

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

Date: 6/17/21

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 6/17/21 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.

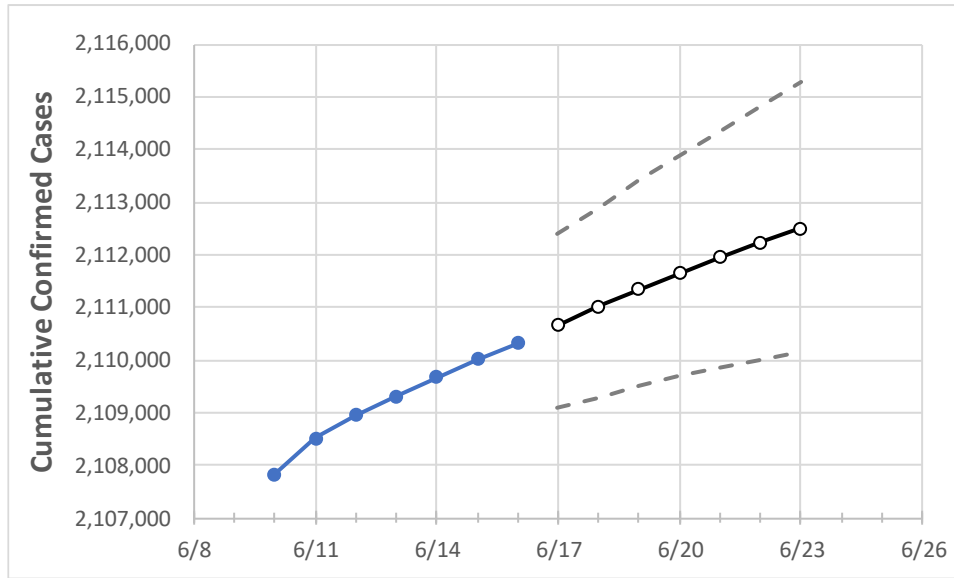
IEM's Modeling Lead

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:						
	6/13	6/14	6/15	6/16	6/17	6/18	6/19	6/20	6/21	6/22	6/23

New York 2,109,313 2,109,677 2,110,004 2,110,310 2,110,667 2,111,010 2,111,338 2,111,649 2,111,947 2,112,237 2,112,500

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:						
	6/13	6/14	6/15	6/16	6/17	6/18	6/19	6/20	6/21	6/22	6/23
Albany	24,694	24,696	24,699	24,700	24,702	24,704	24,706	24,708	24,710	24,711	24,713
Bronx	183,412	183,457	183,505	183,548	183,607	183,662	183,720	183,777	183,834	183,889	183,944
Dutchess	29,468	29,470	29,472	29,475	29,478	29,480	29,482	29,485	29,486	29,488	29,490
Erie	89,564	89,572	89,579	89,583	89,592	89,601	89,609	89,617	89,624	89,631	89,637
Kings	280,513	280,563	280,594	280,607	280,652	280,694	280,733	280,771	280,808	280,844	280,877
Monroe	68,929	68,959	68,976	68,991	69,010	69,028	69,044	69,060	69,075	69,088	69,101
Nassau	183,601	183,624	183,649	183,673	183,699	183,724	183,749	183,772	183,795	183,817	183,840
New York	138,212	138,244	138,272	138,299	138,330	138,361	138,392	138,423	138,452	138,480	138,509
Niagara	20,032	20,033	20,035	20,039	20,041	20,043	20,044	20,046	20,047	20,048	20,049
Onondaga	38,913	38,928	38,931	38,941	38,951	38,961	38,969	38,978	38,986	38,994	39,001
Orange	48,303	48,308	48,312	48,316	48,323	48,330	48,337	48,343	48,350	48,355	48,361
Putnam	10,605	10,606	10,606	10,610	10,611	10,612	10,614	10,615	10,616	10,616	10,617
Queens	277,187	277,244	277,300	277,339	277,383	277,424	277,464	277,502	277,539	277,574	277,608
Rensselaer	11,225	11,228	11,229	11,229	11,231	11,232	11,234	11,235	11,237	11,238	11,240
Richmond	74,944	74,960	74,977	74,991	75,007	75,022	75,037	75,051	75,065	75,078	75,091
Rockland	46,935	46,936	46,944	46,948	46,952	46,956	46,959	46,962	46,965	46,968	46,971
Saratoga	15,359	15,362	15,364	15,367	15,369	15,371	15,373	15,375	15,376	15,378	15,379
Schenectady	13,197	13,200	13,202	13,204	13,206	13,207	13,208	13,210	13,211	13,212	13,213
Suffolk	200,989	201,008	201,036	201,070	201,099	201,127	201,154	201,183	201,208	201,234	201,258
Sullivan	6,672	6,673	6,673	6,674	6,676	6,677	6,678	6,679	6,680	6,682	6,683
Tompkins	4,346	4,346	4,346	4,346	4,347	4,348	4,348	4,349	4,350	4,350	4,351
Ulster	13,905	13,907	13,908	13,911	13,913	13,915	13,916	13,918	13,919	13,921	13,922
Westchester	129,645	129,657	129,664	129,680	129,697	129,714	129,731	129,747	129,763	129,779	129,794

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:											
	6/13	6/14	6/15	6/16	6/18				6/20				6/22			
Albany	24,694	24,696	24,699	24,700	24,704	(4,941)	[1,186]	{593}	24,708	(4,942)	[1,186]	{593}	24,711	(4,942)	[1,186]	{593}
Bronx	183,412	183,457	183,505	183,548	183,662	(36,732)	[8,816]	{4,408}	183,777	(36,755)	[8,821]	{4,411}	183,889	(36,778)	[8,827]	{4,413}
Dutchess	29,468	29,470	29,472	29,475	29,480	(5,896)	[1,415]	{708}	29,485	(5,897)	[1,415]	{708}	29,488	(5,898)	[1,415]	{708}
Erie	89,564	89,572	89,579	89,583	89,601	(17,920)	[4,301]	{2,150}	89,617	(17,923)	[4,302]	{2,151}	89,631	(17,926)	[4,302]	{2,151}
Kings	280,513	280,563	280,594	280,607	280,694	(56,139)	[13,473]	{6,737}	280,771	(56,154)	[13,477]	{6,739}	280,844	(56,169)	[13,480]	{6,740}
Monroe	68,929	68,959	68,976	68,991	69,028	(13,806)	[3,313]	{1,657}	69,060	(13,812)	[3,315]	{1,657}	69,088	(13,818)	[3,316]	{1,658}
Nassau	183,601	183,624	183,649	183,673	183,724	(36,745)	[8,819]	{4,409}	183,772	(36,754)	[8,821]	{4,411}	183,817	(36,763)	[8,823]	{4,412}
New York	138,212	138,244	138,272	138,299	138,361	(27,672)	[6,641]	{3,321}	138,423	(27,685)	[6,644]	{3,322}	138,480	(27,696)	[6,647]	{3,324}
Niagara	20,032	20,033	20,035	20,039	20,043	(4,009)	[962]	{481}	20,046	(4,009)	[962]	{481}	20,048	(4,010)	[962]	{481}
Onondaga	38,913	38,928	38,931	38,941	38,961	(7,792)	[1,870]	{935}	38,978	(7,796)	[1,871]	{935}	38,994	(7,799)	[1,872]	{936}
Orange	48,303	48,308	48,312	48,316	48,330	(9,666)	[2,320]	{1,160}	48,343	(9,669)	[2,320]	{1,160}	48,355	(9,671)	[2,321]	{1,161}
Putnam	10,605	10,606	10,606	10,610	10,612	(2,122)	[509]	{255}	10,615	(2,123)	[510]	{255}	10,616	(2,123)	[510]	{255}
Queens	277,187	277,244	277,300	277,339	277,424	(55,485)	[13,316]	{6,658}	277,502	(55,500)	[13,320]	{6,660}	277,574	(55,515)	[13,324]	{6,662}
Rensselaer	11,225	11,228	11,229	11,229	11,232	(2,246)	[539]	{270}	11,235	(2,247)	[539]	{270}	11,238	(2,248)	[539]	{270}
Richmond	74,944	74,960	74,977	74,991	75,022	(15,004)	[3,601]	{1,801}	75,051	(15,010)	[3,602]	{1,801}	75,078	(15,016)	[3,604]	{1,802}
Rockland	46,935	46,936	46,944	46,948	46,956	(9,391)	[2,254]	{1,127}	46,962	(9,392)	[2,254]	{1,127}	46,968	(9,394)	[2,254]	{1,127}
Saratoga	15,359	15,362	15,364	15,367	15,371	(3,074)	[738]	{369}	15,375	(3,075)	[738]	{369}	15,378	(3,076)	[738]	{369}
Schenectady	13,197	13,200	13,202	13,204	13,207	(2,641)	[634]	{317}	13,210	(2,642)	[634]	{317}	13,212	(2,642)	[634]	{317}
Suffolk	200,989	201,008	201,036	201,070	201,127	(40,225)	[9,654]	{4,827}	201,183	(40,237)	[9,657]	{4,828}	201,234	(40,247)	[9,659]	{4,830}
Sullivan	6,672	6,673	6,673	6,674	6,677	(1,335)	[320]	{160}	6,679	(1,336)	[321]	{160}	6,682	(1,336)	[321]	{160}
Tompkins	4,346	4,346	4,346	4,346	4,348	(870)	[209]	{104}	4,349	(870)	[209]	{104}	4,350	(870)	[209]	{104}
Ulster	13,905	13,907	13,908	13,911	13,915	(2,783)	[668]	{334}	13,918	(2,784)	[668]	{334}	13,921	(2,784)	[668]	{334}
Westchester	129,645	129,657	129,664	129,680	129,714	(25,943)	[6,226]	{3,113}	129,747	(25,949)	[6,228]	{3,114}	129,779	(25,956)	[6,229]	{3,115}

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.