

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 12/22/21**

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 12/22/21 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.

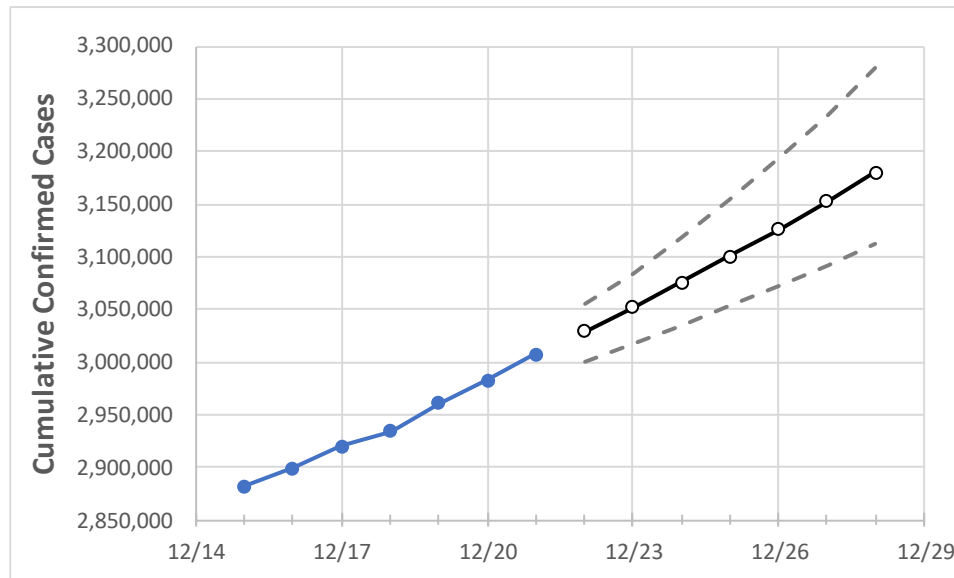
IEM's Modeling Lead

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:					
	12/18	12/19	12/20	12/21	12/22	12/23	12/24	12/25	12/26	12/27	12/28
New York	2,934,453	2,960,416	2,982,994	3,007,231	3,028,741	3,051,874	3,075,819	3,100,267	3,126,196	3,152,429	3,180,532

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:						
	12/18	12/19	12/20	12/21	12/22	12/23	12/24	12/25	12/26	12/27	12/28
Albany	37,379	37,566	37,701	37,882	38,064	38,249	38,434	38,623	38,820	39,018	39,213
Bronx	221,793	222,771	224,238	225,850	227,210	228,663	230,240	231,917	233,699	235,591	237,579
Dutchess	40,839	41,055	41,216	41,375	41,596	41,822	42,047	42,282	42,524	42,771	43,028
Erie	136,422	136,795	137,207	137,716	138,202	138,681	139,147	139,625	140,086	140,543	141,002
Kings	371,125	373,978	377,826	383,733	387,241	390,963	394,790	399,013	403,483	408,161	413,134
Monroe	106,085	106,459	106,765	107,008	107,390	107,770	108,142	108,512	108,879	109,256	109,612
Nassau	243,769	245,792	247,739	249,694	251,687	253,789	255,955	258,244	260,658	263,168	265,781
New York	196,363	200,126	205,807	209,968	214,197	218,821	223,783	229,064	234,825	241,129	247,888
Niagara	31,883	31,978	32,081	32,224	32,367	32,507	32,648	32,781	32,920	33,058	33,192
Onondaga	64,961	65,258	65,494	65,719	66,021	66,323	66,625	66,923	67,235	67,545	67,851
Orange	66,794	67,162	67,470	67,754	68,089	68,438	68,783	69,145	69,507	69,880	70,263
Putnam	14,215	14,320	14,430	14,533	14,642	14,756	14,873	14,996	15,123	15,259	15,399
Queens	343,955	345,728	348,530	351,830	354,632	357,699	361,078	364,710	368,589	372,746	377,272
Rensselaer	19,331	19,438	19,516	19,610	19,709	19,811	19,911	20,011	20,110	20,215	20,314
Richmond	98,168	98,621	99,265	100,023	100,666	101,355	102,083	102,846	103,653	104,518	105,401
Rockland	58,012	58,283	58,489	58,781	59,033	59,302	59,580	59,869	60,173	60,488	60,816
Saratoga	27,776	27,915	28,047	28,188	28,342	28,497	28,643	28,795	28,943	29,095	29,245
Schenectady	21,015	21,078	21,142	21,221	21,304	21,388	21,470	21,552	21,634	21,717	21,800
Suffolk	276,158	278,108	279,804	281,474	283,308	285,167	287,107	289,101	291,170	293,320	295,545
Sullivan	10,688	10,752	10,803	10,852	10,915	10,977	11,042	11,105	11,170	11,235	11,299
Tompkins	9,765	10,321	10,343	10,469	10,789	11,120	11,469	11,853	12,271	12,706	13,152
Ulster	20,642	20,722	20,798	20,872	20,962	21,052	21,142	21,233	21,322	21,419	21,511
Westchester	156,313	157,296	158,253	159,078	159,993	160,970	161,981	163,051	164,190	165,387	166,621

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:											
	12/18	12/19	12/20	12/21	12/23			12/25			12/27					
Albany	37,379	37,566	37,701	37,882	38,249	(7,650)	[1,836]	{918}	38,623	(7,725)	[1,854]	{927}	39,018	(7,804)	[1,873]	{936}
Bronx	221,793	222,771	224,238	225,850	228,663	(45,733)	[10,976]	{5,488}	231,917	(46,383)	[11,132]	{5,566}	235,591	(47,118)	[11,308]	{5,654}
Dutchess	40,839	41,055	41,216	41,375	41,822	(8,364)	[2,007]	{1,004}	42,282	(8,456)	[2,030]	{1,015}	42,771	(8,554)	[2,053]	{1,026}
Erie	136,422	136,795	137,207	137,716	138,681	(27,736)	[6,657]	{3,328}	139,625	(27,925)	[6,702]	{3,351}	140,543	(28,109)	[6,746]	{3,373}
Kings	371,125	373,978	377,826	383,733	390,963	(78,193)	[18,766]	{9,383}	399,013	(79,803)	[19,153]	{9,576}	408,161	(81,632)	[19,592]	{9,796}
Monroe	106,085	106,459	106,765	107,008	107,770	(21,554)	[5,173]	{2,586}	108,512	(21,702)	[5,209]	{2,604}	109,256	(21,851)	[5,244]	{2,622}
Nassau	243,769	245,792	247,739	249,694	253,789	(50,758)	[12,182]	{6,091}	258,244	(51,649)	[12,396]	{6,198}	263,168	(52,634)	[12,632]	{6,316}
New York	196,363	200,126	205,807	209,968	218,821	(43,764)	[10,503]	{5,252}	229,064	(45,813)	[10,995]	{5,498}	241,129	(48,226)	[11,574]	{5,787}
Niagara	31,883	31,978	32,081	32,224	32,507	(6,501)	[1,560]	{780}	32,781	(6,556)	[1,574]	{787}	33,058	(6,612)	[1,587]	{793}
Onondaga	64,961	65,258	65,494	65,719	66,323	(13,265)	[3,184]	{1,592}	66,923	(13,385)	[3,212]	{1,606}	67,545	(13,509)	[3,242]	{1,621}
Orange	66,794	67,162	67,470	67,754	68,438	(13,688)	[3,285]	{1,643}	69,145	(13,829)	[3,319]	{1,659}	69,880	(13,976)	[3,354]	{1,677}
Putnam	14,215	14,320	14,430	14,533	14,756	(2,951)	[708]	{354}	14,996	(2,999)	[720]	{360}	15,259	(3,052)	[732]	{366}
Queens	343,955	345,728	348,530	351,830	357,699	(71,540)	[17,170]	{8,585}	364,710	(72,942)	[17,506]	{8,753}	372,746	(74,549)	[17,892]	{8,946}
Rensselaer	19,331	19,438	19,516	19,610	19,811	(3,962)	[951]	{475}	20,011	(4,002)	[961]	{480}	20,215	(4,043)	[970]	{485}
Richmond	98,168	98,621	99,265	100,023	101,355	(20,271)	[4,865]	{2,433}	102,846	(20,569)	[4,937]	{2,468}	104,518	(20,904)	[5,017]	{2,508}
Rockland	58,012	58,283	58,489	58,781	59,302	(11,860)	[2,846]	{1,423}	59,869	(11,974)	[2,874]	{1,437}	60,488	(12,098)	[2,903]	{1,452}
Saratoga	27,776	27,915	28,047	28,188	28,497	(5,699)	[1,368]	{684}	28,795	(5,759)	[1,382]	{691}	29,095	(5,819)	[1,397]	{698}
Schenectady	21,015	21,078	21,142	21,221	21,388	(4,278)	[1,027]	{513}	21,552	(4,310)	[1,034]	{517}	21,717	(4,343)	[1,042]	{521}
Suffolk	276,158	278,108	279,804	281,474	285,167	(57,033)	[13,688]	{6,844}	289,101	(57,820)	[13,877]	{6,938}	293,320	(58,664)	[14,079]	{7,040}
Sullivan	10,688	10,752	10,803	10,852	10,977	(2,195)	[527]	{263}	11,105	(2,221)	[533]	{267}	11,235	(2,247)	[539]	{270}
Tompkins	9,765	10,321	10,343	10,469	11,120	(2,224)	[534]	{267}	11,853	(2,371)	[569]	{284}	12,706	(2,541)	[610]	{305}
Ulster	20,642	20,722	20,798	20,872	21,052	(4,210)	[1,010]	{505}	21,233	(4,247)	[1,019]	{510}	21,419	(4,284)	[1,028]	{514}
Westchester	156,313	157,296	158,253	159,078	160,970	(32,194)	[7,727]	{3,863}	163,051	(32,610)	[7,826]	{3,913}	165,387	(33,077)	[7,939]	{3,969}

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.