

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

Date: 5/24/21

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 5/24/21 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.

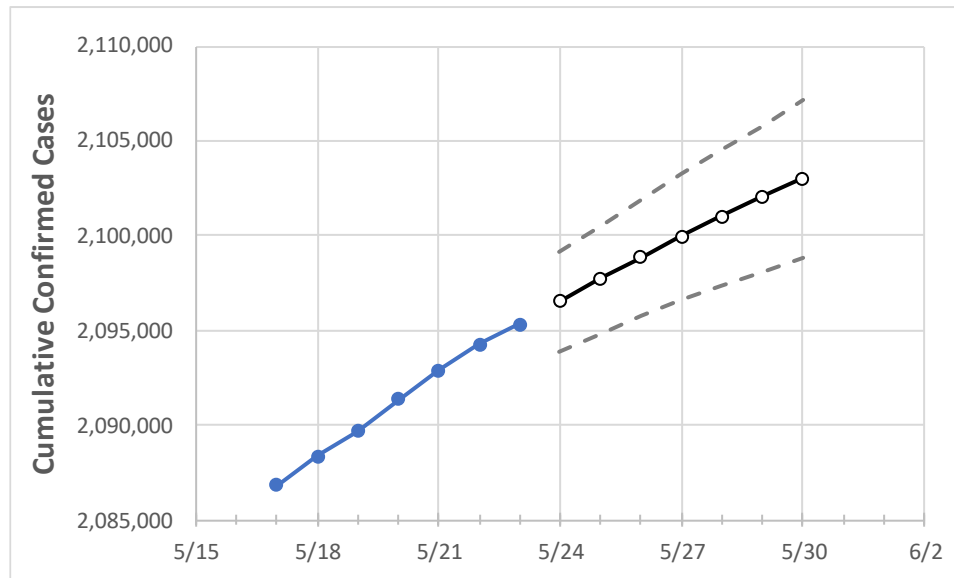
IEM's Modeling Lead

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:						
	5/20	5/21	5/22	5/23	5/24	5/25	5/26	5/27	5/28	5/29	5/30
New York	2,091,342	2,092,916	2,094,245	2,095,319	2,096,549	2,097,728	2,098,860	2,099,975	2,101,029	2,102,048	2,103,028

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:						
	5/20	5/21	5/22	5/23	5/24	5/25	5/26	5/27	5/28	5/29	5/30
Albany	24,493	24,516	24,531	24,549	24,563	24,577	24,591	24,604	24,617	24,630	24,643
Bronx	181,798	181,913	182,006	182,076	182,160	182,239	182,318	182,391	182,462	182,530	182,597
Dutchess	29,275	29,289	29,301	29,320	29,336	29,350	29,364	29,378	29,391	29,404	29,415
Erie	88,726	88,807	88,885	88,925	88,985	89,042	89,094	89,146	89,195	89,241	89,286
Kings	278,210	278,416	278,578	278,726	278,867	279,004	279,130	279,255	279,375	279,493	279,597
Monroe	67,409	67,555	67,672	67,781	67,909	68,034	68,156	68,273	68,390	68,505	68,614
Nassau	182,656	182,739	182,810	182,859	182,923	182,984	183,042	183,098	183,150	183,203	183,252
New York	137,171	137,238	137,312	137,379	137,435	137,491	137,545	137,595	137,645	137,692	137,738
Niagara	19,802	19,837	19,856	19,881	19,902	19,921	19,941	19,960	19,978	19,996	20,013
Onondaga	38,287	38,339	38,380	38,418	38,460	38,502	38,544	38,585	38,624	38,663	38,701
Orange	47,966	47,984	48,015	48,033	48,052	48,070	48,088	48,104	48,119	48,135	48,150
Putnam	10,553	10,556	10,558	10,560	10,562	10,564	10,566	10,568	10,569	10,571	10,572
Queens	275,195	275,360	275,486	275,606	275,748	275,887	276,017	276,147	276,263	276,383	276,497
Rensselaer	11,148	11,156	11,161	11,164	11,171	11,179	11,186	11,193	11,199	11,206	11,212
Richmond	74,267	74,323	74,357	74,389	74,428	74,465	74,500	74,534	74,566	74,597	74,624
Rockland	46,731	46,747	46,768	46,777	46,789	46,800	46,811	46,822	46,831	46,841	46,850
Saratoga	15,187	15,205	15,213	15,226	15,241	15,255	15,269	15,282	15,295	15,307	15,320
Schenectady	13,041	13,064	13,080	13,085	13,097	13,108	13,119	13,129	13,140	13,150	13,159
Suffolk	199,824	199,904	199,991	200,058	200,125	200,189	200,249	200,307	200,363	200,417	200,468
Sullivan	6,574	6,576	6,592	6,600	6,605	6,611	6,615	6,620	6,625	6,629	6,633
Tompkins	4,283	4,289	4,294	4,299	4,306	4,313	4,320	4,328	4,335	4,343	4,350
Ulster	13,813	13,821	13,825	13,838	13,846	13,853	13,859	13,866	13,872	13,878	13,883
Westchester	129,018	129,080	129,131	129,161	129,194	129,226	129,256	129,285	129,313	129,340	129,365

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:											
	5/20	5/21	5/22	5/23	5/25				5/27				5/29			
Albany	24,493	24,516	24,531	24,549	24,577	(4,915)	[1,180]	{590}	24,604	(4,921)	[1,181]	{590}	24,630	(4,926)	[1,182]	{591}
Bronx	181,798	181,913	182,006	182,076	182,239	(36,448)	[8,747]	{4,374}	182,391	(36,478)	[8,755]	{4,377}	182,530	(36,506)	[8,761]	{4,381}
Dutchess	29,275	29,289	29,301	29,320	29,350	(5,870)	[1,409]	{704}	29,378	(5,876)	[1,410]	{705}	29,404	(5,881)	[1,411]	{706}
Erie	88,726	88,807	88,885	88,925	89,042	(17,808)	[4,274]	{2,137}	89,146	(17,829)	[4,279]	{2,139}	89,241	(17,848)	[4,284]	{2,142}
Kings	278,210	278,416	278,578	278,726	279,004	(55,801)	[13,392]	{6,696}	279,255	(55,851)	[13,404]	{6,702}	279,493	(55,899)	[13,416]	{6,708}
Monroe	67,409	67,555	67,672	67,781	68,034	(13,607)	[3,266]	{1,633}	68,273	(13,655)	[3,277]	{1,639}	68,505	(13,701)	[3,288]	{1,644}
Nassau	182,656	182,739	182,810	182,859	182,984	(36,597)	[8,783]	{4,392}	183,098	(36,620)	[8,789]	{4,394}	183,203	(36,641)	[8,794]	{4,397}
New York	137,171	137,238	137,312	137,379	137,491	(27,498)	[6,600]	{3,300}	137,595	(27,519)	[6,605]	{3,302}	137,692	(27,538)	[6,609]	{3,305}
Niagara	19,802	19,837	19,856	19,881	19,921	(3,984)	[956]	{478}	19,960	(3,992)	[958]	{479}	19,996	(3,999)	[960]	{480}
Onondaga	38,287	38,339	38,380	38,418	38,502	(7,700)	[1,848]	{924}	38,585	(7,717)	[1,852]	{926}	38,663	(7,733)	[1,856]	{928}
Orange	47,966	47,984	48,015	48,033	48,070	(9,614)	[2,307]	{1,154}	48,104	(9,621)	[2,309]	{1,154}	48,135	(9,627)	[2,310]	{1,155}
Putnam	10,553	10,556	10,558	10,560	10,564	(2,113)	[507]	{254}	10,568	(2,114)	[507]	{254}	10,571	(2,114)	[507]	{254}
Queens	275,195	275,360	275,486	275,606	275,887	(55,177)	[13,243]	{6,621}	276,147	(55,229)	[13,255]	{6,628}	276,383	(55,277)	[13,266]	{6,633}
Rensselaer	11,148	11,156	11,161	11,164	11,179	(2,236)	[537]	{268}	11,193	(2,239)	[537]	{269}	11,206	(2,241)	[538]	{269}
Richmond	74,267	74,323	74,357	74,389	74,465	(14,893)	[3,574]	{1,787}	74,534	(14,907)	[3,578]	{1,789}	74,597	(14,919)	[3,581]	{1,790}
Rockland	46,731	46,747	46,768	46,777	46,800	(9,360)	[2,246]	{1,123}	46,822	(9,364)	[2,247]	{1,124}	46,841	(9,368)	[2,248]	{1,124}
Saratoga	15,187	15,205	15,213	15,226	15,255	(3,051)	[732]	{366}	15,282	(3,056)	[734]	{367}	15,307	(3,061)	[735]	{367}
Schenectady	13,041	13,064	13,080	13,085	13,108	(2,622)	[629]	{315}	13,129	(2,626)	[630]	{315}	13,150	(2,630)	[631]	{316}
Suffolk	199,824	199,904	199,991	200,058	200,189	(40,038)	[9,609]	{4,805}	200,307	(40,061)	[9,615]	{4,807}	200,417	(40,083)	[9,620]	{4,810}
Sullivan	6,574	6,576	6,592	6,600	6,611	(1,322)	[317]	{159}	6,620	(1,324)	[318]	{159}	6,629	(1,326)	[318]	{159}
Tompkins	4,283	4,289	4,294	4,299	4,313	(863)	[207]	{104}	4,328	(866)	[208]	{104}	4,343	(869)	[208]	{104}
Ulster	13,813	13,821	13,825	13,838	13,853	(2,771)	[665]	{332}	13,866	(2,773)	[666]	{333}	13,878	(2,776)	[666]	{333}
Westchester	129,018	129,080	129,131	129,161	129,226	(25,845)	[6,203]	{3,101}	129,285	(25,857)	[6,206]	{3,103}	129,340	(25,868)	[6,208]	{3,104}

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.