

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 11/16/20**

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 11/16/20 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.

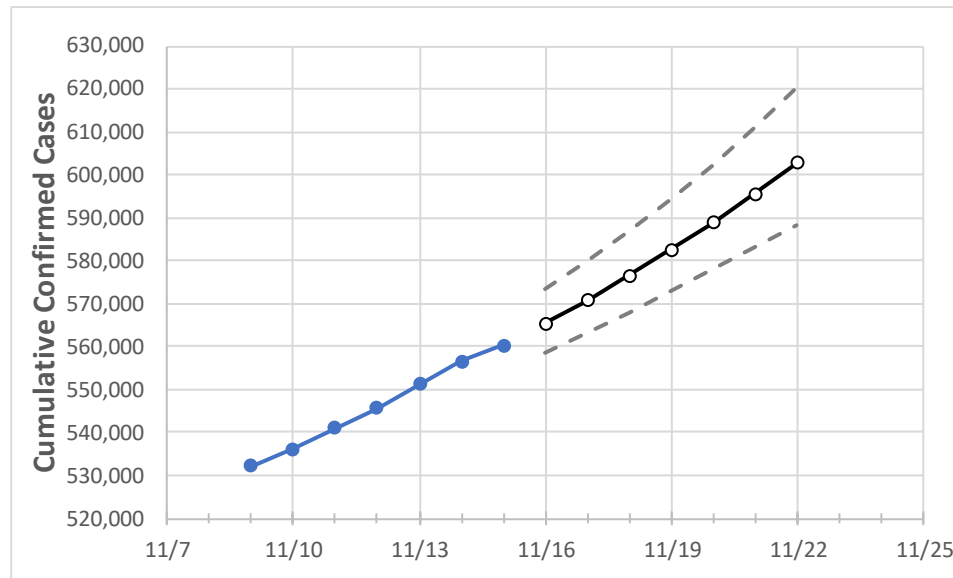
IEM's Modeling Lead

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:					
	11/12	11/13	11/14	11/15	11/16	11/17	11/18	11/19	11/20	11/21	11/22
New York	545,762	551,163	556,551	560,200	565,324	570,739	576,462	582,511	588,903	595,658	602,796

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:						
	11/12	11/13	11/14	11/15	11/16	11/17	11/18	11/19	11/20	11/21	11/22
Albany	4,336	4,425	4,514	4,529	4,594	4,662	4,734	4,810	4,890	4,974	5,063
Bronx	57,917	58,205	58,491	58,712	58,992	59,286	59,596	59,922	60,264	60,624	61,002
Dutchess	6,003	6,074	6,144	6,185	6,253	6,326	6,405	6,489	6,579	6,676	6,780
Erie	16,540	17,021	17,469	17,746	18,306	18,926	19,613	20,373	21,215	22,145	23,175
Kings	80,008	80,491	80,946	81,371	81,851	82,352	82,873	83,415	83,980	84,569	85,181
Monroe	9,763	10,074	10,329	10,453	10,754	11,077	11,422	11,792	12,188	12,612	13,066
Nassau	52,897	53,271	53,688	54,014	54,404	54,819	55,261	55,731	56,230	56,762	57,328
New York	39,006	39,355	39,700	39,975	40,292	40,625	40,977	41,347	41,737	42,147	42,580
Niagara	2,564	2,616	2,678	2,708	2,773	2,843	2,919	3,001	3,090	3,186	3,291
Onondaga	7,211	7,421	7,650	7,749	7,963	8,193	8,440	8,706	8,993	9,301	9,632
Orange	14,803	14,910	15,031	15,124	15,248	15,378	15,516	15,660	15,812	15,971	16,139
Putnam	2,059	2,091	2,134	2,153	2,182	2,212	2,245	2,281	2,319	2,360	2,404
Queens	81,009	81,486	81,971	82,356	82,820	83,310	83,825	84,368	84,940	85,542	86,177
Rensselaer	1,258	1,278	1,304	1,321	1,340	1,360	1,382	1,405	1,430	1,456	1,484
Richmond	19,036	19,265	19,491	19,642	19,856	20,083	20,326	20,585	20,861	21,154	21,467
Rockland	19,414	19,567	19,723	19,843	19,980	20,121	20,267	20,417	20,573	20,733	20,899
Saratoga	1,611	1,642	1,666	1,680	1,701	1,723	1,745	1,768	1,792	1,816	1,841
Schenectady	1,802	1,828	1,860	1,871	1,895	1,921	1,949	1,978	2,009	2,042	2,077
Suffolk	52,065	52,493	52,942	53,308	53,730	54,186	54,680	55,212	55,788	56,410	57,082
Sullivan	1,940	1,956	1,969	1,979	1,990	2,002	2,014	2,026	2,039	2,051	2,064
Tompkins	765	786	799	806	816	827	838	849	861	874	887
Ulster	2,717	2,738	2,768	2,788	2,813	2,841	2,870	2,902	2,936	2,972	3,012
Westchester	43,292	43,656	44,093	44,346	44,716	45,111	45,533	45,983	46,463	46,976	47,524

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:											
	11/12	11/13	11/14	11/15	11/17				11/19				11/21			
Albany	4,336	4,425	4,514	4,529	4,662	(932)	[224]	{112}	4,810	(962)	[231]	{115}	4,974	(995)	[239]	{119}
Bronx	57,917	58,205	58,491	58,712	59,286	(11,857)	[2,846]	{1,423}	59,922	(11,984)	[2,876]	{1,438}	60,624	(12,125)	[2,910]	{1,455}
Dutchess	6,003	6,074	6,144	6,185	6,326	(1,265)	[304]	{152}	6,489	(1,298)	[311]	{156}	6,676	(1,335)	[320]	{160}
Erie	16,540	17,021	17,469	17,746	18,926	(3,785)	[908]	{454}	20,373	(4,075)	[978]	{489}	22,145	(4,429)	[1,063]	{531}
Kings	80,008	80,491	80,946	81,371	82,352	(16,470)	[3,953]	{1,976}	83,415	(16,683)	[4,004]	{2,002}	84,569	(16,914)	[4,059]	{2,030}
Monroe	9,763	10,074	10,329	10,453	11,077	(2,215)	[532]	{266}	11,792	(2,358)	[566]	{283}	12,612	(2,522)	[605]	{303}
Nassau	52,897	53,271	53,688	54,014	54,819	(10,964)	[2,631]	{1,316}	55,731	(11,146)	[2,675]	{1,338}	56,762	(11,352)	[2,725]	{1,362}
New York	39,006	39,355	39,700	39,975	40,625	(8,125)	[1,950]	{975}	41,347	(8,269)	[1,985]	{992}	42,147	(8,429)	[2,023]	{1,012}
Niagara	2,564	2,616	2,678	2,708	2,843	(569)	[136]	{68}	3,001	(600)	[144]	{72}	3,186	(637)	[153]	{76}
Onondaga	7,211	7,421	7,650	7,749	8,193	(1,639)	[393]	{197}	8,706	(1,741)	[418]	{209}	9,301	(1,860)	[446]	{223}
Orange	14,803	14,910	15,031	15,124	15,378	(3,076)	[738]	{369}	15,660	(3,132)	[752]	{376}	15,971	(3,194)	[767]	{383}
Putnam	2,059	2,091	2,134	2,153	2,212	(442)	[106]	{53}	2,281	(456)	[109]	{55}	2,360	(472)	[113]	{57}
Queens	81,009	81,486	81,971	82,356	83,310	(16,662)	[3,999]	{1,999}	84,368	(16,874)	[4,050]	{2,025}	85,542	(17,108)	[4,106]	{2,053}
Rensselaer	1,258	1,278	1,304	1,321	1,360	(272)	[65]	{33}	1,405	(281)	[67]	{34}	1,456	(291)	[70]	{35}
Richmond	19,036	19,265	19,491	19,642	20,083	(4,017)	[964]	{482}	20,585	(4,117)	[988]	{494}	21,154	(4,231)	[1,015]	{508}
Rockland	19,414	19,567	19,723	19,843	20,121	(4,024)	[966]	{483}	20,417	(4,083)	[980]	{490}	20,733	(4,147)	[995]	{498}
Saratoga	1,611	1,642	1,666	1,680	1,723	(345)	[83]	{41}	1,768	(354)	[85]	{42}	1,816	(363)	[87]	{44}
Schenectady	1,802	1,828	1,860	1,871	1,921	(384)	[92]	{46}	1,978	(396)	[95]	{47}	2,042	(408)	[98]	{49}
Suffolk	52,065	52,493	52,942	53,308	54,186	(10,837)	[2,601]	{1,300}	55,212	(11,042)	[2,650]	{1,325}	56,410	(11,282)	[2,708]	{1,354}
Sullivan	1,940	1,956	1,969	1,979	2,002	(400)	[96]	{48}	2,026	(405)	[97]	{49}	2,051	(410)	[98]	{49}
Tompkins	765	786	799	806	827	(165)	[40]	{20}	849	(170)	[41]	{20}	874	(175)	[42]	{21}
Ulster	2,717	2,738	2,768	2,788	2,841	(568)	[136]	{68}	2,902	(580)	[139]	{70}	2,972	(594)	[143]	{71}
Westchester	43,292	43,656	44,093	44,346	45,111	(9,022)	[2,165]	{1,083}	45,983	(9,197)	[2,207]	{1,104}	46,976	(9,395)	[2,255]	{1,127}

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.