

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 12/10/21**

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 12/10/21 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.

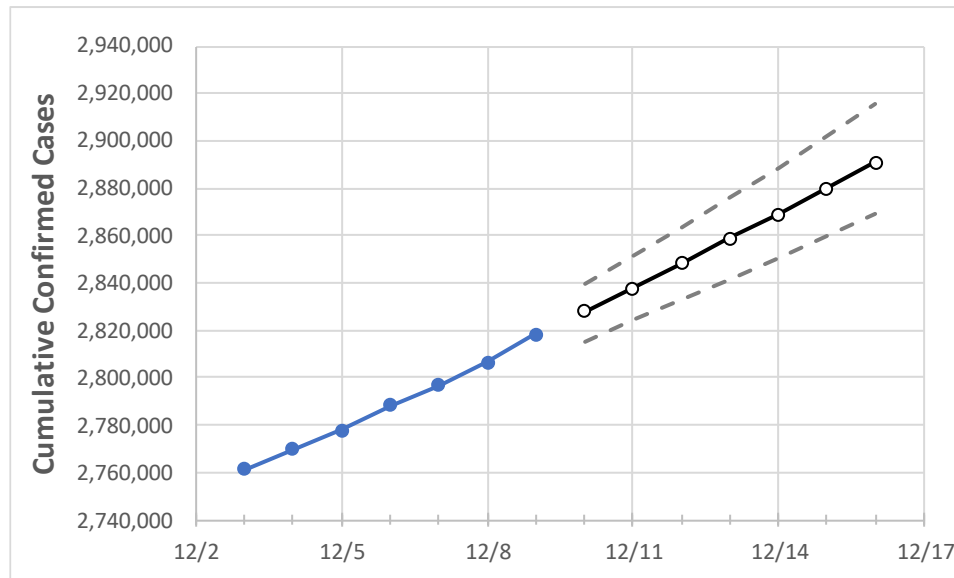
IEM's Modeling Lead

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:					
	12/6	12/7	12/8	12/9	12/10	12/11	12/12	12/13	12/14	12/15	12/16
New York	2,788,476	2,796,990	2,806,456	2,818,175	2,827,858	2,837,967	2,848,211	2,858,768	2,869,140	2,880,124	2,891,102

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:						
	12/6	12/7	12/8	12/9	12/10	12/11	12/12	12/13	12/14	12/15	12/16
Albany	35,437	35,586	35,729	35,905	36,070	36,232	36,403	36,574	36,748	36,926	37,110
Bronx	215,197	215,588	215,817	216,326	216,672	217,035	217,405	217,792	218,183	218,593	219,005
Dutchess	38,792	38,898	39,072	39,239	39,382	39,529	39,679	39,831	39,990	40,158	40,329
Erie	129,728	130,221	130,859	131,586	132,290	133,007	133,720	134,438	135,178	135,932	136,645
Kings	354,071	354,764	355,398	356,413	357,204	358,026	358,873	359,740	360,636	361,550	362,483
Monroe	101,004	101,434	101,904	102,528	103,033	103,531	104,028	104,542	105,058	105,568	106,107
Nassau	230,523	231,282	232,051	232,962	233,768	234,606	235,476	236,351	237,272	238,224	239,198
New York	179,234	179,596	180,152	180,849	181,310	181,779	182,267	182,763	183,274	183,784	184,322
Niagara	29,939	30,089	30,247	30,434	30,609	30,784	30,960	31,136	31,317	31,495	31,676
Onondaga	61,428	61,679	62,018	62,372	62,668	62,975	63,275	63,576	63,906	64,224	64,544
Orange	63,609	63,761	64,019	64,278	64,510	64,743	64,989	65,236	65,481	65,743	66,003
Putnam	13,401	13,437	13,508	13,565	13,617	13,672	13,728	13,786	13,846	13,911	13,977
Queens	330,744	331,493	332,092	333,021	333,817	334,631	335,477	336,356	337,261	338,205	339,163
Rensselaer	18,137	18,229	18,322	18,447	18,561	18,676	18,795	18,915	19,037	19,161	19,286
Richmond	94,122	94,390	94,598	94,928	95,200	95,489	95,792	96,103	96,429	96,758	97,105
Rockland	56,166	56,262	56,362	56,511	56,628	56,748	56,873	56,999	57,129	57,263	57,398
Saratoga	25,874	26,027	26,181	26,350	26,526	26,710	26,886	27,067	27,254	27,434	27,624
Schenectady	19,967	20,033	20,125	20,230	20,321	20,412	20,505	20,597	20,690	20,783	20,878
Suffolk	260,951	261,883	262,900	264,032	265,019	266,063	267,095	268,176	269,289	270,424	271,601
Sullivan	9,984	10,012	10,084	10,150	10,215	10,280	10,350	10,418	10,489	10,563	10,634
Tompkins	7,704	7,741	7,773	7,846	7,895	7,944	7,993	8,043	8,095	8,151	8,204
Ulster	19,624	19,676	19,752	19,849	19,931	20,019	20,105	20,194	20,281	20,373	20,464
Westchester	150,068	150,348	150,743	151,109	151,459	151,821	152,192	152,581	152,983	153,397	153,835

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:											
	12/6	12/7	12/8	12/9	12/11				12/13				12/15			
Albany	35,437	35,586	35,729	35,905	36,232	(7,246)	[1,739]	{870}	36,574	(7,315)	[1,756]	{878}	36,926	(7,385)	[1,772]	{886}
Bronx	215,197	215,588	215,817	216,326	217,035	(43,407)	[10,418]	{5,209}	217,792	(43,558)	[10,454]	{5,227}	218,593	(43,719)	[10,492]	{5,246}
Dutchess	38,792	38,898	39,072	39,239	39,529	(7,906)	[1,897]	{949}	39,831	(7,966)	[1,912]	{956}	40,158	(8,032)	[1,928]	{964}
Erie	129,728	130,221	130,859	131,586	133,007	(26,601)	[6,384]	{3,192}	134,438	(26,888)	[6,453]	{3,227}	135,932	(27,186)	[6,525]	{3,262}
Kings	354,071	354,764	355,398	356,413	358,026	(71,605)	[17,185]	{8,593}	359,740	(71,948)	[17,268]	{8,634}	361,550	(72,310)	[17,354]	{8,677}
Monroe	101,004	101,434	101,904	102,528	103,531	(20,706)	[4,970]	{2,485}	104,542	(20,908)	[5,018]	{2,509}	105,568	(21,114)	[5,067]	{2,534}
Nassau	230,523	231,282	232,051	232,962	234,606	(46,921)	[11,261]	{5,631}	236,351	(47,270)	[11,345]	{5,672}	238,224	(47,645)	[11,435]	{5,717}
New York	179,234	179,596	180,152	180,849	181,779	(36,356)	[8,725]	{4,363}	182,763	(36,553)	[8,773]	{4,386}	183,784	(36,757)	[8,822]	{4,411}
Niagara	29,939	30,089	30,247	30,434	30,784	(6,157)	[1,478]	{739}	31,136	(6,227)	[1,495]	{747}	31,495	(6,299)	[1,512]	{756}
Onondaga	61,428	61,679	62,018	62,372	62,975	(12,595)	[3,023]	{1,511}	63,576	(12,715)	[3,052]	{1,526}	64,224	(12,845)	[3,083]	{1,541}
Orange	63,609	63,761	64,019	64,278	64,743	(12,949)	[3,108]	{1,554}	65,236	(13,047)	[3,131]	{1,566}	65,743	(13,149)	[3,156]	{1,578}
Putnam	13,401	13,437	13,508	13,565	13,672	(2,734)	[656]	{328}	13,786	(2,757)	[662]	{331}	13,911	(2,782)	[668]	{334}
Queens	330,744	331,493	332,092	333,021	334,631	(66,926)	[16,062]	{8,031}	336,356	(67,271)	[16,145]	{8,073}	338,205	(67,641)	[16,234]	{8,117}
Rensselaer	18,137	18,229	18,322	18,447	18,676	(3,735)	[896]	{448}	18,915	(3,783)	[908]	{454}	19,161	(3,832)	[920]	{460}
Richmond	94,122	94,390	94,598	94,928	95,489	(19,098)	[4,583]	{2,292}	96,103	(19,221)	[4,613]	{2,306}	96,758	(19,352)	[4,644]	{2,322}
Rockland	56,166	56,262	56,362	56,511	56,748	(11,350)	[2,724]	{1,362}	56,999	(11,400)	[2,736]	{1,368}	57,263	(11,453)	[2,749]	{1,374}
Saratoga	25,874	26,027	26,181	26,350	26,710	(5,342)	[1,282]	{641}	27,067	(5,413)	[1,299]	{650}	27,434	(5,487)	[1,317]	{658}
Schenectady	19,967	20,033	20,125	20,230	20,412	(4,082)	[980]	{490}	20,597	(4,119)	[989]	{494}	20,783	(4,157)	[998]	{499}
Suffolk	260,951	261,883	262,900	264,032	266,063	(53,213)	[12,771]	{6,386}	268,176	(53,635)	[12,872]	{6,436}	270,424	(54,085)	[12,980]	{6,490}
Sullivan	9,984	10,012	10,084	10,150	10,280	(2,056)	[493]	{247}	10,418	(2,084)	[500]	{250}	10,563	(2,113)	[507]	{254}
Tompkins	7,704	7,741	7,773	7,846	7,944	(1,589)	[381]	{191}	8,043	(1,609)	[386]	{193}	8,151	(1,630)	[391]	{196}
Ulster	19,624	19,676	19,752	19,849	20,019	(4,004)	[961]	{480}	20,194	(4,039)	[969]	{485}	20,373	(4,075)	[978]	{489}
Westchester	150,068	150,348	150,743	151,109	151,821	(30,364)	[7,287]	{3,644}	152,581	(30,516)	[7,324]	{3,662}	153,397	(30,679)	[7,363]	{3,682}

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.