

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 10/27/20**

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 10/27/20 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.

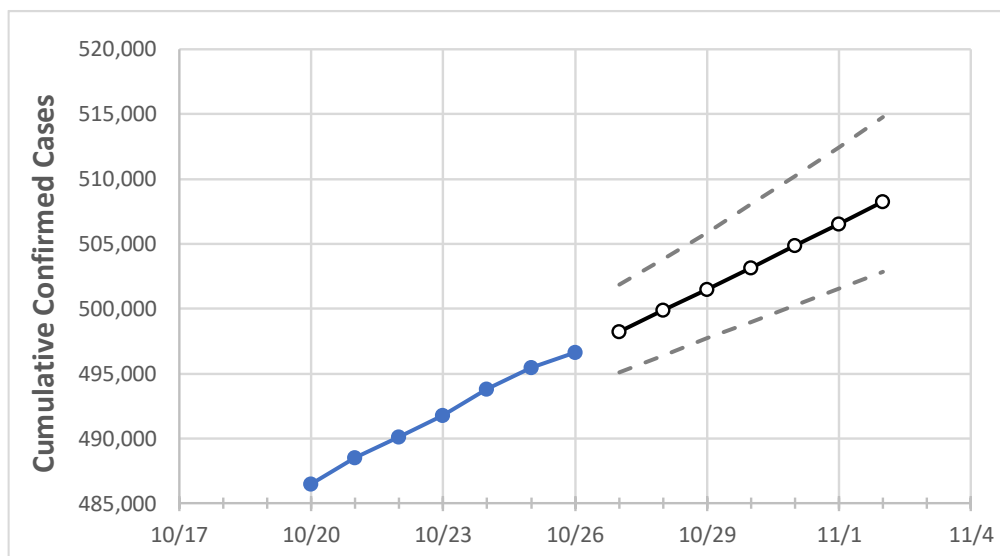
IEM's Modeling Lead

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:						
	10/23	10/24	10/25	10/26	10/27	10/28	10/29	10/30	10/31	11/1	11/2
New York	491,771	493,832	495,464	496,655	498,258	499,878	501,516	503,172	504,845	506,537	508,247

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 20%, and are often within 10%, of actual confirmed cases.

New York Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	10/23	10/24	10/25	10/26	10/27	10/28	10/29	10/30	10/31	11/1	11/2
Albany	3,516	3,549	3,577	3,590	3,612	3,635	3,658	3,682	3,706	3,731	3,757
Bronx	54,792	54,892	55,011	55,086	55,175	55,266	55,358	55,452	55,547	55,644	55,742
Dutchess	5,403	5,421	5,438	5,450	5,466	5,483	5,501	5,519	5,538	5,557	5,577
Erie	12,705	12,782	12,819	12,855	12,903	12,951	12,999	13,047	13,096	13,145	13,194
Kings	74,114	74,339	74,553	74,703	74,895	75,086	75,276	75,465	75,653	75,839	76,025
Monroe	6,992	7,070	7,111	7,174	7,243	7,316	7,392	7,472	7,555	7,642	7,734
Nassau	49,042	49,203	49,312	49,377	49,475	49,574	49,674	49,774	49,875	49,977	50,080
New York	35,459	35,610	35,723	35,789	35,899	36,013	36,129	36,248	36,370	36,494	36,622
Niagara	2,016	2,032	2,041	2,050	2,062	2,074	2,086	2,099	2,112	2,126	2,140
Onondaga	5,222	5,277	5,309	5,337	5,377	5,419	5,461	5,504	5,548	5,594	5,640
Orange	13,342	13,413	13,457	13,475	13,510	13,544	13,577	13,611	13,644	13,676	13,708
Putnam	1,780	1,788	1,794	1,800	1,808	1,816	1,824	1,832	1,841	1,850	1,859
Queens	75,853	76,057	76,220	76,316	76,463	76,611	76,760	76,909	77,060	77,212	77,365
Rensselaer	1,064	1,073	1,080	1,088	1,097	1,106	1,115	1,124	1,134	1,145	1,156
Richmond	16,929	17,004	17,048	17,085	17,132	17,181	17,230	17,279	17,330	17,381	17,434
Rockland	17,581	17,635	17,685	17,760	17,824	17,888	17,953	18,017	18,081	18,145	18,209
Saratoga	1,265	1,295	1,308	1,319	1,332	1,346	1,360	1,374	1,390	1,405	1,422
Schenectady	1,530	1,539	1,546	1,549	1,557	1,564	1,573	1,581	1,591	1,600	1,610
Suffolk	48,399	48,562	48,663	48,717	48,806	48,895	48,986	49,079	49,172	49,267	49,363
Sullivan	1,714	1,725	1,743	1,750	1,758	1,766	1,775	1,785	1,795	1,805	1,816
Tompkins	585	593	603	606	616	626	636	647	658	670	682
Ulster	2,450	2,459	2,471	2,500	2,511	2,523	2,535	2,548	2,562	2,576	2,590
Westchester	39,890	40,041	40,131	40,202	40,305	40,411	40,520	40,633	40,748	40,867	40,990

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:											
	10/23	10/24	10/25	10/26	10/28				10/30				11/1			
Albany	3,516	3,549	3,577	3,590	3,635	(727)	[174]	{87}	3,682	(736)	[177]	{88}	3,731	(746)	[179]	{90}
Bronx	54,792	54,892	55,011	55,086	55,266	(11,053)	[2,653]	{1,326}	55,452	(11,090)	[2,662]	{1,331}	55,644	(11,129)	[2,671]	{1,336}
Dutchess	5,403	5,421	5,438	5,450	5,483	(1,097)	[263]	{132}	5,519	(1,104)	[265]	{132}	5,557	(1,111)	[267]	{133}
Erie	12,705	12,782	12,819	12,855	12,951	(2,590)	[622]	{311}	13,047	(2,609)	[626]	{313}	13,145	(2,629)	[631]	{316}
Kings	74,114	74,339	74,553	74,703	75,086	(15,017)	[3,604]	{1,802}	75,465	(15,093)	[3,622]	{1,811}	75,839	(15,168)	[3,640]	{1,820}
Monroe	6,992	7,070	7,111	7,174	7,316	(1,463)	[351]	{176}	7,472	(1,494)	[359]	{179}	7,642	(1,528)	[367]	{183}
Nassau	49,042	49,203	49,312	49,377	49,574	(9,915)	[2,380]	{1,190}	49,774	(9,955)	[2,389]	{1,195}	49,977	(9,995)	[2,399]	{1,200}
New York	35,459	35,610	35,723	35,789	36,013	(7,203)	[1,729]	{864}	36,248	(7,250)	[1,740]	{870}	36,494	(7,299)	[1,752]	{876}
Niagara	2,016	2,032	2,041	2,050	2,074	(415)	[100]	{50}	2,099	(420)	[101]	{50}	2,126	(425)	[102]	{51}
Onondaga	5,222	5,277	5,309	5,337	5,419	(1,084)	[260]	{130}	5,504	(1,101)	[264]	{132}	5,594	(1,119)	[268]	{134}
Orange	13,342	13,413	13,457	13,475	13,544	(2,709)	[650]	{325}	13,611	(2,722)	[653]	{327}	13,676	(2,735)	[656]	{329}
Putnam	1,780	1,788	1,794	1,800	1,816	(363)	[87]	{44}	1,832	(366)	[88]	{44}	1,850	(370)	[89]	{44}
Queens	75,853	76,057	76,220	76,316	76,611	(15,322)	[3,677]	{1,839}	76,909	(15,382)	[3,692]	{1,846}	77,212	(15,442)	[3,706]	{1,853}
Rensselaer	1,064	1,073	1,080	1,088	1,106	(221)	[53]	{27}	1,124	(225)	[54]	{27}	1,145	(229)	[55]	{27}
Richmond	16,929	17,004	17,048	17,085	17,181	(3,436)	[825]	{412}	17,279	(3,456)	[829]	{415}	17,381	(3,476)	[834]	{418}
Rockland	17,581	17,635	17,685	17,760	17,888	(3,578)	[859]	{429}	18,017	(3,603)	[865]	{432}	18,145	(3,629)	[871]	{435}
Saratoga	1,265	1,295	1,308	1,319	1,346	(269)	[65]	{32}	1,374	(275)	[66]	{33}	1,405	(281)	[67]	{34}
Schenectady	1,530	1,539	1,546	1,549	1,564	(313)	[75]	{38}	1,581	(316)	[76]	{38}	1,600	(320)	[77]	{38}
Suffolk	48,399	48,562	48,663	48,717	48,895	(9,779)	[2,347]	{1,173}	49,079	(9,816)	[2,356]	{1,178}	49,267	(9,853)	[2,365]	{1,183}
Sullivan	1,714	1,725	1,743	1,750	1,766	(353)	[85]	{42}	1,785	(357)	[86]	{43}	1,805	(361)	[87]	{43}
Tompkins	585	593	603	606	626	(125)	[30]	{15}	647	(129)	[31]	{16}	670	(134)	[32]	{16}
Ulster	2,450	2,459	2,471	2,500	2,523	(505)	[121]	{61}	2,548	(510)	[122]	{61}	2,576	(515)	[124]	{62}
Westchester	39,890	40,041	40,131	40,202	40,411	(8,082)	[1,940]	{970}	40,633	(8,127)	[1,950]	{975}	40,867	(8,173)	[1,962]	{980}

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.