

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 10/11/21**

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 10/11/21 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.

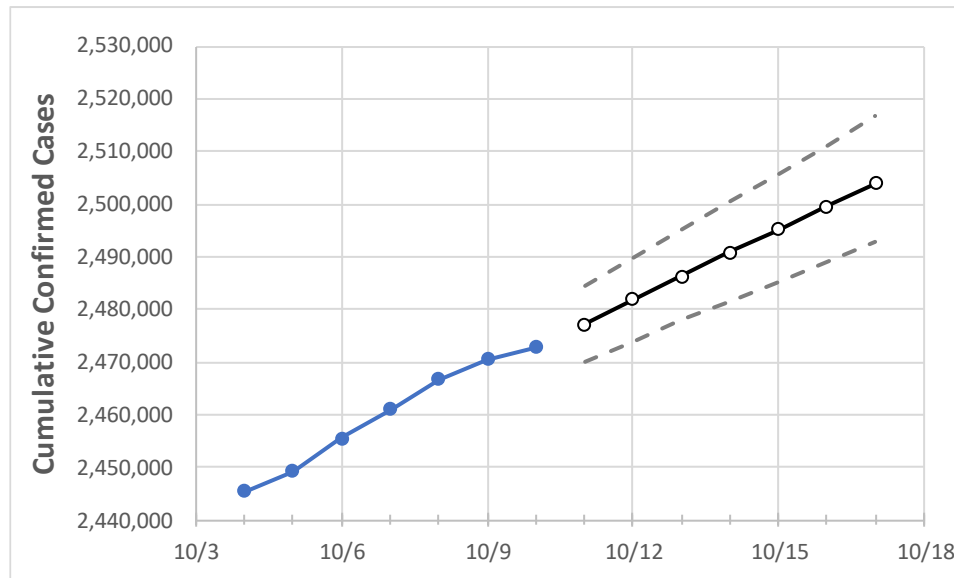
IEM's Modeling Lead

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:					
	10/7	10/8	10/9	10/10	10/11	10/12	10/13	10/14	10/15	10/16	10/17	
New York	2,460,966	2,466,780	2,470,550	2,472,757	2,477,244	2,481,813	2,486,241	2,490,777	2,495,120	2,499,646	2,503,982	

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:						
	10/7	10/8	10/9	10/10	10/11	10/12	10/13	10/14	10/15	10/16	10/17
Albany	29,671	29,773	29,852	29,893	29,975	30,058	30,141	30,225	30,308	30,396	30,482
Bronx	205,413	205,622	205,622	205,622	205,839	206,066	206,286	206,500	206,721	206,937	207,152
Dutchess	34,772	34,859	34,935	34,946	35,009	35,071	35,133	35,197	35,257	35,320	35,383
Erie	102,820	103,183	103,449	103,604	103,870	104,143	104,411	104,689	104,972	105,249	105,536
Kings	327,211	327,749	327,749	327,749	328,363	328,966	329,582	330,200	330,827	331,456	332,080
Monroe	81,250	81,503	81,720	81,834	82,053	82,264	82,483	82,699	82,923	83,147	83,367
Nassau	211,019	211,335	211,636	211,797	212,039	212,286	212,523	212,760	213,003	213,242	213,468
New York	165,405	165,652	165,883	166,013	166,219	166,420	166,617	166,813	167,010	167,207	167,395
Niagara	23,123	23,211	23,271	23,309	23,379	23,449	23,520	23,591	23,663	23,736	23,808
Onondaga	49,204	49,517	49,737	49,878	50,129	50,399	50,655	50,922	51,193	51,469	51,749
Orange	56,064	56,180	56,299	56,364	56,464	56,566	56,667	56,767	56,869	56,971	57,075
Putnam	12,172	12,209	12,239	12,244	12,267	12,287	12,309	12,330	12,352	12,373	12,395
Queens	311,348	311,693	311,693	311,693	312,056	312,407	312,771	313,122	313,475	313,828	314,179
Rensselaer	14,067	14,145	14,209	14,239	14,293	14,351	14,405	14,461	14,519	14,576	14,633
Richmond	87,474	87,598	87,598	87,598	87,705	87,810	87,914	88,020	88,123	88,225	88,327
Rockland	52,101	52,185	52,270	52,312	52,393	52,475	52,555	52,636	52,717	52,798	52,882
Saratoga	19,360	19,440	19,498	19,549	19,617	19,686	19,755	19,825	19,895	19,967	20,040
Schenectady	15,954	16,017	16,070	16,089	16,134	16,182	16,228	16,276	16,324	16,369	16,419
Suffolk	234,329	234,756	235,189	235,484	235,884	236,273	236,658	237,049	237,444	237,830	238,212
Sullivan	8,138	8,162	8,190	8,208	8,231	8,254	8,278	8,301	8,325	8,349	8,373
Tompkins	6,265	6,288	6,315	6,335	6,354	6,373	6,391	6,411	6,429	6,448	6,466
Ulster	16,848	16,886	16,922	16,933	16,962	16,990	17,018	17,048	17,074	17,102	17,129
Westchester	142,434	142,548	142,649	142,697	142,784	142,869	142,951	143,034	143,118	143,197	143,276

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:											
	10/7	10/8	10/9	10/10	10/12			10/14			10/16					
Albany	29,671	29,773	29,852	29,893	30,058	(6,012)	{1,443}	{721}	30,225	(6,045)	{1,451}	{725}	30,396	(6,079)	{1,459}	{730}
Bronx	205,413	205,622	205,622	205,622	206,066	(41,213)	{9,891}	{4,946}	206,500	(41,300)	{9,912}	{4,956}	206,937	(41,387)	{9,933}	{4,966}
Dutchess	34,772	34,859	34,935	34,946	35,071	(7,014)	{1,683}	{842}	35,197	(7,039)	{1,689}	{845}	35,320	(7,064)	{1,695}	{848}
Erie	102,820	103,183	103,449	103,604	104,143	(20,829)	{4,999}	{2,499}	104,689	(20,938)	{5,025}	{2,513}	105,249	(21,050)	{5,052}	{2,526}
Kings	327,211	327,749	327,749	327,749	328,966	(65,793)	{15,790}	{7,895}	330,200	(66,040)	{15,850}	{7,925}	331,456	(66,291)	{15,910}	{7,955}
Monroe	81,250	81,503	81,720	81,834	82,264	(16,453)	{3,949}	{1,974}	82,699	(16,540)	{3,970}	{1,985}	83,147	(16,629)	{3,991}	{1,996}
Nassau	211,019	211,335	211,636	211,797	212,286	(42,457)	{10,190}	{5,095}	212,760	(42,552)	{10,212}	{5,106}	213,242	(42,648)	{10,236}	{5,118}
New York	165,405	165,652	165,883	166,013	166,420	(33,284)	{7,988}	{3,994}	166,813	(33,363)	{8,007}	{4,004}	167,207	(33,441)	{8,026}	{4,013}
Niagara	23,123	23,211	23,271	23,309	23,449	(4,690)	{1,126}	{563}	23,591	(4,718)	{1,132}	{566}	23,736	(4,747)	{1,139}	{570}
Onondaga	49,204	49,517	49,737	49,878	50,399	(10,080)	{2,419}	{1,210}	50,922	(10,184)	{2,444}	{1,222}	51,469	(10,294)	{2,471}	{1,235}
Orange	56,064	56,180	56,299	56,364	56,566	(11,313)	{2,715}	{1,358}	56,767	(11,353)	{2,725}	{1,362}	56,971	(11,394)	{2,735}	{1,367}
Putnam	12,172	12,209	12,239	12,244	12,287	(2,457)	{590}	{295}	12,330	(2,466)	{592}	{296}	12,373	(2,475)	{594}	{297}
Queens	311,348	311,693	311,693	311,693	312,407	(62,481)	{14,996}	{7,498}	313,122	(62,624)	{15,030}	{7,515}	313,828	(62,766)	{15,064}	{7,532}
Rensselaer	14,067	14,145	14,209	14,239	14,351	(2,870)	{689}	{344}	14,461	(2,892)	{694}	{347}	14,576	(2,915)	{700}	{350}
Richmond	87,474	87,598	87,598	87,598	87,810	(17,562)	{4,215}	{2,107}	88,020	(17,604)	{4,225}	{2,112}	88,225	(17,645)	{4,235}	{2,117}
Rockland	52,101	52,185	52,270	52,312	52,475	(10,495)	{2,519}	{1,259}	52,636	(10,527)	{2,527}	{1,263}	52,798	(10,560)	{2,534}	{1,267}
Saratoga	19,360	19,440	19,498	19,549	19,686	(3,937)	{945}	{472}	19,825	(3,965)	{952}	{476}	19,967	(3,993)	{958}	{479}
Schenectady	15,954	16,017	16,070	16,089	16,182	(3,236)	{777}	{388}	16,276	(3,255)	{781}	{391}	16,369	(3,274)	{786}	{393}
Suffolk	234,329	234,756	235,189	235,484	236,273	(47,255)	{11,341}	{5,671}	237,049	(47,410)	{11,378}	{5,689}	237,830	(47,566)	{11,416}	{5,708}
Sullivan	8,138	8,162	8,190	8,208	8,254	(1,651)	{396}	{198}	8,301	(1,660)	{398}	{199}	8,349	(1,670)	{401}	{200}
Tompkins	6,265	6,288	6,315	6,335	6,373	(1,275)	{306}	{153}	6,411	(1,282)	{308}	{154}	6,448	(1,290)	{310}	{155}
Ulster	16,848	16,886	16,922	16,933	16,990	(3,398)	{816}	{408}	17,048	(3,410)	{818}	{409}	17,102	(3,420)	{821}	{410}
Westchester	142,434	142,548	142,649	142,697	142,869	(28,574)	{6,858}	{3,429}	143,034	(28,607)	{6,866}	{3,433}	143,197	(28,639)	{6,873}	{3,437}

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.