

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

Date: 5/4/21

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 5/4/21 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.

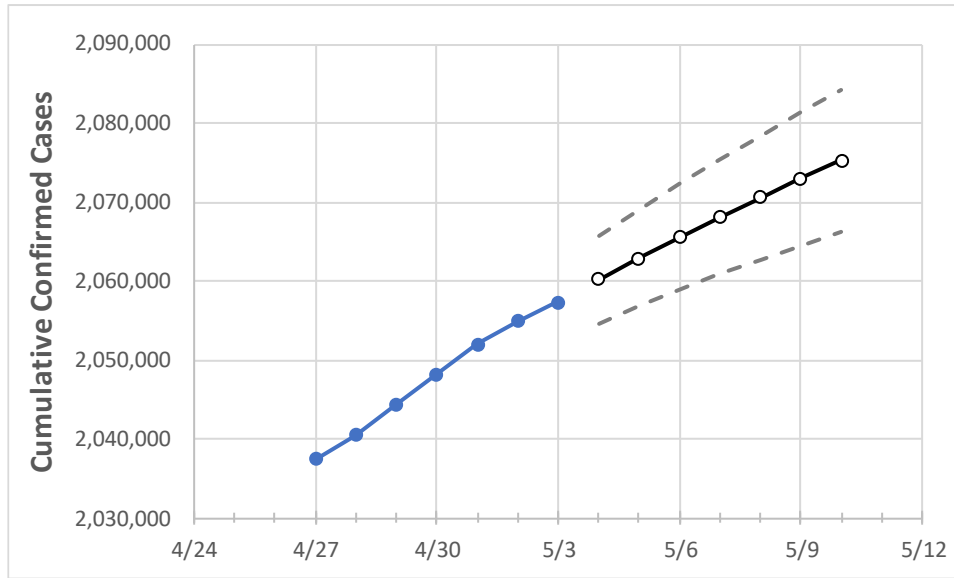
IEM's Modeling Lead

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:						
	4/30	5/1	5/2	5/3	5/4	5/5	5/6	5/7	5/8	5/9	5/10

New York	2,048,150	2,052,022	2,054,848	2,057,276	2,060,151	2,062,892	2,065,563	2,068,093	2,070,594	2,073,019	2,075,239
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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:						
	4/30	5/1	5/2	5/3	5/4	5/5	5/6	5/7	5/8	5/9	5/10
Albany	24,128	24,159	24,180	24,192	24,218	24,242	24,266	24,289	24,312	24,333	24,354
Bronx	178,699	178,985	179,181	179,370	179,586	179,793	179,989	180,180	180,368	180,541	180,705
Dutchess	28,640	28,698	28,744	28,781	28,822	28,863	28,902	28,940	28,977	29,012	29,047
Erie	86,167	86,439	86,606	86,742	86,945	87,138	87,324	87,506	87,682	87,848	88,004
Kings	272,407	272,978	273,437	273,833	274,276	274,698	275,109	275,495	275,871	276,234	276,593
Monroe	63,783	63,999	64,206	64,407	64,616	64,822	65,031	65,237	65,443	65,647	65,847
Nassau	180,373	180,605	180,730	180,860	181,013	181,157	181,297	181,429	181,550	181,667	181,777
New York	134,956	135,193	135,366	135,467	135,615	135,760	135,899	136,028	136,152	136,269	136,386
Niagara	19,078	19,138	19,190	19,228	19,279	19,330	19,377	19,425	19,470	19,515	19,558
Onondaga	37,125	37,232	37,316	37,359	37,444	37,528	37,612	37,692	37,777	37,862	37,947
Orange	47,198	47,264	47,317	47,349	47,406	47,461	47,514	47,567	47,617	47,664	47,708
Putnam	10,416	10,427	10,433	10,448	10,458	10,469	10,478	10,487	10,495	10,503	10,511
Queens	270,031	270,503	270,843	271,187	271,534	271,869	272,183	272,496	272,787	273,063	273,328
Rensselaer	10,912	10,928	10,942	10,952	10,965	10,977	10,989	11,000	11,010	11,021	11,031
Richmond	72,760	72,899	73,008	73,114	73,221	73,325	73,422	73,516	73,605	73,690	73,770
Rockland	46,268	46,319	46,347	46,362	46,391	46,416	46,441	46,464	46,487	46,509	46,528
Saratoga	14,760	14,789	14,806	14,833	14,853	14,873	14,892	14,910	14,928	14,945	14,962
Schenectady	12,688	12,717	12,743	12,754	12,773	12,792	12,811	12,830	12,847	12,865	12,882
Suffolk	197,095	197,356	197,546	197,718	197,911	198,094	198,270	198,441	198,608	198,765	198,919
Sullivan	6,386	6,400	6,415	6,419	6,431	6,443	6,454	6,465	6,475	6,485	6,495
Tompkins	4,140	4,151	4,158	4,160	4,166	4,172	4,178	4,184	4,190	4,195	4,201
Ulster	13,480	13,517	13,537	13,559	13,586	13,612	13,637	13,661	13,685	13,709	13,731
Westchester	127,664	127,817	127,913	127,975	128,078	128,176	128,267	128,354	128,439	128,517	128,593

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:											
	4/30	5/1	5/2	5/3	5/5				5/7				5/9			
Albany	24,128	24,159	24,180	24,192	24,242	(4,848)	[1,164]	{582}	24,289	(4,858)	[1,166]	{583}	24,333	(4,867)	[1,168]	{584}
Bronx	178,699	178,985	179,181	179,370	179,793	(35,959)	[8,630]	{4,315}	180,180	(36,036)	[8,649]	{4,324}	180,541	(36,108)	[8,666]	{4,333}
Dutchess	28,640	28,698	28,744	28,781	28,863	(5,773)	[1,385]	{693}	28,940	(5,788)	[1,389]	{695}	29,012	(5,802)	[1,393]	{696}
Erie	86,167	86,439	86,606	86,742	87,138	(17,428)	[4,183]	{2,091}	87,506	(17,501)	[4,200]	{2,100}	87,848	(17,570)	[4,217]	{2,108}
Kings	272,407	272,978	273,437	273,833	274,698	(54,940)	[13,186]	{6,593}	275,495	(55,099)	[13,224]	{6,612}	276,234	(55,247)	[13,259]	{6,630}
Monroe	63,783	63,999	64,206	64,407	64,822	(12,964)	[3,111]	{1,556}	65,237	(13,047)	[3,131]	{1,566}	65,647	(13,129)	[3,151]	{1,576}
Nassau	180,373	180,605	180,730	180,860	181,157	(36,231)	[8,696]	{4,348}	181,429	(36,286)	[8,709]	{4,354}	181,667	(36,333)	[8,720]	{4,360}
New York	134,956	135,193	135,366	135,467	135,760	(27,152)	[6,516]	{3,258}	136,028	(27,206)	[6,529]	{3,265}	136,269	(27,254)	[6,541]	{3,270}
Niagara	19,078	19,138	19,190	19,228	19,330	(3,866)	[928]	{464}	19,425	(3,885)	[932]	{466}	19,515	(3,903)	[937]	{468}
Onondaga	37,125	37,232	37,316	37,359	37,528	(7,506)	[1,801]	{901}	37,692	(7,538)	[1,809]	{905}	37,862	(7,572)	[1,817]	{909}
Orange	47,198	47,264	47,317	47,349	47,461	(9,492)	[2,278]	{1,139}	47,567	(9,513)	[2,283]	{1,142}	47,664	(9,533)	[2,288]	{1,144}
Putnam	10,416	10,427	10,433	10,448	10,469	(2,094)	[502]	{251}	10,487	(2,097)	[503]	{252}	10,503	(2,101)	[504]	{252}
Queens	270,031	270,503	270,843	271,187	271,869	(54,374)	[13,050]	{6,525}	272,496	(54,499)	[13,080]	{6,540}	273,063	(54,613)	[13,107]	{6,554}
Rensselaer	10,912	10,928	10,942	10,952	10,977	(2,195)	[527]	{263}	11,000	(2,200)	[528]	{264}	11,021	(2,204)	[529]	{264}
Richmond	72,760	72,899	73,008	73,114	73,325	(14,665)	[3,520]	{1,760}	73,516	(14,703)	[3,529]	{1,764}	73,690	(14,738)	[3,537]	{1,769}
Rockland	46,268	46,319	46,347	46,362	46,416	(9,283)	[2,228]	{1,114}	46,464	(9,293)	[2,230]	{1,115}	46,509	(9,302)	[2,232]	{1,116}
Saratoga	14,760	14,789	14,806	14,833	14,873	(2,975)	[714]	{357}	14,910	(2,982)	[716]	{358}	14,945	(2,989)	[717]	{359}
Schenectady	12,688	12,717	12,743	12,754	12,792	(2,558)	[614]	{307}	12,830	(2,566)	[616]	{308}	12,865	(2,573)	[618]	{309}
Suffolk	197,095	197,356	197,546	197,718	198,094	(39,619)	[9,509]	{4,754}	198,441	(39,688)	[9,525]	{4,763}	198,765	(39,753)	[9,541]	{4,770}
Sullivan	6,386	6,400	6,415	6,419	6,443	(1,289)	[309]	{155}	6,465	(1,293)	[310]	{155}	6,485	(1,297)	[311]	{156}
Tompkins	4,140	4,151	4,158	4,160	4,172	(834)	[200]	{100}	4,184	(837)	[201]	{100}	4,195	(839)	[201]	{101}
Ulster	13,480	13,517	13,537	13,559	13,612	(2,722)	[653]	{327}	13,661	(2,732)	[656]	{328}	13,709	(2,742)	[658]	{329}
Westchester	127,664	127,817	127,913	127,975	128,176	(25,635)	[6,152]	{3,076}	128,354	(25,671)	[6,161]	{3,080}	128,517	(25,703)	[6,169]	{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.