

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

Date: 3/22/21

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 3/22/21 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.

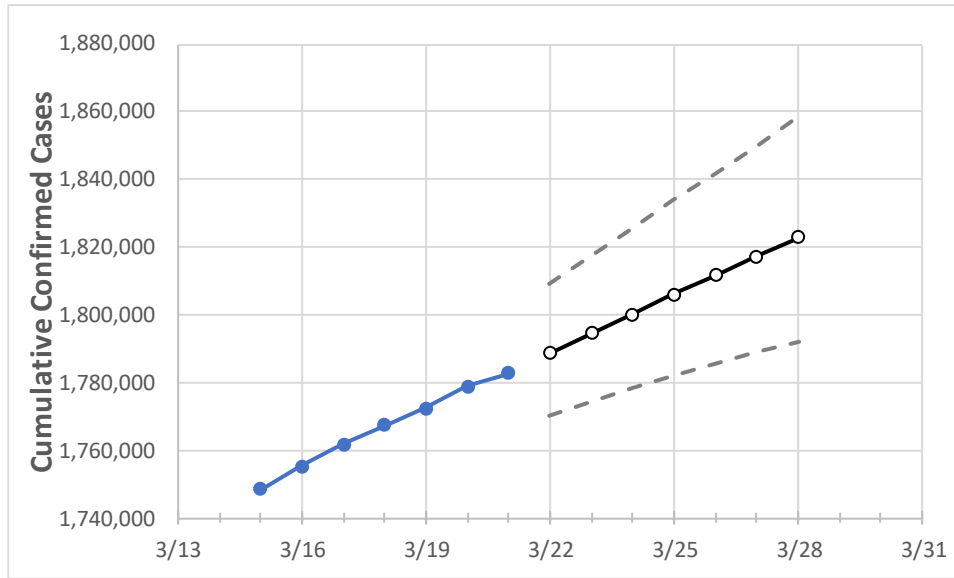
IEM's Modeling Lead

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:						
	3/18	3/19	3/20	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28

New York 1,767,290 1,772,367 1,779,034 1,782,769 1,788,691 1,794,405 1,800,204 1,806,040 1,811,569 1,817,154 1,822,812

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:							
	3/18	3/19	3/20	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28	
Albany	21,806	21,867	21,914	21,982	22,033	22,084	22,135	22,184	22,234	22,284	22,334	
Bronx	155,544	155,795	156,250	156,250	156,685	157,106	157,531	157,923	158,328	158,702	159,049	
Dutchess	24,282	24,409	24,571	24,744	24,890	25,038	25,189	25,342	25,502	25,665	25,830	
Erie	69,273	69,594	69,936	70,323	70,617	70,914	71,222	71,539	71,859	72,186	72,517	
Kings	229,782	230,188	231,077	231,077	231,923	232,757	233,572	234,361	235,124	235,880	236,613	
Monroe	54,671	54,800	54,934	55,119	55,251	55,386	55,521	55,658	55,795	55,933	56,071	
Nassau	159,401	160,103	160,800	161,408	162,056	162,688	163,332	163,975	164,618	165,261	165,914	
New York	113,144	113,370	113,760	113,760	114,149	114,541	114,912	115,282	115,629	115,986	116,310	
Niagara	15,907	15,936	15,965	16,009	16,040	16,071	16,101	16,131	16,160	16,190	16,219	
Onondaga	33,385	33,441	33,504	33,584	33,647	33,711	33,775	33,841	33,907	33,974	34,043	
Orange	40,277	40,499	40,780	40,993	41,229	41,468	41,713	41,962	42,219	42,478	42,746	
Putnam	8,928	8,994	9,033	9,079	9,118	9,159	9,200	9,241	9,283	9,326	9,369	
Queens	229,594	229,999	230,868	230,868	231,724	232,564	233,371	234,169	234,959	235,727	236,498	
Rensselaer	9,570	9,601	9,625	9,657	9,685	9,714	9,743	9,772	9,801	9,830	9,859	
Richmond	61,603	61,712	61,922	61,922	62,127	62,330	62,532	62,730	62,922	63,113	63,302	
Rockland	41,546	41,729	41,858	41,990	42,153	42,313	42,478	42,641	42,803	42,966	43,126	
Saratoga	12,664	12,714	12,774	12,834	12,878	12,923	12,968	13,013	13,059	13,105	13,151	
Schenectady	11,322	11,356	11,381	11,407	11,433	11,459	11,485	11,511	11,537	11,563	11,588	
Suffolk	173,321	174,032	174,799	175,528	176,224	176,920	177,632	178,349	179,072	179,804	180,541	
Sullivan	5,114	5,153	5,186	5,216	5,245	5,275	5,306	5,337	5,370	5,403	5,438	
Tompkins	3,680	3,699	3,718	3,730	3,749	3,768	3,788	3,809	3,830	3,852	3,875	
Ulster	10,973	11,037	11,123	11,203	11,282	11,362	11,445	11,533	11,624	11,715	11,810	
Westchester	114,402	114,802	115,222	115,563	115,933	116,302	116,670	117,042	117,407	117,773	118,139	

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:											
	3/18	3/19	3/20	3/21	3/23			3/25			3/27					
Albany	21,806	21,867	21,914	21,982	22,084	(4,417)	[1,060]	{530}	22,184	(4,437)	[1,065]	{532}	22,284	(4,457)	[1,070]	{535}
Bronx	155,544	155,795	156,250	156,250	157,106	(31,421)	[7,541]	{3,771}	157,923	(31,585)	[7,580]	{3,790}	158,702	(31,740)	[7,618]	{3,809}
Dutchess	24,282	24,409	24,571	24,744	25,038	(5,008)	[1,202]	{601}	25,342	(5,068)	[1,216]	{608}	25,665	(5,133)	[1,232]	{616}
Erie	69,273	69,594	69,936	70,323	70,914	(14,183)	[3,404]	{1,702}	71,539	(14,308)	[3,434]	{1,717}	72,186	(14,437)	[3,465]	{1,732}
Kings	229,782	230,188	231,077	231,077	232,757	(46,551)	[11,172]	{5,586}	234,361	(46,872)	[11,249]	{5,625}	235,880	(47,176)	[11,322]	{5,661}
Monroe	54,671	54,800	54,934	55,119	55,386	(11,077)	[2,659]	{1,329}	55,658	(11,132)	[2,672]	{1,336}	55,933	(11,187)	[2,685]	{1,342}
Nassau	159,401	160,103	160,800	161,408	162,688	(32,538)	[7,809]	{3,905}	163,975	(32,795)	[7,871]	{3,935}	165,261	(33,052)	[7,933]	{3,966}
New York	113,144	113,370	113,760	113,760	114,541	(22,908)	[5,498]	{2,749}	115,282	(23,056)	[5,534]	{2,767}	115,986	(23,197)	[5,567]	{2,784}
Niagara	15,907	15,936	15,965	16,009	16,071	(3,214)	[771]	{386}	16,131	(3,226)	[774]	{387}	16,190	(3,238)	[777]	{389}
Onondaga	33,385	33,441	33,504	33,584	33,711	(6,742)	[1,618]	{809}	33,841	(6,768)	[1,624]	{812}	33,974	(6,795)	[1,631]	{815}
Orange	40,277	40,499	40,780	40,993	41,468	(8,294)	[1,990]	{995}	41,962	(8,392)	[2,014]	{1,007}	42,478	(8,496)	[2,039]	{1,019}
Putnam	8,928	8,994	9,033	9,079	9,159	(1,832)	[440]	{220}	9,241	(1,848)	[444]	{222}	9,326	(1,865)	[448]	{224}
Queens	229,594	229,999	230,868	230,868	232,564	(46,513)	[11,163]	{5,582}	234,169	(46,834)	[11,240]	{5,620}	235,727	(47,145)	[11,315]	{5,657}
Rensselaer	9,570	9,601	9,625	9,657	9,714	(1,943)	[466]	{233}	9,772	(1,954)	[469]	{235}	9,830	(1,966)	[472]	{236}
Richmond	61,603	61,712	61,922	61,922	62,330	(12,466)	[2,992]	{1,496}	62,730	(12,546)	[3,011]	{1,506}	63,113	(12,623)	[3,029]	{1,515}
Rockland	41,546	41,729	41,858	41,990	42,313	(8,463)	[2,031]	{1,016}	42,641	(8,528)	[2,047]	{1,023}	42,966	(8,593)	[2,062]	{1,031}
Saratoga	12,664	12,714	12,774	12,834	12,923	(2,585)	[620]	{310}	13,013	(2,603)	[625]	{312}	13,105	(2,621)	[629]	{315}
Schenectady	11,322	11,356	11,381	11,407	11,459	(2,292)	[550]	{275}	11,511	(2,302)	[553]	{276}	11,563	(2,313)	[555]	{278}
Suffolk	173,321	174,032	174,799	175,528	176,920	(35,384)	[8,492]	{4,246}	178,349	(35,670)	[8,561]	{4,280}	179,804	(35,961)	[8,631]	{4,315}
Sullivan	5,114	5,153	5,186	5,216	5,275	(1,055)	[253]	{127}	5,337	(1,067)	[256]	{128}	5,403	(1,081)	[259]	{130}
Tompkins	3,680	3,699	3,718	3,730	3,768	(754)	[181]	{90}	3,809	(762)	[183]	{91}	3,852	(770)	[185]	{92}
Ulster	10,973	11,037	11,123	11,203	11,362	(2,272)	[545]	{273}	11,533	(2,307)	[554]	{277}	11,715	(2,343)	[562]	{281}
Westchester	114,402	114,802	115,222	115,563	116,302	(23,260)	[5,582]	{2,791}	117,042	(23,408)	[5,618]	{2,809}	117,773	(23,555)	[5,653]	{2,827}

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.