

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 12/13/21**

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 12/13/21 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.

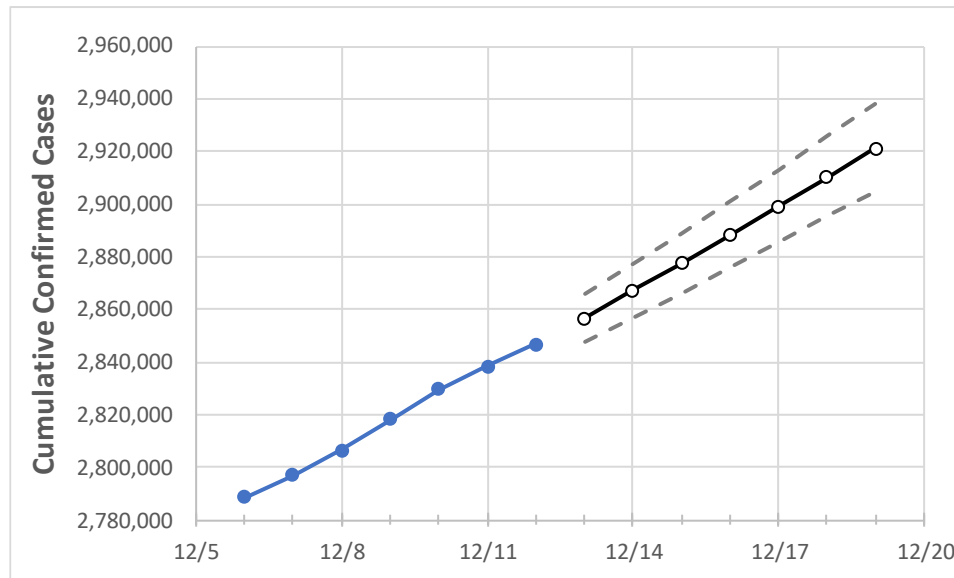
IEM's Modeling Lead

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:					
	12/9	12/10	12/11	12/12	12/13	12/14	12/15	12/16	12/17	12/18	12/19
New York	2,818,175	2,829,502	2,838,326	2,846,533	2,856,710	2,867,099	2,877,524	2,888,209	2,899,052	2,910,134	2,921,206

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:						
	12/9	12/10	12/11	12/12	12/13	12/14	12/15	12/16	12/17	12/18	12/19
Albany	35,905	36,117	36,288	36,401	36,574	36,747	36,926	37,107	37,295	37,482	37,675
Bronx	216,326	216,715	216,715	216,715	217,107	217,507	217,918	218,346	218,801	219,253	219,723
Dutchess	39,239	39,381	39,561	39,719	39,886	40,056	40,230	40,409	40,595	40,785	40,979
Erie	131,586	132,352	132,934	133,442	134,133	134,839	135,552	136,237	136,942	137,665	138,365
Kings	356,413	357,383	357,383	357,383	358,277	359,212	360,155	361,144	362,137	363,185	364,231
Monroe	102,528	103,052	103,400	103,793	104,285	104,777	105,255	105,751	106,252	106,752	107,253
Nassau	232,962	233,888	234,881	235,824	236,777	237,737	238,759	239,800	240,873	241,982	243,118
New York	180,849	181,588	182,540	183,463	184,359	185,321	186,367	187,513	188,703	189,997	191,372
Niagara	30,434	30,645	30,826	30,989	31,170	31,353	31,535	31,720	31,905	32,091	32,278
Onondaga	62,372	62,668	62,935	63,178	63,483	63,796	64,096	64,420	64,744	65,074	65,392
Orange	64,278	64,559	64,817	65,072	65,329	65,594	65,854	66,131	66,410	66,697	66,987
Putnam	13,565	13,630	13,714	13,772	13,837	13,906	13,977	14,052	14,131	14,212	14,298
Queens	333,021	333,871	333,871	333,871	334,738	335,651	336,566	337,545	338,542	339,556	340,627
Rensselaer	18,447	18,581	18,703	18,819	18,941	19,066	19,193	19,322	19,454	19,589	19,722
Richmond	94,928	95,215	95,215	95,215	95,519	95,835	96,158	96,491	96,840	97,203	97,570
Rockland	56,511	56,632	56,757	56,856	56,980	57,106	57,235	57,369	57,504	57,643	57,782
Saratoga	26,350	26,517	26,713	26,876	27,055	27,237	27,418	27,602	27,789	27,975	28,164
Schenectady	20,230	20,354	20,453	20,533	20,632	20,729	20,826	20,929	21,029	21,131	21,231
Suffolk	264,032	265,204	266,425	267,652	268,815	270,026	271,262	272,564	273,870	275,244	276,630
Sullivan	10,150	10,212	10,276	10,321	10,387	10,453	10,523	10,592	10,660	10,733	10,807
Tompkins	7,846	7,949	8,058	8,377	8,482	8,595	8,702	8,819	8,941	9,075	9,213
Ulster	19,849	19,961	20,042	20,157	20,250	20,348	20,445	20,544	20,646	20,748	20,855
Westchester	151,109	151,550	152,047	152,506	152,953	153,421	153,912	154,414	154,945	155,485	156,045

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:											
	12/9	12/10	12/11	12/12	12/14				12/16				12/18			
Albany	35,905	36,117	36,288	36,401	36,747	(7,349)	[1,764]	{882}	37,107	(7,421)	[1,781]	{891}	37,482	(7,496)	[1,799]	{900}
Bronx	216,326	216,715	216,715	216,715	217,507	(43,501)	[10,440]	{5,220}	218,346	(43,669)	[10,481]	{5,240}	219,253	(43,851)	[10,524]	{5,262}
Dutchess	39,239	39,381	39,561	39,719	40,056	(8,011)	[1,923]	{961}	40,409	(8,082)	[1,940]	{970}	40,785	(8,157)	[1,958]	{979}
Erie	131,586	132,352	132,934	133,442	134,839	(26,968)	[6,472]	{3,236}	136,237	(27,247)	[6,539]	{3,270}	137,665	(27,533)	[6,608]	{3,304}
Kings	356,413	357,383	357,383	357,383	359,212	(71,842)	[17,242]	{8,621}	361,144	(72,229)	[17,335]	{8,667}	363,185	(72,637)	[17,433]	{8,716}
Monroe	102,528	103,052	103,400	103,793	104,777	(20,955)	[5,029]	{2,515}	105,751	(21,150)	[5,076]	{2,538}	106,752	(21,350)	[5,124]	{2,562}
Nassau	232,962	233,888	234,881	235,824	237,737	(47,547)	[11,411]	{5,706}	239,800	(47,960)	[11,510]	{5,755}	241,982	(48,396)	[11,615]	{5,808}
New York	180,849	181,588	182,540	183,463	185,321	(37,064)	[8,895]	{4,448}	187,513	(37,503)	[9,001]	{4,500}	189,997	(37,999)	[9,120]	{4,560}
Niagara	30,434	30,645	30,826	30,989	31,353	(6,271)	[1,505]	{752}	31,720	(6,344)	[1,523]	{761}	32,091	(6,418)	[1,540]	{770}
Onondaga	62,372	62,668	62,935	63,178	63,796	(12,759)	[3,062]	{1,531}	64,420	(12,884)	[3,092]	{1,546}	65,074	(13,015)	[3,124]	{1,562}
Orange	64,278	64,559	64,817	65,072	65,594	(13,119)	[3,149]	{1,574}	66,131	(13,226)	[3,174]	{1,587}	66,697	(13,339)	[3,201]	{1,601}
Putnam	13,565	13,630	13,714	13,772	13,906	(2,781)	[667]	{334}	14,052	(2,810)	[675]	{337}	14,212	(2,842)	[682]	{341}
Queens	333,021	333,871	333,871	333,871	335,651	(67,130)	[16,111]	{8,056}	337,545	(67,509)	[16,202]	{8,101}	339,556	(67,911)	[16,299]	{8,149}
Rensselaer	18,447	18,581	18,703	18,819	19,066	(3,813)	[915]	{458}	19,322	(3,864)	[927]	{464}	19,589	(3,918)	[940]	{470}
Richmond	94,928	95,215	95,215	95,215	95,835	(19,167)	[4,600]	{2,300}	96,491	(19,298)	[4,632]	{2,316}	97,203	(19,441)	[4,666]	{2,333}
Rockland	56,511	56,632	56,757	56,856	57,106	(11,421)	[2,741]	{1,371}	57,369	(11,474)	[2,754]	{1,377}	57,643	(11,529)	[2,767]	{1,383}
Saratoga	26,350	26,517	26,713	26,876	27,237	(5,447)	[1,307]	{654}	27,602	(5,520)	[1,325]	{662}	27,975	(5,595)	[1,343]	{671}
Schenectady	20,230	20,354	20,453	20,533	20,729	(4,146)	[995]	{498}	20,929	(4,186)	[1,005]	{502}	21,131	(4,226)	[1,014]	{507}
Suffolk	264,032	265,204	266,425	267,652	270,026	(54,005)	[12,961]	{6,481}	272,564	(54,513)	[13,083]	{6,542}	275,244	(55,049)	[13,212]	{6,606}
Sullivan	10,150	10,212	10,276	10,321	10,453	(2,091)	[502]	{251}	10,592	(2,118)	[508]	{254}	10,733	(2,147)	[515]	{258}
Tompkins	7,846	7,949	8,058	8,377	8,595	(1,719)	[413]	{206}	8,819	(1,764)	[423]	{212}	9,075	(1,815)	[436]	{218}
Ulster	19,849	19,961	20,042	20,157	20,348	(4,070)	[977]	{488}	20,544	(4,109)	[986]	{493}	20,748	(4,150)	[996]	{498}
Westchester	151,109	151,550	152,047	152,506	153,421	(30,684)	[7,364]	{3,682}	154,414	(30,883)	[7,412]	{3,706}	155,485	(31,097)	[7,463]	{3,732}

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.