

IEM's AI Modeling: Short-term COVID-19 Projections

Date: 12/20/21

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 12/20/21 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.

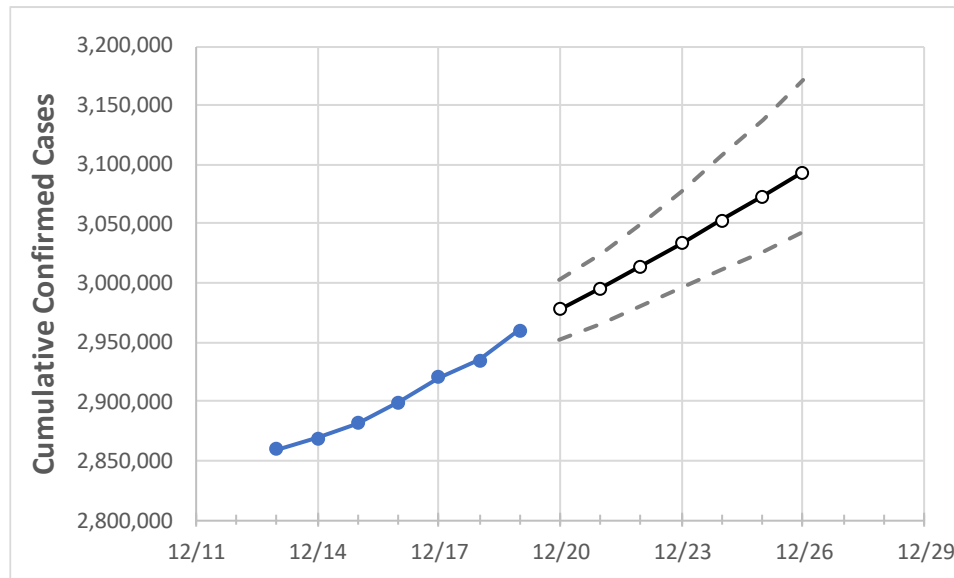
IEM's Modeling Lead

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:						
	12/16	12/17	12/18	12/19	12/20	12/21	12/22	12/23	12/24	12/25	12/26
New York	2,899,469	2,920,366	2,934,453	2,960,416	2,977,732	2,995,902	3,014,358	3,033,094	3,052,896	3,073,031	3,093,553

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:						
	12/16	12/17	12/18	12/19	12/20	12/21	12/22	12/23	12/24	12/25	12/26
Albany	36,959	37,161	37,379	37,566	37,750	37,937	38,129	38,320	38,519	38,720	38,922
Bronx	219,812	220,815	221,793	222,771	223,699	224,660	225,680	226,787	227,940	229,170	230,429
Dutchess	40,340	40,565	40,839	41,055	41,278	41,510	41,748	41,997	42,257	42,520	42,792
Erie	135,342	135,926	136,422	136,795	137,312	137,815	138,316	138,800	139,293	139,778	140,266
Kings	365,241	368,272	371,125	373,978	376,365	378,894	381,526	384,377	387,279	390,412	393,666
Monroe	105,131	105,602	106,085	106,459	106,872	107,282	107,695	108,102	108,509	108,912	109,312
Nassau	240,073	242,013	243,769	245,792	247,504	249,332	251,223	253,175	255,260	257,389	259,626
New York	189,081	192,595	196,363	200,126	203,085	206,392	209,858	213,717	217,717	222,129	226,706
Niagara	31,529	31,724	31,883	31,978	32,128	32,276	32,423	32,568	32,714	32,860	33,006
Onondaga	64,227	64,567	64,961	65,258	65,576	65,893	66,223	66,548	66,882	67,226	67,567
Orange	66,065	66,411	66,794	67,162	67,498	67,848	68,206	68,569	68,943	69,332	69,722
Putnam	14,000	14,119	14,215	14,320	14,415	14,515	14,619	14,729	14,844	14,964	15,087
Queens	340,143	342,182	343,955	345,728	347,529	349,493	351,525	353,731	355,983	358,425	360,966
Rensselaer	19,102	19,222	19,331	19,438	19,543	19,647	19,751	19,859	19,967	20,076	20,183
Richmond	97,162	97,714	98,168	98,621	99,083	99,568	100,065	100,590	101,128	101,687	102,272
Rockland	57,487	57,706	58,012	58,283	58,548	58,837	59,140	59,474	59,819	60,194	60,581
Saratoga	27,399	27,568	27,776	27,915	28,074	28,230	28,387	28,543	28,704	28,862	29,020
Schenectady	20,814	20,914	21,015	21,078	21,164	21,251	21,339	21,427	21,513	21,601	21,688
Suffolk	272,396	274,373	276,158	278,108	279,840	281,635	283,509	285,398	287,420	289,513	291,649
Sullivan	10,550	10,617	10,688	10,752	10,818	10,883	10,949	11,016	11,082	11,152	11,222
Tompkins	9,234	9,550	9,765	10,321	10,711	11,136	11,599	12,093	12,626	13,219	13,839
Ulster	20,435	20,531	20,642	20,722	20,812	20,904	21,000	21,092	21,190	21,285	21,383
Westchester	154,426	155,409	156,313	157,296	158,118	158,990	159,917	160,868	161,879	162,944	164,072

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:											
	12/16	12/17	12/18	12/19	12/21				12/23				12/25			
Albany	36,959	37,161	37,379	37,566	37,937	(7,587)	[1,821]	{910}	38,320	(7,664)	[1,839]	{920}	38,720	(7,744)	[1,859]	{929}
Bronx	219,812	220,815	221,793	222,771	224,660	(44,932)	[10,784]	{5,392}	226,787	(45,357)	[10,886]	{5,443}	229,170	(45,834)	[11,000]	{5,500}
Dutchess	40,340	40,565	40,839	41,055	41,510	(8,302)	[1,992]	{996}	41,997	(8,399)	[2,016]	{1,008}	42,520	(8,504)	[2,041]	{1,020}
Erie	135,342	135,926	136,422	136,795	137,815	(27,563)	[6,615]	{3,308}	138,800	(27,760)	[6,662]	{3,331}	139,778	(27,956)	[6,709]	{3,355}
Kings	365,241	368,272	371,125	373,978	378,894	(75,779)	[18,187]	{9,093}	384,377	(76,875)	[18,450]	{9,225}	390,412	(78,082)	[18,740]	{9,370}
Monroe	105,131	105,602	106,085	106,459	107,282	(21,456)	[5,150]	{2,575}	108,102	(21,620)	[5,189]	{2,594}	108,912	(21,782)	[5,228]	{2,614}
Nassau	240,073	242,013	243,769	245,792	249,332	(49,866)	[11,968]	{5,984}	253,175	(50,635)	[12,152]	{6,076}	257,389	(51,478)	[12,355]	{6,177}
New York	189,081	192,595	196,363	200,126	206,392	(41,278)	[9,907]	{4,953}	213,717	(42,743)	[10,258]	{5,129}	222,129	(44,426)	[10,662]	{5,331}
Niagara	31,529	31,724	31,883	31,978	32,276	(6,455)	[1,549]	{775}	32,568	(6,514)	[1,563]	{782}	32,860	(6,572)	[1,577]	{789}
Onondaga	64,227	64,567	64,961	65,258	65,893	(13,179)	[3,163]	{1,581}	66,548	(13,310)	[3,194]	{1,597}	67,226	(13,445)	[3,227]	{1,613}
Orange	66,065	66,411	66,794	67,162	67,848	(13,570)	[3,257]	{1,628}	68,569	(13,714)	[3,291]	{1,646}	69,332	(13,866)	[3,328]	{1,664}
Putnam	14,000	14,119	14,215	14,320	14,515	(2,903)	[697]	{348}	14,729	(2,946)	[707]	{354}	14,964	(2,993)	[718]	{359}
Queens	340,143	342,182	343,955	345,728	349,493	(69,899)	[16,776]	{8,388}	353,731	(70,746)	[16,979]	{8,490}	358,425	(71,685)	[17,204]	{8,602}
Rensselaer	19,102	19,222	19,331	19,438	19,647	(3,929)	[943]	{472}	19,859	(3,972)	[953]	{477}	20,076	(4,015)	[964]	{482}
Richmond	97,162	97,714	98,168	98,621	99,568	(19,914)	[4,779]	{2,390}	100,590	(20,118)	[4,828]	{2,414}	101,687	(20,337)	[4,881]	{2,440}
Rockland	57,487	57,706	58,012	58,283	58,837	(11,767)	[2,824]	{1,412}	59,474	(11,895)	[2,855]	{1,427}	60,194	(12,039)	[2,889]	{1,445}
Saratoga	27,399	27,568	27,776	27,915	28,230	(5,646)	[1,355]	{678}	28,543	(5,709)	[1,370]	{685}	28,862	(5,772)	[1,385]	{693}
Schenectady	20,814	20,914	21,015	21,078	21,251	(4,250)	[1,020]	{510}	21,427	(4,285)	[1,028]	{514}	21,601	(4,320)	[1,037]	{518}
Suffolk	272,396	274,373	276,158	278,108	281,635	(56,327)	[13,518]	{6,759}	285,398	(57,080)	[13,699]	{6,850}	289,513	(57,903)	[13,897]	{6,948}
Sullivan	10,550	10,617	10,688	10,752	10,883	(2,177)	[522]	{261}	11,016	(2,203)	[529]	{264}	11,152	(2,230)	[535]	{268}
Tompkins	9,234	9,550	9,765	10,321	11,136	(2,227)	[535]	{267}	12,093	(2,419)	[580]	{290}	13,219	(2,644)	[635]	{317}
Ulster	20,435	20,531	20,642	20,722	20,904	(4,181)	[1,003]	{502}	21,092	(4,218)	[1,012]	{506}	21,285	(4,257)	[1,022]	{511}
Westchester	154,426	155,409	156,313	157,296	158,990	(31,798)	[7,632]	{3,816}	160,868	(32,174)	[7,722]	{3,861}	162,944	(32,589)	[7,821]	{3,911}

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.