

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 11/3/21**

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 11/3/21 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.

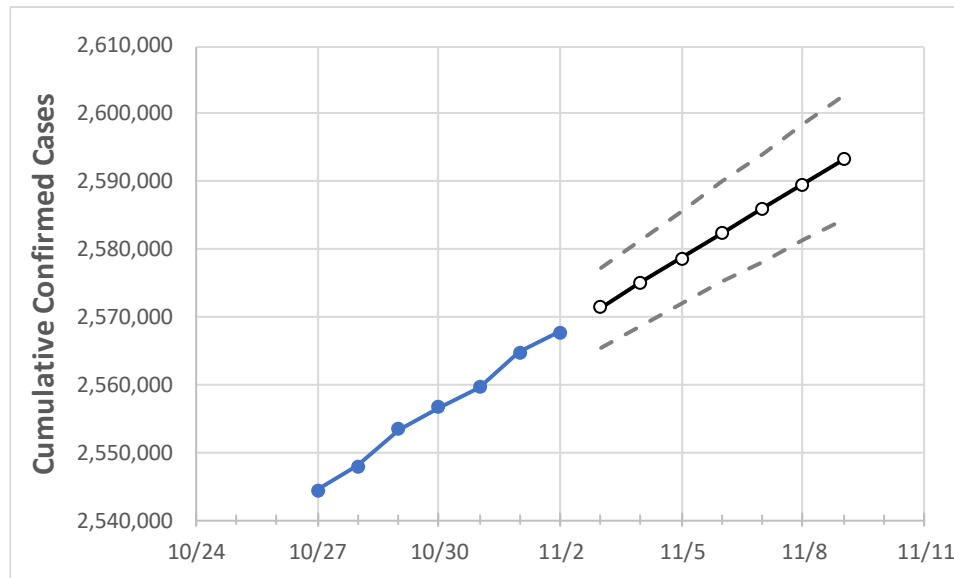
IEM's Modeling Lead

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:						
	10/30	10/31	11/1	11/2	11/3	11/4	11/5	11/6	11/7	11/8	11/9
New York	2,556,628	2,559,583	2,564,789	2,567,747	2,571,389	2,575,086	2,578,680	2,582,306	2,586,003	2,589,637	2,593,310

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:						
	10/30	10/31	11/1	11/2	11/3	11/4	11/5	11/6	11/7	11/8	11/9
Albany	31,574	31,649	31,696	31,750	31,830	31,907	31,987	32,066	32,144	32,221	32,300
Bronx	208,714	208,866	209,019	209,098	209,212	209,325	209,435	209,545	209,653	209,762	209,868
Dutchess	36,019	36,057	36,082	36,128	36,168	36,208	36,247	36,286	36,324	36,363	36,399
Erie	109,071	109,322	109,567	109,851	110,151	110,453	110,753	111,058	111,373	111,683	111,986
Kings	336,917	337,375	337,834	338,115	338,456	338,785	339,117	339,443	339,766	340,087	340,400
Monroe	86,230	86,489	86,669	86,834	87,050	87,266	87,481	87,693	87,916	88,130	88,356
Nassau	216,060	216,266	216,407	216,578	216,755	216,930	217,104	217,276	217,447	217,614	217,782
New York	169,504	169,665	169,780	169,885	170,024	170,164	170,302	170,435	170,570	170,706	170,840
Niagara	24,695	24,767	24,822	24,880	24,953	25,025	25,096	25,172	25,246	25,322	25,396
Onondaga	53,532	53,686	53,813	53,927	54,087	54,231	54,378	54,535	54,679	54,826	54,966
Orange	58,280	58,360	58,424	58,502	58,583	58,664	58,740	58,819	58,898	58,974	59,050
Putnam	12,632	12,643	12,650	12,659	12,672	12,685	12,697	12,709	12,721	12,733	12,745
Queens	317,073	317,309	317,545	317,667	317,844	318,018	318,185	318,354	318,519	318,681	318,840
Rensselaer	15,274	15,312	15,339	15,389	15,439	15,488	15,536	15,584	15,634	15,684	15,733
Richmond	89,698	89,787	89,876	89,918	89,994	90,070	90,145	90,217	90,291	90,364	90,434
Rockland	53,632	53,682	53,724	53,765	53,817	53,868	53,917	53,966	54,016	54,063	54,111
Saratoga	20,934	21,003	21,055	21,108	21,180	21,252	21,323	21,396	21,468	21,542	21,614
Schenectady	17,259	17,317	17,349	17,369	17,425	17,478	17,536	17,589	17,645	17,704	17,761
Suffolk	242,050	242,318	242,536	242,728	242,967	243,208	243,441	243,670	243,897	244,121	244,341
Sullivan	8,649	8,671	8,684	8,692	8,710	8,729	8,746	8,764	8,782	8,801	8,818
Tompkins	6,662	6,670	6,674	6,699	6,715	6,731	6,746	6,761	6,776	6,792	6,809
Ulster	17,530	17,557	17,567	17,591	17,617	17,642	17,667	17,693	17,718	17,743	17,769
Westchester	144,343	144,409	144,477	144,542	144,616	144,687	144,759	144,830	144,900	144,972	145,045

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:											
	10/30	10/31	11/1	11/2	11/4			11/6			11/8					
Albany	31,574	31,649	31,696	31,750	31,907	(6,381)	[1,532]	{766}	32,066	(6,413)	[1,539]	{770}	32,221	(6,444)	[1,547]	{773}
Bronx	208,714	208,866	209,019	209,098	209,325	(41,865)	[10,048]	{5,024}	209,545	(41,909)	[10,058]	{5,029}	209,762	(41,952)	[10,069]	{5,034}
Dutchess	36,019	36,057	36,082	36,128	36,208	(7,242)	[1,738]	{869}	36,286	(7,257)	[1,742]	{871}	36,363	(7,273)	[1,745]	{873}
Erie	109,071	109,322	109,567	109,851	110,453	(22,091)	[5,302]	{2,651}	111,058	(22,212)	[5,331]	{2,665}	111,683	(22,337)	[5,361]	{2,680}
Kings	336,917	337,375	337,834	338,115	338,785	(67,757)	[16,262]	{8,131}	339,443	(67,889)	[16,293]	{8,147}	340,087	(68,017)	[16,324]	{8,162}
Monroe	86,230	86,489	86,669	86,834	87,266	(17,453)	[4,189]	{2,094}	87,693	(17,539)	[4,209]	{2,105}	88,130	(17,626)	[4,230]	{2,115}
Nassau	216,060	216,266	216,407	216,578	216,930	(43,386)	[10,413]	{5,206}	217,276	(43,455)	[10,429]	{5,215}	217,614	(43,523)	[10,445]	{5,223}
New York	169,504	169,665	169,780	169,885	170,164	(34,033)	[8,168]	{4,084}	170,435	(34,087)	[8,181]	{4,090}	170,706	(34,141)	[8,194]	{4,097}
Niagara	24,695	24,767	24,822	24,880	25,025	(5,005)	[1,201]	{601}	25,172	(5,034)	[1,208]	{604}	25,322	(5,064)	[1,215]	{608}
Onondaga	53,532	53,686	53,813	53,927	54,231	(10,846)	[2,603]	{1,302}	54,535	(10,907)	[2,618]	{1,309}	54,826	(10,965)	[2,632]	{1,316}
Orange	58,280	58,360	58,424	58,502	58,664	(11,733)	[2,816]	{1,408}	58,819	(11,764)	[2,823]	{1,412}	58,974	(11,795)	[2,831]	{1,415}
Putnam	12,632	12,643	12,650	12,659	12,685	(2,537)	[609]	{304}	12,709	(2,542)	[610]	{305}	12,733	(2,547)	[611]	{306}
Queens	317,073	317,309	317,545	317,667	318,018	(63,604)	[15,265]	{7,632}	318,354	(63,671)	[15,281]	{7,640}	318,681	(63,736)	[15,297]	{7,648}
Rensselaer	15,274	15,312	15,339	15,389	15,488	(3,098)	[743]	{372}	15,584	(3,117)	[748]	{374}	15,684	(3,137)	[753]	{376}
Richmond	89,698	89,787	89,876	89,918	90,070	(18,014)	[4,323]	{2,162}	90,217	(18,043)	[4,330]	{2,165}	90,364	(18,073)	[4,337]	{2,169}
Rockland	53,632	53,682	53,724	53,765	53,868	(10,774)	[2,586]	{1,293}	53,966	(10,793)	[2,590]	{1,295}	54,063	(10,813)	[2,595]	{1,298}
Saratoga	20,934	21,003	21,055	21,108	21,252	(4,250)	[1,020]	{510}	21,396	(4,279)	[1,027]	{514}	21,542	(4,308)	[1,034]	{517}
Schenectady	17,259	17,317	17,349	17,369	17,478	(3,496)	[839]	{419}	17,589	(3,518)	[844]	{422}	17,704	(3,541)	[850]	{425}
Suffolk	242,050	242,318	242,536	242,728	243,208	(48,642)	[11,674]	{5,837}	243,670	(48,734)	[11,696]	{5,848}	244,121	(48,824)	[11,718]	{5,859}
Sullivan	8,649	8,671	8,684	8,692	8,729	(1,746)	[419]	{209}	8,764	(1,753)	[421]	{210}	8,801	(1,760)	[422]	{211}
Tompkins	6,662	6,670	6,674	6,699	6,731	(1,346)	[323]	{162}	6,761	(1,352)	[325]	{162}	6,792	(1,358)	[326]	{163}
Ulster	17,530	17,557	17,567	17,591	17,642	(3,528)	[847]	{423}	17,693	(3,539)	[849]	{425}	17,743	(3,549)	[852]	{426}
Westchester	144,343	144,409	144,477	144,542	144,687	(28,937)	[6,945]	{3,472}	144,830	(28,966)	[6,952]	{3,476}	144,972	(28,994)	[6,959]	{3,479}

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.