

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 10/1/21**

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 10/1/21 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.

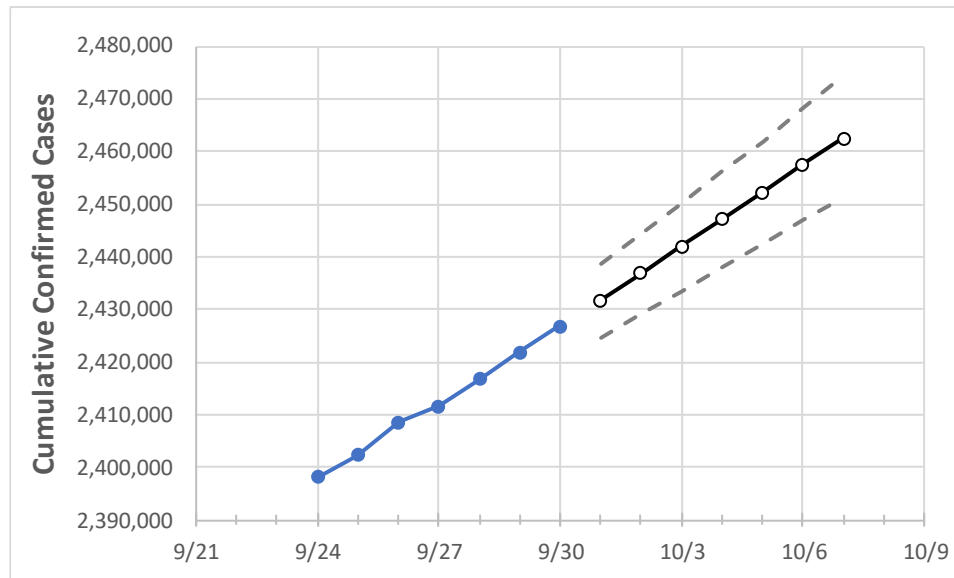
IEM's Modeling Lead

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:						
	9/27	9/28	9/29	9/30	10/1	10/2	10/3	10/4	10/5	10/6	10/7
New York	2,411,626	2,416,683	2,421,755	2,426,683	2,431,755	2,436,862	2,441,981	2,447,102	2,452,223	2,457,462	2,462,481

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:						
	9/27	9/28	9/29	9/30	10/1	10/2	10/3	10/4	10/5	10/6	10/7
Albany	28,836	28,933	29,026	29,092	29,175	29,259	29,344	29,429	29,515	29,603	29,690
Bronx	203,164	203,330	203,496	203,707	203,926	204,142	204,358	204,567	204,783	204,991	205,205
Dutchess	34,073	34,139	34,235	34,329	34,398	34,466	34,535	34,604	34,671	34,738	34,806
Erie	100,356	100,521	100,804	101,007	101,253	101,503	101,756	102,003	102,259	102,523	102,786
Kings	321,402	321,867	322,298	322,907	323,498	324,080	324,653	325,231	325,812	326,410	326,987
Monroe	79,131	79,289	79,539	79,758	79,976	80,190	80,404	80,626	80,848	81,076	81,302
Nassau	208,290	208,596	208,903	209,215	209,529	209,836	210,143	210,445	210,750	211,053	211,355
New York	163,017	163,268	163,527	163,785	164,064	164,341	164,609	164,881	165,148	165,414	165,676
Niagara	22,456	22,504	22,585	22,639	22,704	22,771	22,837	22,904	22,974	23,046	23,117
Onondaga	46,939	47,082	47,374	47,570	47,784	48,007	48,228	48,455	48,683	48,919	49,151
Orange	55,053	55,130	55,217	55,345	55,446	55,547	55,646	55,749	55,847	55,948	56,046
Putnam	11,955	11,973	11,993	12,022	12,048	12,074	12,100	12,126	12,153	12,180	12,207
Queens	307,705	308,020	308,305	308,670	309,063	309,456	309,846	310,228	310,617	311,014	311,395
Rensselaer	13,565	13,604	13,657	13,708	13,759	13,811	13,862	13,915	13,967	14,021	14,075
Richmond	86,365	86,458	86,563	86,674	86,797	86,916	87,034	87,151	87,267	87,382	87,500
Rockland	51,271	51,342	51,420	51,464	51,550	51,633	51,715	51,801	51,887	51,974	52,062
Saratoga	18,703	18,764	18,846	18,930	18,990	19,050	19,110	19,171	19,232	19,294	19,357
Schenectady	15,512	15,558	15,623	15,656	15,704	15,753	15,802	15,851	15,902	15,953	16,005
Suffolk	229,990	230,459	230,952	231,463	231,942	232,417	232,880	233,363	233,836	234,306	234,793
Sullivan	7,922	7,936	7,963	7,993	8,015	8,038	8,060	8,082	8,106	8,128	8,151
Tompkins	6,079	6,097	6,116	6,136	6,159	6,181	6,205	6,226	6,249	6,271	6,293
Ulster	16,522	16,546	16,587	16,631	16,667	16,701	16,734	16,768	16,802	16,836	16,867
Westchester	141,416	141,532	141,628	141,731	141,846	141,956	142,066	142,174	142,281	142,387	142,492

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:											
	9/27	9/28	9/29	9/30	10/2				10/4				10/6			
Albany	28,836	28,933	29,026	29,092	29,259	(5,852)	[1,404]	{702}	29,429	(5,886)	[1,413]	{706}	29,603	(5,921)	[1,421]	{710}
Bronx	203,164	203,330	203,496	203,707	204,142	(40,828)	[9,799]	{4,899}	204,567	(40,913)	[9,819]	{4,910}	204,991	(40,998)	[9,840]	{4,920}
Dutchess	34,073	34,139	34,235	34,329	34,466	(6,893)	[1,654]	{827}	34,604	(6,921)	[1,661]	{831}	34,738	(6,948)	[1,667]	{834}
Erie	100,356	100,521	100,804	101,007	101,503	(20,301)	[4,872]	{2,436}	102,003	(20,401)	[4,896]	{2,448}	102,523	(20,505)	[4,921]	{2,461}
Kings	321,402	321,867	322,298	322,907	324,080	(64,816)	[15,556]	{7,778}	325,231	(65,046)	[15,611]	{7,806}	326,410	(65,282)	[15,668]	{7,834}
Monroe	79,131	79,289	79,539	79,758	80,190	(16,038)	[3,849]	{1,925}	80,626	(16,125)	[3,870]	{1,935}	81,076	(16,215)	[3,892]	{1,946}
Nassau	208,290	208,596	208,903	209,215	209,836	(41,967)	[10,072]	{5,036}	210,445	(42,089)	[10,101]	{5,051}	211,053	(42,211)	[10,131]	{5,065}
New York	163,017	163,268	163,527	163,785	164,341	(32,868)	[7,888]	{3,944}	164,881	(32,976)	[7,914]	{3,957}	165,414	(33,083)	[7,940]	{3,970}
Niagara	22,456	22,504	22,585	22,639	22,771	(4,554)	[1,093]	{546}	22,904	(4,581)	[1,099]	{550}	23,046	(4,609)	[1,106]	{553}
Onondaga	46,939	47,082	47,374	47,570	48,007	(9,601)	[2,304]	{1,152}	48,455	(9,691)	[2,326]	{1,163}	48,919	(9,784)	[2,348]	{1,174}
Orange	55,053	55,130	55,217	55,345	55,547	(11,109)	[2,666]	{1,333}	55,749	(11,150)	[2,676]	{1,338}	55,948	(11,190)	[2,685]	{1,343}
Putnam	11,955	11,973	11,993	12,022	12,074	(2,415)	[580]	{290}	12,126	(2,425)	[582]	{291}	12,180	(2,436)	[585]	{292}
Queens	307,705	308,020	308,305	308,670	309,456	(61,891)	[14,854]	{7,427}	310,228	(62,046)	[14,891]	{7,445}	311,014	(62,203)	[14,929]	{7,464}
Rensselaer	13,565	13,604	13,657	13,708	13,811	(2,762)	[663]	{331}	13,915	(2,783)	[668]	{334}	14,021	(2,804)	[673]	{337}
Richmond	86,365	86,458	86,563	86,674	86,916	(17,383)	[4,172]	{2,086}	87,151	(17,430)	[4,183]	{2,092}	87,382	(17,476)	[4,194]	{2,097}
Rockland	51,271	51,342	51,420	51,464	51,633	(10,327)	[2,478]	{1,239}	51,801	(10,360)	[2,486]	{1,243}	51,974	(10,395)	[2,495]	{1,247}
Saratoga	18,703	18,764	18,846	18,930	19,050	(3,810)	[914]	{457}	19,171	(3,834)	[920]	{460}	19,294	(3,859)	[926]	{463}
Schenectady	15,512	15,558	15,623	15,656	15,753	(3,151)	[756]	{378}	15,851	(3,170)	[761]	{380}	15,953	(3,191)	[766]	{383}
Suffolk	229,990	230,459	230,952	231,463	232,417	(46,483)	[11,156]	{5,578}	233,363	(46,673)	[11,201]	{5,601}	234,306	(46,861)	[11,247]	{5,623}
Sullivan	7,922	7,936	7,963	7,993	8,038	(1,608)	[386]	{193}	8,082	(1,616)	[388]	{194}	8,128	(1,626)	[390]	{195}
Tompkins	6,079	6,097	6,116	6,136	6,181	(1,236)	[297]	{148}	6,226	(1,245)	[299]	{149}	6,271	(1,254)	[301]	{151}
Ulster	16,522	16,546	16,587	16,631	16,701	(3,340)	[802]	{401}	16,768	(3,354)	[805]	{402}	16,836	(3,367)	[808]	{404}
Westchester	141,416	141,532	141,628	141,731	141,956	(28,391)	[6,814]	{3,407}	142,174	(28,435)	[6,824]	{3,412}	142,387	(28,477)	[6,835]	{3,417}

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.