

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

Date: 9/27/21

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 9/27/21 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.

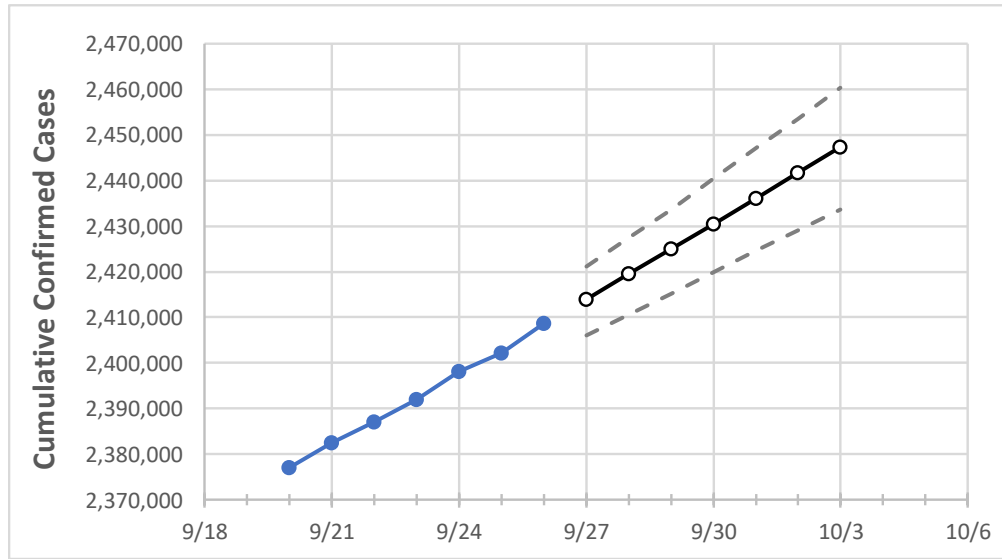
IEM's Modeling Lead

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:						
	9/23	9/24	9/25	9/26	9/27	9/28	9/29	9/30	10/1	10/2	10/3
New York	2,392,060	2,398,152	2,402,248	2,408,593	2,414,012	2,419,495	2,424,971	2,430,489	2,436,121	2,441,715	2,447,382

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:						
	9/23	9/24	9/25	9/26	9/27	9/28	9/29	9/30	10/1	10/2	10/3
Albany	28,513	28,637	28,708	28,778	28,860	28,944	29,029	29,115	29,204	29,290	29,379
Bronx	202,155	202,408	202,703	202,997	203,257	203,522	203,774	204,041	204,301	204,568	204,828
Dutchess	33,827	33,903	33,960	34,029	34,094	34,157	34,221	34,284	34,345	34,409	34,470
Erie	99,259	99,652	99,889	100,094	100,345	100,592	100,858	101,099	101,374	101,649	101,917
Kings	319,096	319,592	320,264	320,936	321,586	322,222	322,870	323,529	324,197	324,859	325,536
Monroe	78,254	78,516	78,767	78,943	79,156	79,368	79,582	79,796	80,022	80,239	80,466
Nassau	207,104	207,463	207,815	208,087	208,446	208,805	209,155	209,519	209,862	210,219	210,580
New York	161,922	162,250	162,548	162,810	163,137	163,457	163,771	164,090	164,412	164,732	165,047
Niagara	22,183	22,271	22,357	22,399	22,465	22,531	22,598	22,666	22,736	22,809	22,881
Onondaga	45,981	46,325	46,538	46,663	46,852	47,039	47,228	47,429	47,627	47,832	48,036
Orange	54,619	54,729	54,852	54,975	55,080	55,187	55,293	55,400	55,508	55,615	55,720
Putnam	11,870	11,901	11,928	11,941	11,970	11,998	12,027	12,057	12,087	12,118	12,148
Queens	306,075	306,485	306,937	307,389	307,833	308,282	308,730	309,183	309,637	310,099	310,555
Rensselaer	13,364	13,442	13,483	13,522	13,573	13,625	13,677	13,731	13,785	13,841	13,895
Richmond	85,840	85,979	86,125	86,271	86,410	86,555	86,694	86,831	86,971	87,111	87,247
Rockland	50,943	50,996	51,090	51,151	51,242	51,331	51,421	51,513	51,605	51,703	51,801
Saratoga	18,468	18,553	18,595	18,656	18,707	18,756	18,807	18,856	18,907	18,959	19,011
Schenectady	15,325	15,387	15,434	15,473	15,520	15,568	15,616	15,665	15,714	15,766	15,817
Suffolk	228,170	228,719	229,286	229,695	230,186	230,705	231,206	231,723	232,241	232,742	233,267
Sullivan	7,827	7,852	7,879	7,897	7,918	7,939	7,960	7,980	8,002	8,023	8,044
Tompkins	5,974	6,001	6,024	6,071	6,097	6,124	6,151	6,177	6,205	6,230	6,255
Ulster	16,373	16,409	16,449	16,501	16,539	16,577	16,615	16,652	16,689	16,725	16,762
Westchester	140,934	141,091	141,220	141,335	141,476	141,613	141,751	141,884	142,020	142,157	142,288

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:											
	9/23	9/24	9/25	9/26	9/28			9/30			10/2					
Albany	28,513	28,637	28,708	28,778	28,944	(5,789)	[1,389]	{695}	29,115	(5,823)	[1,398]	{699}	29,290	(5,858)	[1,406]	{703}
Bronx	202,155	202,408	202,703	202,997	203,522	(40,704)	[9,769]	{4,885}	204,041	(40,808)	[9,794]	{4,897}	204,568	(40,914)	[9,819]	{4,910}
Dutchess	33,827	33,903	33,960	34,029	34,157	(6,831)	[1,640]	{820}	34,284	(6,857)	[1,646]	{823}	34,409	(6,882)	[1,652]	{826}
Erie	99,259	99,652	99,889	100,094	100,592	(20,118)	[4,828]	{2,414}	101,099	(20,220)	[4,853]	{2,426}	101,649	(20,330)	[4,879]	{2,440}
Kings	319,096	319,592	320,264	320,936	322,222	(64,444)	[15,467]	{7,733}	323,529	(64,706)	[15,529]	{7,765}	324,859	(64,972)	[15,593]	{7,797}
Monroe	78,254	78,516	78,767	78,943	79,368	(15,874)	[3,810]	{1,905}	79,796	(15,959)	[3,830]	{1,915}	80,239	(16,048)	[3,851]	{1,926}
Nassau	207,104	207,463	207,815	208,087	208,805	(41,761)	[10,023]	{5,011}	209,519	(41,904)	[10,057]	{5,028}	210,219	(42,044)	[10,091]	{5,045}
New York	161,922	162,250	162,548	162,810	163,457	(32,691)	[7,846]	{3,923}	164,090	(32,818)	[7,876]	{3,938}	164,732	(32,946)	[7,907]	{3,954}
Niagara	22,183	22,271	22,357	22,399	22,531	(4,506)	[1,081]	{541}	22,666	(4,533)	[1,088]	{544}	22,809	(4,562)	[1,095]	{547}
Onondaga	45,981	46,325	46,538	46,663	47,039	(9,408)	[2,258]	{1,129}	47,429	(9,486)	[2,277]	{1,138}	47,832	(9,566)	[2,296]	{1,148}
Orange	54,619	54,729	54,852	54,975	55,187	(11,037)	[2,649]	{1,324}	55,400	(11,080)	[2,659]	{1,330}	55,615	(11,123)	[2,670]	{1,335}
Putnam	11,870	11,901	11,928	11,941	11,998	(2,400)	[576]	{288}	12,057	(2,411)	[579]	{289}	12,118	(2,424)	[582]	{291}
Queens	306,075	306,485	306,937	307,389	308,282	(61,656)	[14,798]	{7,399}	309,183	(61,837)	[14,841]	{7,420}	310,099	(62,020)	[14,885]	{7,442}
Rensselaer	13,364	13,442	13,483	13,522	13,625	(2,725)	[654]	{327}	13,731	(2,746)	[659]	{330}	13,841	(2,768)	[664]	{332}
Richmond	85,840	85,979	86,125	86,271	86,555	(17,311)	[4,155]	{2,077}	86,831	(17,366)	[4,168]	{2,084}	87,111	(17,422)	[4,181]	{2,091}
Rockland	50,943	50,996	51,090	51,151	51,331	(10,266)	[2,464]	{1,232}	51,513	(10,303)	[2,473]	{1,236}	51,703	(10,341)	[2,482]	{1,241}
Saratoga	18,468	18,553	18,595	18,656	18,756	(3,751)	[900]	{450}	18,856	(3,771)	[905]	{453}	18,959	(3,792)	[910]	{455}
Schenectady	15,325	15,387	15,434	15,473	15,568	(3,114)	[747]	{374}	15,665	(3,133)	[752]	{376}	15,766	(3,153)	[757]	{378}
Suffolk	228,170	228,719	229,286	229,695	230,705	(46,141)	[11,074]	{5,537}	231,723	(46,345)	[11,123]	{5,561}	232,742	(46,548)	[11,172]	{5,586}
Sullivan	7,827	7,852	7,879	7,897	7,939	(1,588)	[381]	{191}	7,980	(1,596)	[383]	{192}	8,023	(1,605)	[385]	{193}
Tompkins	5,974	6,001	6,024	6,071	6,124	(1,225)	[294]	{147}	6,177	(1,235)	[296]	{148}	6,230	(1,246)	[299]	{150}
Ulster	16,373	16,409	16,449	16,501	16,577	(3,315)	[796]	{398}	16,652	(3,330)	[799]	{400}	16,725	(3,345)	[803]	{401}
Westchester	140,934	141,091	141,220	141,335	141,613	(28,323)	[6,797]	{3,399}	141,884	(28,377)	[6,810]	{3,405}	142,157	(28,431)	[6,824]	{3,412}

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.