

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 1/20/21**

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 1/20/21 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.

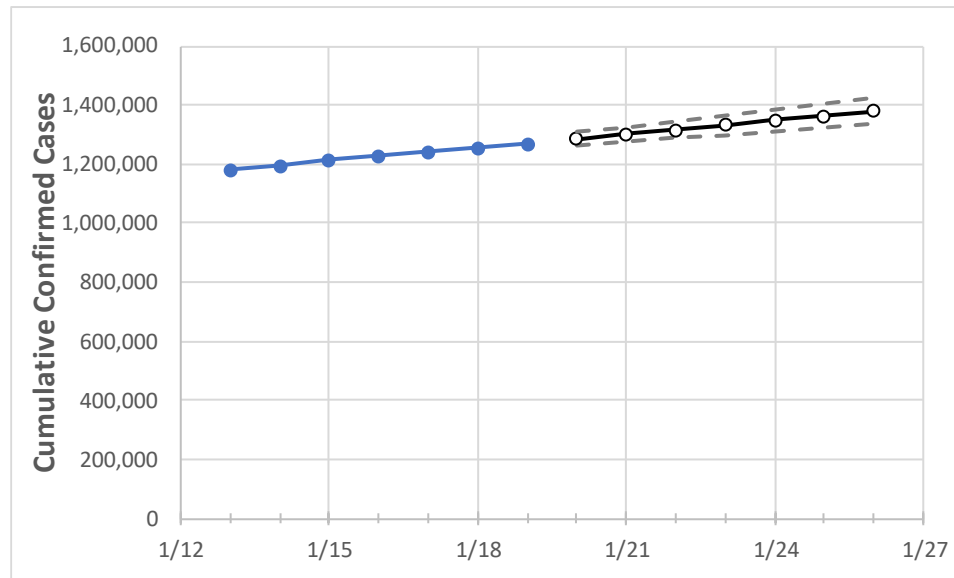
IEM's Modeling Lead

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:							
	1/16	1/17	1/18	1/19	1/20	1/21	1/22	1/23	1/24	1/25	1/26	
New York	1,228,867	1,242,561	1,255,971	1,268,692	1,284,480	1,300,376	1,316,235	1,331,930	1,347,770	1,363,603	1,379,458	

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:						
	1/16	1/17	1/18	1/19	1/20	1/21	1/22	1/23	1/24	1/25	1/26
Albany	15,771	15,981	16,168	16,343	16,589	16,832	17,078	17,323	17,565	17,806	18,043
Bronx	102,739	103,869	105,175	106,253	107,567	108,895	110,263	111,627	113,029	114,484	115,931
Dutchess	16,115	16,327	16,541	16,757	17,025	17,293	17,560	17,828	18,104	18,378	18,656
Erie	50,716	51,384	51,718	52,228	52,819	53,404	53,977	54,557	55,149	55,726	56,325
Kings	150,376	151,971	153,838	155,509	157,452	159,430	161,454	163,503	165,574	167,693	169,800
Monroe	43,226	43,659	44,007	44,318	44,785	45,248	45,701	46,134	46,561	46,977	47,393
Nassau	111,393	112,702	113,812	114,969	116,419	117,824	119,235	120,637	122,006	123,391	124,739
New York	73,634	74,452	75,319	75,965	76,927	77,895	78,904	79,914	80,963	82,038	83,117
Niagara	11,664	11,822	11,933	12,143	12,332	12,518	12,710	12,902	13,089	13,276	13,462
Onondaga	26,954	27,190	27,492	27,755	28,063	28,366	28,664	28,959	29,260	29,556	29,858
Orange	28,168	28,386	28,574	28,848	29,160	29,476	29,786	30,099	30,409	30,721	31,037
Putnam	6,294	6,386	6,447	6,521	6,612	6,703	6,794	6,886	6,979	7,072	7,165
Queens	153,424	155,059	156,940	158,683	160,652	162,657	164,677	166,725	168,844	170,914	173,055
Rensselaer	6,596	6,693	6,772	6,874	7,008	7,141	7,271	7,403	7,533	7,665	7,789
Richmond	43,785	44,210	44,737	45,156	45,668	46,176	46,667	47,158	47,647	48,143	48,637
Rockland	31,346	31,509	31,668	31,884	32,116	32,351	32,579	32,812	33,047	33,282	33,515
Saratoga	8,839	8,984	9,140	9,267	9,439	9,607	9,771	9,935	10,096	10,260	10,415
Schenectady	8,347	8,480	8,587	8,660	8,794	8,926	9,056	9,189	9,318	9,448	9,572
Suffolk	124,384	125,925	127,287	128,580	130,205	131,846	133,458	135,086	136,702	138,312	139,926
Sullivan	3,751	3,765	3,798	3,841	3,881	3,920	3,959	3,998	4,038	4,077	4,117
Tompkins	2,572	2,613	2,641	2,657	2,690	2,722	2,755	2,789	2,821	2,853	2,887
Ulster	7,448	7,548	7,642	7,745	7,863	7,981	8,103	8,222	8,342	8,464	8,590
Westchester	82,933	83,708	84,420	85,020	85,874	86,721	87,582	88,442	89,330	90,198	91,077

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:											
	1/16	1/17	1/18	1/19	1/21				1/23				1/25			
Albany	15,771	15,981	16,168	16,343	16,832	(3,366)	[808]	{404}	17,323	(3,465)	[832]	{416}	17,806	(3,561)	[855]	{427}
Bronx	102,739	103,869	105,175	106,253	108,895	(21,779)	[5,227]	{2,613}	111,627	(22,325)	[5,358]	{2,679}	114,484	(22,897)	[5,495]	{2,748}
Dutchess	16,115	16,327	16,541	16,757	17,293	(3,459)	[830]	{415}	17,828	(3,566)	[856]	{428}	18,378	(3,676)	[882]	{441}
Erie	50,716	51,384	51,718	52,228	53,404	(10,681)	[2,563]	{1,282}	54,557	(10,911)	[2,619]	{1,309}	55,726	(11,145)	[2,675]	{1,337}
Kings	150,376	151,971	153,838	155,509	159,430	(31,886)	[7,653]	{3,826}	163,503	(32,701)	[7,848]	{3,924}	167,693	(33,539)	[8,049]	{4,025}
Monroe	43,226	43,659	44,007	44,318	45,248	(9,050)	[2,172]	{1,086}	46,134	(9,227)	[2,214]	{1,107}	46,977	(9,395)	[2,255]	{1,127}
Nassau	111,393	112,702	113,812	114,969	117,824	(23,565)	[5,656]	{2,828}	120,637	(24,127)	[5,791]	{2,895}	123,391	(24,678)	[5,923]	{2,961}
New York	73,634	74,452	75,319	75,965	77,895	(15,579)	[3,739]	{1,869}	79,914	(15,983)	[3,836]	{1,918}	82,038	(16,408)	[3,938]	{1,969}
Niagara	11,664	11,822	11,933	12,143	12,518	(2,504)	[601]	{300}	12,902	(2,580)	[619]	{310}	13,276	(2,655)	[637]	{319}
Onondaga	26,954	27,190	27,492	27,755	28,366	(5,673)	[1,362]	{681}	28,959	(5,792)	[1,390]	{695}	29,556	(5,911)	[1,419]	{709}
Orange	28,168	28,386	28,574	28,848	29,476	(5,895)	[1,415]	{707}	30,099	(6,020)	[1,445]	{722}	30,721	(6,144)	[1,475]	{737}
Putnam	6,294	6,386	6,447	6,521	6,703	(1,341)	[322]	{161}	6,886	(1,377)	[331]	{165}	7,072	(1,414)	[339]	{170}
Queens	153,424	155,059	156,940	158,683	162,657	(32,531)	[7,808]	{3,904}	166,725	(33,345)	[8,003]	{4,001}	170,914	(34,183)	[8,204]	{4,102}
Rensselaer	6,596	6,693	6,772	6,874	7,141	(1,428)	[343]	{171}	7,403	(1,481)	[355]	{178}	7,665	(1,533)	[368]	{184}
Richmond	43,785	44,210	44,737	45,156	46,176	(9,235)	[2,216]	{1,108}	47,158	(9,432)	[2,264]	{1,132}	48,143	(9,629)	[2,311]	{1,155}
Rockland	31,346	31,509	31,668	31,884	32,351	(6,470)	[1,553]	{776}	32,812	(6,562)	[1,575]	{787}	33,282	(6,656)	[1,598]	{799}
Saratoga	8,839	8,984	9,140	9,267	9,607	(1,921)	[461]	{231}	9,935	(1,987)	[477]	{238}	10,260	(2,052)	[492]	{246}
Schenectady	8,347	8,480	8,587	8,660	8,926	(1,785)	[428]	{214}	9,189	(1,838)	[441]	{221}	9,448	(1,890)	[454]	{227}
Suffolk	124,384	125,925	127,287	128,580	131,846	(26,369)	[6,329]	{3,164}	135,086	(27,017)	[6,484]	{3,242}	138,312	(27,662)	[6,639]	{3,319}
Sullivan	3,751	3,765	3,798	3,841	3,920	(784)	[188]	{94}	3,998	(800)	[192]	{96}	4,077	(815)	[196]	{98}
Tompkins	2,572	2,613	2,641	2,657	2,722	(544)	[131]	{65}	2,789	(558)	[134]	{67}	2,853	(571)	[137]	{68}
Ulster	7,448	7,548	7,642	7,745	7,981	(1,596)	[383]	{192}	8,222	(1,644)	[395]	{197}	8,464	(1,693)	[406]	{203}
Westchester	82,933	83,708	84,420	85,020	86,721	(17,344)	[4,163]	{2,081}	88,442	(17,688)	[4,245]	{2,123}	90,198	(18,040)	[4,329]	{2,165}

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.