

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

Date: 2/18/21

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 2/18/21 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.

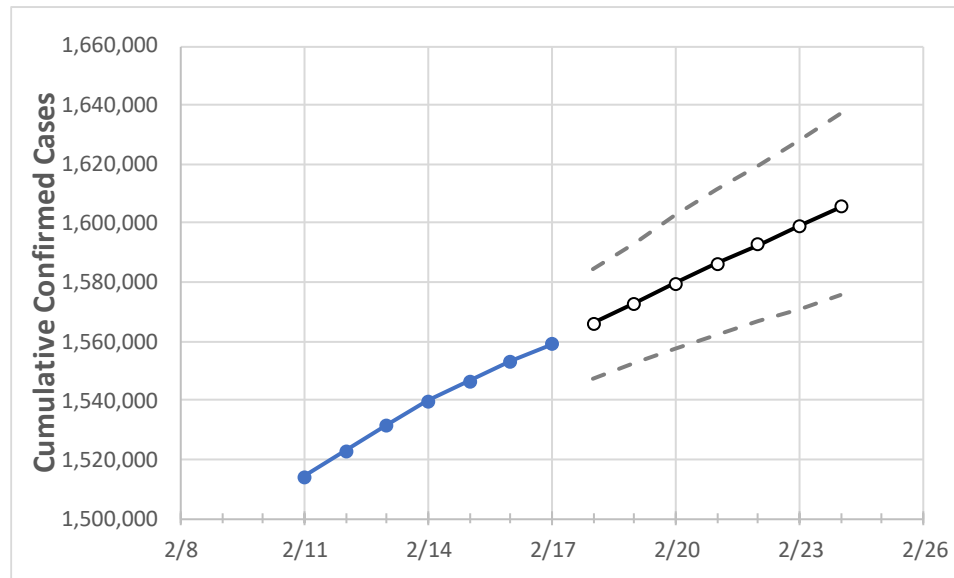
IEM's Modeling Lead

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:						
	2/14	2/15	2/16	2/17	2/18	2/19	2/20	2/21	2/22	2/23	2/24
New York	1,539,870	1,546,408	1,553,117	1,559,042	1,566,114	1,572,871	1,579,537	1,586,282	1,592,892	1,599,282	1,605,561

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:						
	2/14	2/15	2/16	2/17	2/18	2/19	2/20	2/21	2/22	2/23	2/24
Albany	19,982	20,033	20,090	20,132	20,187	20,239	20,289	20,337	20,382	20,425	20,465
Bronx	132,334	133,111	133,786	134,393	135,228	136,048	136,839	137,623	138,430	139,232	139,988
Dutchess	20,837	20,943	21,024	21,131	21,227	21,320	21,410	21,500	21,587	21,677	21,759
Erie	61,800	61,999	62,208	62,391	62,639	62,879	63,115	63,346	63,567	63,780	63,996
Kings	192,881	193,853	194,965	195,859	196,957	198,028	199,080	200,122	201,139	202,138	203,133
Monroe	50,550	50,697	50,830	50,935	51,062	51,189	51,314	51,429	51,543	51,651	51,755
Nassau	139,516	140,107	140,686	141,224	141,848	142,465	143,061	143,633	144,219	144,782	145,335
New York	94,575	95,177	95,669	96,072	96,618	97,178	97,721	98,252	98,779	99,318	99,846
Niagara	14,736	14,756	14,803	14,837	14,881	14,923	14,960	14,998	15,033	15,065	15,097
Onondaga	31,445	31,505	31,580	31,639	31,712	31,782	31,849	31,914	31,977	32,037	32,097
Orange	34,588	34,729	34,898	35,035	35,183	35,328	35,472	35,614	35,749	35,883	36,016
Putnam	7,878	7,911	7,943	7,986	8,023	8,060	8,095	8,129	8,165	8,199	8,234
Queens	194,714	195,745	196,889	197,718	198,764	199,795	200,828	201,814	202,802	203,789	204,743
Rensselaer	8,561	8,592	8,621	8,641	8,670	8,698	8,724	8,750	8,773	8,798	8,821
Richmond	53,403	53,646	53,879	54,056	54,293	54,522	54,748	54,967	55,183	55,406	55,622
Rockland	36,672	36,777	36,954	37,088	37,226	37,361	37,497	37,628	37,756	37,884	38,011
Saratoga	11,349	11,379	11,415	11,441	11,475	11,507	11,538	11,567	11,595	11,621	11,646
Schenectady	10,451	10,472	10,493	10,513	10,544	10,573	10,601	10,629	10,654	10,679	10,702
Suffolk	154,098	154,623	155,149	155,739	156,323	156,890	157,445	157,987	158,518	159,030	159,540
Sullivan	4,482	4,497	4,506	4,533	4,548	4,562	4,575	4,589	4,602	4,614	4,627
Tompkins	3,325	3,335	3,340	3,345	3,359	3,371	3,384	3,396	3,408	3,419	3,429
Ulster	9,464	9,498	9,541	9,569	9,607	9,645	9,682	9,718	9,753	9,784	9,818
Westchester	101,511	101,816	102,197	102,598	103,025	103,445	103,860	104,258	104,660	105,053	105,433

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:											
	2/14	2/15	2/16	2/17	2/19				2/21				2/23			
Albany	19,982	20,033	20,090	20,132	20,239	(4,048)	[971]	{486}	20,337	(4,067)	[976]	{488}	20,425	(4,085)	[980]	{490}
Bronx	132,334	133,111	133,786	134,393	136,048	(27,210)	[6,530]	{3,265}	137,623	(27,525)	[6,606]	{3,303}	139,232	(27,846)	[6,683]	{3,342}
Dutchess	20,837	20,943	21,024	21,131	21,320	(4,264)	[1,023]	{512}	21,500	(4,300)	[1,032]	{516}	21,677	(4,335)	[1,040]	{520}
Erie	61,800	61,999	62,208	62,391	62,879	(12,576)	[3,018]	{1,509}	63,346	(12,669)	[3,041]	{1,520}	63,780	(12,756)	[3,061]	{1,531}
Kings	192,881	193,853	194,965	195,859	198,028	(39,606)	[9,505]	{4,753}	200,122	(40,024)	[9,606]	{4,803}	202,138	(40,428)	[9,703]	{4,851}
Monroe	50,550	50,697	50,830	50,935	51,189	(10,238)	[2,457]	{1,229}	51,429	(10,286)	[2,469]	{1,234}	51,651	(10,330)	[2,479]	{1,240}
Nassau	139,516	140,107	140,686	141,224	142,465	(28,493)	[6,838]	{3,419}	143,633	(28,727)	[6,894]	{3,447}	144,782	(28,956)	[6,950]	{3,475}
New York	94,575	95,177	95,669	96,072	97,178	(19,436)	[4,665]	{2,332}	98,252	(19,650)	[4,716]	{2,358}	99,318	(19,864)	[4,767]	{2,384}
Niagara	14,736	14,756	14,803	14,837	14,923	(2,985)	[716]	{358}	14,998	(3,000)	[720]	{360}	15,065	(3,013)	[723]	{362}
Onondaga	31,445	31,505	31,580	31,639	31,782	(6,356)	[1,526]	{763}	31,914	(6,383)	[1,532]	{766}	32,037	(6,407)	[1,538]	{769}
Orange	34,588	34,729	34,898	35,035	35,328	(7,066)	[1,696]	{848}	35,614	(7,123)	[1,709]	{855}	35,883	(7,177)	[1,722]	{861}
Putnam	7,878	7,911	7,943	7,986	8,060	(1,612)	[387]	{193}	8,129	(1,626)	[390]	{195}	8,199	(1,640)	[394]	{197}
Queens	194,714	195,745	196,889	197,718	199,795	(39,959)	[9,590]	{4,795}	201,814	(40,363)	[9,687]	{4,844}	203,789	(40,758)	[9,782]	{4,891}
Rensselaer	8,561	8,592	8,621	8,641	8,698	(1,740)	[418]	{209}	8,750	(1,750)	[420]	{210}	8,798	(1,760)	[422]	{211}
Richmond	53,403	53,646	53,879	54,056	54,522	(10,904)	[2,617]	{1,309}	54,967	(10,993)	[2,638]	{1,319}	55,406	(11,081)	[2,660]	{1,330}
Rockland	36,672	36,777	36,954	37,088	37,361	(7,472)	[1,793]	{897}	37,628	(7,526)	[1,806]	{903}	37,884	(7,577)	[1,818]	{909}
Saratoga	11,349	11,379	11,415	11,441	11,507	(2,301)	[552]	{276}	11,567	(2,313)	[555]	{278}	11,621	(2,324)	[558]	{279}
Schenectady	10,451	10,472	10,493	10,513	10,573	(2,115)	[507]	{254}	10,629	(2,126)	[510]	{255}	10,679	(2,136)	[513]	{256}
Suffolk	154,098	154,623	155,149	155,739	156,890	(31,378)	[7,531]	{3,765}	157,987	(31,597)	[7,583]	{3,792}	159,030	(31,806)	[7,633]	{3,817}
Sullivan	4,482	4,497	4,506	4,533	4,562	(912)	[219]	{109}	4,589	(918)	[220]	{110}	4,614	(923)	[221]	{111}
Tompkins	3,325	3,335	3,340	3,345	3,371	(674)	[162]	{81}	3,396	(679)	[163]	{82}	3,419	(684)	[164]	{82}
Ulster	9,464	9,498	9,541	9,569	9,645	(1,929)	[463]	{231}	9,718	(1,944)	[466]	{233}	9,784	(1,957)	[470]	{235}
Westchester	101,511	101,816	102,197	102,598	103,445	(20,689)	[4,965]	{2,483}	104,258	(20,852)	[5,004]	{2,502}	105,053	(21,011)	[5,043]	{2,521}

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.