

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 1/21/22**

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 1/21/22 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.

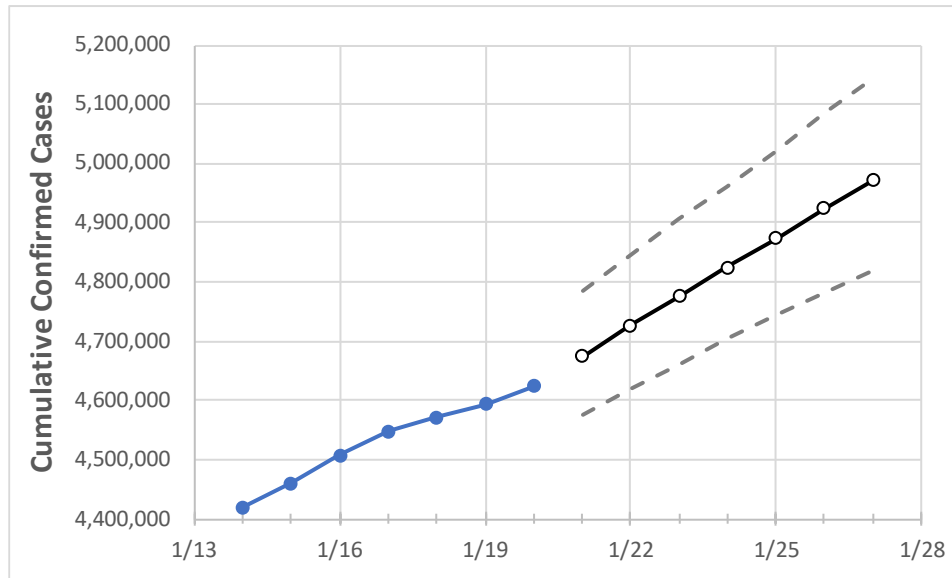
IEM's Modeling Lead

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:							
	1/17	1/18	1/19	1/20	1/21	1/22	1/23	1/24	1/25	1/26	1/27	
New York	4,547,472	4,571,356	4,594,182	4,624,257	4,674,838	4,726,639	4,775,134	4,825,493	4,874,148	4,924,003	4,972,357	

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:						
	1/17	1/18	1/19	1/20	1/21	1/22	1/23	1/24	1/25	1/26	1/27
Albany	51,823	52,146	52,444	52,918	53,669	54,426	55,169	55,938	56,694	57,487	58,316
Bronx	382,144	384,448	385,713	387,372	392,566	398,175	403,435	408,605	413,959	419,311	423,934
Dutchess	58,133	58,418	58,736	59,146	59,921	60,704	61,456	62,243	63,023	63,808	64,610
Erie	187,260	188,389	189,318	190,704	193,178	195,767	198,312	200,876	203,482	206,202	208,846
Kings	636,407	640,739	644,060	647,831	655,866	663,569	670,951	678,634	685,851	693,401	700,299
Monroe	137,633	138,074	138,581	139,416	141,079	142,633	144,232	145,887	147,567	149,218	150,933
Nassau	376,298	377,485	379,090	380,937	384,374	387,911	391,178	394,405	397,572	400,849	403,863
New York	369,717	371,591	373,935	376,948	380,835	384,594	388,225	391,957	395,706	398,979	402,398
Niagara	42,971	43,189	43,351	43,671	44,301	44,946	45,583	46,235	46,898	47,576	48,264
Onondaga	93,076	93,776	94,516	95,860	97,460	99,068	100,719	102,405	104,078	105,826	107,633
Orange	97,731	98,247	98,785	99,455	100,565	101,881	102,985	104,152	105,279	106,512	107,633
Putnam	21,747	21,827	21,931	22,097	22,301	22,503	22,693	22,885	23,076	23,255	23,436
Queens	593,568	596,794	600,047	603,782	612,385	621,284	629,463	638,070	646,859	655,035	663,025
Rensselaer	27,033	27,231	27,378	27,722	28,136	28,584	29,011	29,459	29,924	30,390	30,856
Richmond	154,637	155,367	155,932	156,662	158,290	159,921	161,486	162,949	164,443	165,989	167,442
Rockland	85,695	86,360	86,822	87,192	88,201	89,183	90,154	91,094	92,075	93,057	93,980
Saratoga	39,662	39,920	40,217	40,631	41,194	41,764	42,326	42,899	43,466	44,044	44,629
Schenectady	28,634	28,840	29,044	29,377	29,799	30,225	30,639	31,084	31,523	31,970	32,425
Suffolk	399,673	401,099	402,658	404,714	408,536	412,129	415,733	419,320	422,889	426,445	429,915
Sullivan	16,346	16,511	16,603	16,741	16,982	17,226	17,468	17,702	17,955	18,205	18,449
Tompkins	14,770	14,864	14,923	15,124	15,321	15,517	15,707	15,898	16,097	16,303	16,498
Ulster	27,618	27,812	27,979	28,258	28,651	29,048	29,442	29,846	30,264	30,699	31,125
Westchester	233,046	233,867	234,789	235,818	238,329	240,867	243,370	245,742	248,246	250,738	253,181

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:											
	1/17	1/18	1/19	1/20	1/22				1/24				1/26			
Albany	51,823	52,146	52,444	52,918	54,426	(10,885)	[2,612]	{1,306}	55,938	(11,188)	[2,685]	{1,343}	57,487	(11,497)	[2,759]	{1,380}
Bronx	382,144	384,448	385,713	387,372	398,175	(79,635)	[19,112]	{9,556}	408,605	(81,721)	[19,613]	{9,807}	419,311	(83,862)	[20,127]	{10,063}
Dutchess	58,133	58,418	58,736	59,146	60,704	(12,141)	[2,914]	{1,457}	62,243	(12,449)	[2,988]	{1,494}	63,808	(12,762)	[3,063]	{1,531}
Erie	187,260	188,389	189,318	190,704	195,767	(39,153)	[9,397]	{4,698}	200,876	(40,175)	[9,642]	{4,821}	206,202	(41,240)	[9,898]	{4,949}
Kings	636,407	640,739	644,060	647,831	663,569	(132,714)	[31,851]	{15,926}	678,634	(135,727)	[32,574]	{16,287}	693,401	(138,680)	[33,283]	{16,642}
Monroe	137,633	138,074	138,581	139,416	142,633	(28,527)	[6,846]	{3,423}	145,887	(29,177)	[7,003]	{3,501}	149,218	(29,844)	[7,162]	{3,581}
Nassau	376,298	377,485	379,090	380,937	387,911	(77,582)	[18,620]	{9,310}	394,405	(78,881)	[18,931]	{9,466}	400,849	(80,170)	[19,241]	{9,620}
New York	369,717	371,591	373,935	376,948	384,594	(76,919)	[18,461]	{9,230}	391,957	(78,391)	[18,814]	{9,407}	398,979	(79,796)	[19,151]	{9,576}
Niagara	42,971	43,189	43,351	43,671	44,946	(8,989)	[2,157]	{1,079}	46,235	(9,247)	[2,219]	{1,110}	47,576	(9,515)	[2,284]	{1,142}
Onondaga	93,076	93,776	94,516	95,860	99,068	(19,814)	[4,755]	{2,378}	102,405	(20,481)	[4,915]	{2,458}	105,826	(21,165)	[5,080]	{2,540}
Orange	97,731	98,247	98,785	99,455	101,881	(20,376)	[4,890]	{2,445}	104,152	(20,830)	[4,999]	{2,500}	106,512	(21,302)	[5,113]	{2,556}
Putnam	21,747	21,827	21,931	22,097	22,503	(4,501)	[1,080]	{540}	22,885	(4,577)	[1,098]	{549}	23,255	(4,651)	[1,116]	{558}
Queens	593,568	596,794	600,047	603,782	621,284	(124,257)	[29,822]	{14,911}	638,070	(127,614)	[30,627]	{15,314}	655,035	(131,007)	[31,442]	{15,721}
Rensselaer	27,033	27,231	27,378	27,722	28,584	(5,717)	[1,372]	{686}	29,459	(5,892)	[1,414]	{707}	30,390	(6,078)	[1,459]	{729}
Richmond	154,637	155,367	155,932	156,662	159,921	(31,984)	[7,676]	{3,838}	162,949	(32,590)	[7,822]	{3,911}	165,989	(33,198)	[7,967]	{3,984}
Rockland	85,695	86,360	86,822	87,192	89,183	(17,837)	[4,281]	{2,140}	91,094	(18,219)	[4,373]	{2,186}	93,057	(18,611)	[4,467]	{2,233}
Saratoga	39,662	39,920	40,217	40,631	41,764	(8,353)	[2,005]	{1,002}	42,899	(8,580)	[2,059]	{1,030}	44,044	(8,809)	[2,114]	{1,057}
Schenectady	28,634	28,840	29,044	29,377	30,225	(6,045)	[1,451]	{725}	31,084	(6,217)	[1,492]	{746}	31,970	(6,394)	[1,535]	{767}
Suffolk	399,673	401,099	402,658	404,714	412,129	(82,426)	[19,782]	{9,891}	419,320	(83,864)	[20,127]	{10,064}	426,445	(85,289)	[20,469]	{10,235}
Sullivan	16,346	16,511	16,603	16,741	17,226	(3,445)	[827]	{413}	17,702	(3,540)	[850]	{425}	18,205	(3,641)	[874]	{437}
Tompkins	14,770	14,864	14,923	15,124	15,517	(3,103)	[745]	{372}	15,898	(3,180)	[763]	{382}	16,303	(3,261)	[783]	{391}
Ulster	27,618	27,812	27,979	28,258	29,048	(5,810)	[1,394]	{697}	29,846	(5,969)	[1,433]	{716}	30,699	(6,140)	[1,474]	{737}
Westchester	233,046	233,867	234,789	235,818	240,867	(48,173)	[11,562]	{5,781}	245,742	(49,148)	[11,796]	{5,898}	250,738	(50,148)	[12,035]	{6,018}

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.