631]	{316}	13,446	(2,689)	[645]	{323}	13,744	(2,749)	[660]	{330}
Onondaga	28,226	28,476	28,797	29,039	29,542	(5,908)	[1,418]	{709}	30,036	(6,007)	[1,442]	{721}	30,506	(6,101)	[1,464]	{732}
Orange	29,406	29,753	30,012	30,288	30,889	(6,178)	[1,483]	{741}	31,498	(6,300)	[1,512]	{756}	32,104	(6,421)	[1,541]	{771}
Putnam	6,670	6,748	6,824	6,927	7,094	(1,419)	[341]	{170}	7,260	(1,452)	[348]	{174}	7,422	(1,484)	[356]	{178}
Queens	161,507	163,464	165,178	166,808	170,385	(34,077)	[8,178]	{4,089}	173,991	(34,798)	[8,352]	{4,176}	177,631	(35,526)	[8,526]	{4,263}
Rensselaer	7,112	7,262	7,349	7,450	7,687	(1,537)	[369]	{184}	7,920	(1,584)	[380]	{190}	8,144	(1,629)	[391]	{195}
Richmond	45,939	46,442	46,861	47,253	48,136	(9,627)	[2,311]	{1,155}	49,016	(9,803)	[2,353]	{1,176}	49,872	(9,974)	[2,394]	{1,197}
Rockland	32,407	32,660	32,948	33,124	33,610	(6,722)	[1,613]	{807}	34,092	(6,818)	[1,636]	{818}	34,583	(6,917)	[1,660]	{830}
Saratoga	9,527	9,689	9,842	9,951	10,221	(2,044)	[491]	{245}	10,482	(2,096)	[503]	{252}	10,734	(2,147)	[515]	{258}
Schenectady	8,869	9,021	9,131	9,231	9,470	(1,894)	[455]	{227}	9,700	(1,940)	[466]	{233}	9,932	(1,986)	[477]	{238}
Suffolk	131,309	132,748	134,057	135,174	137,793	(27,559)	[6,614]	{3,307}	140,284	(28,057)	[6,734]	{3,367}	142,656	(28,531)	[6,847]	{3,424}
Sullivan	3,923	3,954	3,994	4,015	4,085	(817)	[196]	{98}	4,155	(831)	[199]	{100}	4,223	(845)	[203]	{101}
Tompkins	2,752	2,779	2,811	2,831	2,898	(580)	[139]	{70}	2,967	(593)	[142]	{71}	3,037	(607)	[146]	{73}
Ulster	7,901	8,017	8,129	8,227	8,433	(1,687)	[405]	{202}	8,639	(1,728)	[415]	{207}	8,842	(1,768)	[424]	{212}
Westchester	86,646	87,570	88,404	89,225	90,937	(18,187)	[4,365]	{2,182}	92,655	(18,531)	[4,447]	{2,224}	94,400	(18,880)	[4,531]	{2,266}

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.