

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

Date: 5/3/21

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 5/3/21 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.

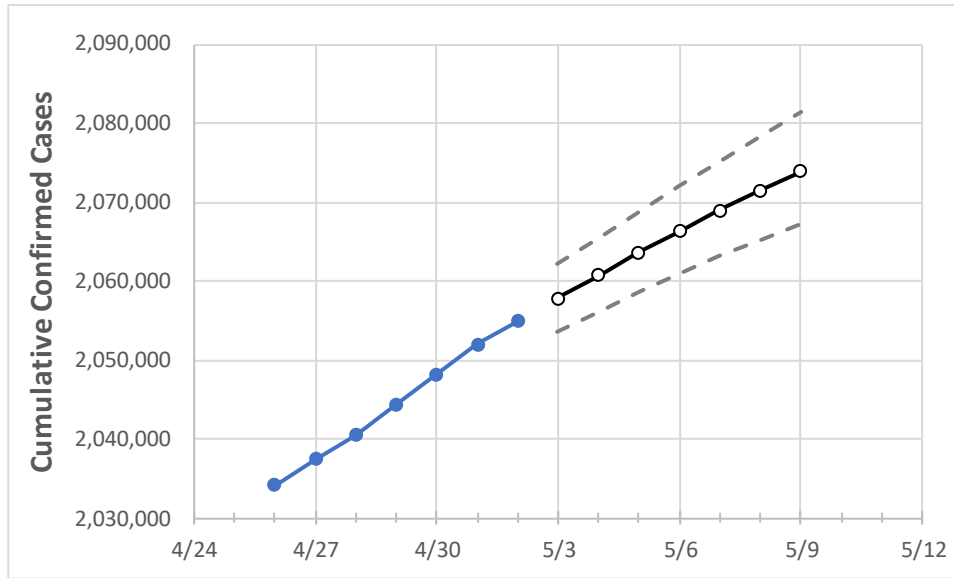
IEM's Modeling Lead

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:						
	4/29	4/30	5/1	5/2	5/3	5/4	5/5	5/6	5/7	5/8	5/9
New York	2,044,345	2,048,150	2,052,022	2,054,848	2,057,864	2,060,780	2,063,569	2,066,313	2,068,936	2,071,471	2,073,894

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:						
	4/29	4/30	5/1	5/2	5/3	5/4	5/5	5/6	5/7	5/8	5/9
Albany	24,102	24,128	24,159	24,180	24,209	24,237	24,265	24,290	24,316	24,340	24,365
Bronx	178,411	178,699	178,985	179,181	179,411	179,630	179,840	180,040	180,233	180,418	180,596
Dutchess	28,587	28,640	28,698	28,744	28,788	28,832	28,874	28,915	28,955	28,994	29,033
Erie	85,879	86,167	86,439	86,606	86,824	87,039	87,240	87,431	87,621	87,809	87,992
Kings	271,836	272,407	272,978	273,437	273,898	274,336	274,763	275,175	275,572	275,945	276,317
Monroe	63,563	63,783	63,999	64,206	64,417	64,630	64,838	65,044	65,253	65,461	65,666
Nassau	180,144	180,373	180,605	180,730	180,896	181,052	181,202	181,346	181,481	181,614	181,739
New York	134,751	134,956	135,193	135,366	135,528	135,681	135,829	135,970	136,108	136,240	136,364
Niagara	18,995	19,078	19,138	19,190	19,244	19,297	19,348	19,399	19,447	19,494	19,542
Onondaga	36,982	37,125	37,232	37,316	37,409	37,505	37,598	37,690	37,784	37,877	37,972
Orange	47,121	47,198	47,264	47,317	47,379	47,440	47,497	47,553	47,608	47,661	47,710
Putnam	10,404	10,416	10,427	10,433	10,443	10,453	10,463	10,471	10,480	10,488	10,496
Queens	269,646	270,031	270,503	270,843	271,202	271,548	271,877	272,200	272,508	272,792	273,067
Rensselaer	10,890	10,912	10,928	10,942	10,955	10,969	10,981	10,993	11,005	11,016	11,027
Richmond	72,630	72,760	72,899	73,008	73,127	73,246	73,356	73,463	73,566	73,665	73,760
Rockland	46,231	46,268	46,319	46,347	46,377	46,404	46,431	46,458	46,481	46,504	46,526
Saratoga	14,735	14,760	14,789	14,806	14,826	14,846	14,865	14,882	14,900	14,916	14,932
Schenectady	12,670	12,688	12,717	12,743	12,763	12,783	12,802	12,821	12,840	12,858	12,876
Suffolk	196,806	197,095	197,356	197,546	197,748	197,942	198,130	198,308	198,483	198,645	198,805
Sullivan	6,374	6,386	6,400	6,415	6,429	6,442	6,456	6,468	6,480	6,491	6,503
Tompkins	4,135	4,140	4,151	4,158	4,164	4,170	4,176	4,183	4,188	4,195	4,200
Ulster	13,446	13,480	13,517	13,537	13,567	13,596	13,624	13,651	13,678	13,704	13,729
Westchester	127,521	127,664	127,817	127,913	128,021	128,124	128,222	128,316	128,405	128,491	128,573

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:											
	4/29	4/30	5/1	5/2	5/4				5/6				5/8			
Albany	24,102	24,128	24,159	24,180	24,237	(4,847)	[1,163]	{582}	24,290	(4,858)	[1,166]	{583}	24,340	(4,868)	[1,168]	{584}
Bronx	178,411	178,699	178,985	179,181	179,630	(35,926)	[8,622]	{4,311}	180,040	(36,008)	[8,642]	{4,321}	180,418	(36,084)	[8,660]	{4,330}
Dutchess	28,587	28,640	28,698	28,744	28,832	(5,766)	[1,384]	{692}	28,915	(5,783)	[1,388]	{694}	28,994	(5,799)	[1,392]	{696}
Erie	85,879	86,167	86,439	86,606	87,039	(17,408)	[4,178]	{2,089}	87,431	(17,486)	[4,197]	{2,098}	87,809	(17,562)	[4,215]	{2,107}
Kings	271,836	272,407	272,978	273,437	274,336	(54,867)	[13,168]	{6,584}	275,175	(55,035)	[13,208]	{6,604}	275,945	(55,189)	[13,245]	{6,623}
Monroe	63,563	63,783	63,999	64,206	64,630	(12,926)	[3,102]	{1,551}	65,044	(13,009)	[3,122]	{1,561}	65,461	(13,092)	[3,142]	{1,571}
Nassau	180,144	180,373	180,605	180,730	181,052	(36,210)	[8,691]	{4,345}	181,346	(36,269)	[8,705]	{4,352}	181,614	(36,323)	[8,717]	{4,359}
New York	134,751	134,956	135,193	135,366	135,681	(27,136)	[6,513]	{3,256}	135,970	(27,194)	[6,527]	{3,263}	136,240	(27,248)	[6,540]	{3,270}
Niagara	18,995	19,078	19,138	19,190	19,297	(3,859)	[926]	{463}	19,399	(3,880)	[931]	{466}	19,494	(3,899)	[936]	{468}
Onondaga	36,982	37,125	37,232	37,316	37,505	(7,501)	[1,800]	{900}	37,690	(7,538)	[1,809]	{905}	37,877	(7,575)	[1,818]	{909}
Orange	47,121	47,198	47,264	47,317	47,440	(9,488)	[2,277]	{1,139}	47,553	(9,511)	[2,283]	{1,141}	47,661	(9,532)	[2,288]	{1,144}
Putnam	10,404	10,416	10,427	10,433	10,453	(2,091)	[502]	{251}	10,471	(2,094)	[503]	{251}	10,488	(2,098)	[503]	{252}
Queens	269,646	270,031	270,503	270,843	271,548	(54,310)	[13,034]	{6,517}	272,200	(54,440)	[13,066]	{6,533}	272,792	(54,558)	[13,094]	{6,547}
Rensselaer	10,890	10,912	10,928	10,942	10,969	(2,194)	[527]	{263}	10,993	(2,199)	[528]	{264}	11,016	(2,203)	[529]	{264}
Richmond	72,630	72,760	72,899	73,008	73,246	(14,649)	[3,516]	{1,758}	73,463	(14,693)	[3,526]	{1,763}	73,665	(14,733)	[3,536]	{1,768}
Rockland	46,231	46,268	46,319	46,347	46,404	(9,281)	[2,227]	{1,114}	46,458	(9,292)	[2,230]	{1,115}	46,504	(9,301)	[2,232]	{1,116}
Saratoga	14,735	14,760	14,789	14,806	14,846	(2,969)	[713]	{356}	14,882	(2,976)	[714]	{357}	14,916	(2,983)	[716]	{358}
Schenectady	12,670	12,688	12,717	12,743	12,783	(2,557)	[614]	{307}	12,821	(2,564)	[615]	{308}	12,858	(2,572)	[617]	{309}
Suffolk	196,806	197,095	197,356	197,546	197,942	(39,588)	[9,501]	{4,751}	198,308	(39,662)	[9,519]	{4,759}	198,645	(39,729)	[9,535]	{4,767}
Sullivan	6,374	6,386	6,400	6,415	6,442	(1,288)	[309]	{155}	6,468	(1,294)	[310]	{155}	6,491	(1,298)	[312]	{156}
Tompkins	4,135	4,140	4,151	4,158	4,170	(834)	[200]	{100}	4,183	(837)	[201]	{100}	4,195	(839)	[201]	{101}
Ulster	13,446	13,480	13,517	13,537	13,596	(2,719)	[653]	{326}	13,651	(2,730)	[655]	{328}	13,704	(2,741)	[658]	{329}
Westchester	127,521	127,664	127,817	127,913	128,124	(25,625)	[6,150]	{3,075}	128,316	(25,663)	[6,159]	{3,080}	128,491	(25,698)	[6,168]	{3,084}

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.