

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 10/7/20**

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 10/7/20 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.

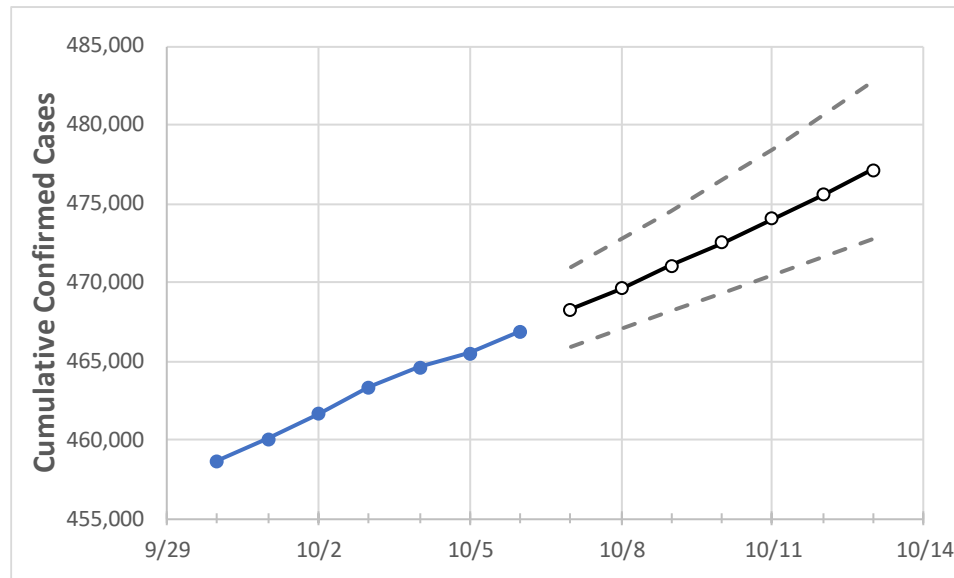
IEM's Modeling Lead

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:				
	10/3	10/4	10/5	10/6	10/7	10/8	10/9	10/10	10/11	10/12	10/13
New York	463,360	464,582	465,515	466,908	468,242	469,618	471,036	472,499	474,006	475,561	477,163

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:						
	10/3	10/4	10/5	10/6	10/7	10/8	10/9	10/10	10/11	10/12	10/13
Albany	3,175	3,190	3,201	3,218	3,232	3,246	3,260	3,275	3,290	3,305	3,321
Bronx	53,298	53,353	53,417	53,501	53,569	53,639	53,711	53,784	53,859	53,935	54,014
Dutchess	5,169	5,179	5,187	5,205	5,213	5,220	5,228	5,235	5,243	5,251	5,259
Erie	11,697	11,767	11,798	11,864	11,915	11,967	12,019	12,072	12,125	12,178	12,232
Kings	69,677	69,933	70,131	70,354	70,638	70,934	71,243	71,566	71,902	72,254	72,621
Monroe	6,186	6,206	6,220	6,248	6,270	6,292	6,314	6,336	6,359	6,382	6,404
Nassau	47,167	47,246	47,302	47,392	47,470	47,548	47,627	47,707	47,788	47,870	47,952
New York	33,791	33,863	33,935	34,005	34,077	34,151	34,226	34,304	34,384	34,465	34,549
Niagara	1,813	1,828	1,834	1,840	1,847	1,855	1,862	1,870	1,878	1,886	1,894
Onondaga	4,528	4,537	4,556	4,593	4,619	4,645	4,671	4,698	4,726	4,754	4,783
Orange	12,360	12,394	12,438	12,493	12,551	12,613	12,677	12,745	12,817	12,892	12,972
Putnam	1,646	1,650	1,652	1,656	1,661	1,666	1,671	1,676	1,682	1,687	1,693
Queens	73,012	73,131	73,245	73,383	73,520	73,662	73,810	73,962	74,119	74,283	74,451
Rensselaer	937	944	945	952	956	961	965	970	976	981	987
Richmond	16,107	16,137	16,157	16,209	16,242	16,277	16,312	16,349	16,386	16,425	16,465
Rockland	15,973	16,016	16,071	16,190	16,317	16,453	16,597	16,752	16,917	17,093	17,280
Saratoga	1,090	1,095	1,100	1,103	1,109	1,115	1,122	1,128	1,135	1,141	1,148
Schenectady	1,425	1,429	1,430	1,430	1,432	1,433	1,435	1,436	1,437	1,439	1,440
Suffolk	46,770	46,842	46,891	46,980	47,034	47,089	47,145	47,201	47,257	47,314	47,371
Sullivan	1,614	1,615	1,616	1,623	1,626	1,629	1,633	1,636	1,640	1,643	1,647
Tompkins	438	445	451	455	459	463	466	470	475	479	483
Ulster	2,303	2,315	2,324	2,329	2,335	2,342	2,349	2,356	2,364	2,373	2,381
Westchester	38,431	38,475	38,515	38,567	38,621	38,676	38,731	38,788	38,845	38,903	38,963

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:							
	10/3	10/4	10/5	10/6	10/8		10/10		10/12			
Albany	3,175	3,190	3,201	3,218	3,246	(649) [156] {78}	3,275	(655) [157] {79}	3,305	(661) [159] {79}		
Bronx	53,298	53,353	53,417	53,501	53,639	(10,728) [2,575] {1,287}	53,784	(10,757) [2,582] {1,291}	53,935	(10,787) [2,589] {1,294}		
Dutchess	5,169	5,179	5,187	5,205	5,220	(1,044) [251] {125}	5,235	(1,047) [251] {126}	5,251	(1,050) [252] {126}		
Erie	11,697	11,767	11,798	11,864	11,967	(2,393) [574] {287}	12,072	(2,414) [579] {290}	12,178	(2,436) [585] {292}		
Kings	69,677	69,933	70,131	70,354	70,934	(14,187) [3,405] {1,702}	71,566	(14,313) [3,435] {1,718}	72,254	(14,451) [3,468] {1,734}		
Monroe	6,186	6,206	6,220	6,248	6,292	(1,258) [302] {151}	6,336	(1,267) [304] {152}	6,382	(1,276) [306] {153}		
Nassau	47,167	47,246	47,302	47,392	47,548	(9,510) [2,282] {1,141}	47,707	(9,541) [2,290] {1,145}	47,870	(9,574) [2,298] {1,149}		
New York	33,791	33,863	33,935	34,005	34,151	(6,830) [1,639] {820}	34,304	(6,861) [1,647] {823}	34,465	(6,893) [1,654] {827}		
Niagara	1,813	1,828	1,834	1,840	1,855	(371) [89] {45}	1,870	(374) [90] {45}	1,886	(377) [91] {45}		
Onondaga	4,528	4,537	4,556	4,593	4,645	(929) [223] {111}	4,698	(940) [226] {113}	4,754	(951) [228] {114}		
Orange	12,360	12,394	12,438	12,493	12,613	(2,523) [605] {303}	12,745	(2,549) [612] {306}	12,892	(2,578) [619] {309}		
Putnam	1,646	1,650	1,652	1,656	1,666	(333) [80] {40}	1,676	(335) [80] {40}	1,687	(337) [81] {40}		
Queens	73,012	73,131	73,245	73,383	73,662	(14,732) [3,536] {1,768}	73,962	(14,792) [3,550] {1,775}	74,283	(14,857) [3,566] {1,783}		
Rensselaer	937	944	945	952	961	(192) [46] {23}	970	(194) [47] {23}	981	(196) [47] {24}		
Richmond	16,107	16,137	16,157	16,209	16,277	(3,255) [781] {391}	16,349	(3,270) [785] {392}	16,425	(3,285) [788] {394}		
Rockland	15,973	16,016	16,071	16,190	16,453	(3,291) [790] {395}	16,752	(3,350) [804] {402}	17,093	(3,419) [820] {410}		
Saratoga	1,090	1,095	1,100	1,103	1,115	(223) [54] {27}	1,128	(226) [54] {27}	1,141	(228) [55] {27}		
Schenectady	1,425	1,429	1,430	1,430	1,433	(287) [69] {34}	1,436	(287) [69] {34}	1,439	(288) [69] {35}		
Suffolk	46,770	46,842	46,891	46,980	47,089	(9,418) [2,260] {1,130}	47,201	(9,440) [2,266] {1,133}	47,314	(9,463) [2,271] {1,136}		
Sullivan	1,614	1,615	1,616	1,623	1,629	(326) [78] {39}	1,636	(327) [79] {39}	1,643	(329) [79] {39}		
Tompkins	438	445	451	455	463	(93) [22] {11}	470	(94) [23] {11}	479	(96) [23] {11}		
Ulster	2,303	2,315	2,324	2,329	2,342	(468) [112] {56}	2,356	(471) [113] {57}	2,373	(475) [114] {57}		
Westchester	38,431	38,475	38,515	38,567	38,676	(7,735) [1,856] {928}	38,788	(7,758) [1,862] {931}	38,903	(7,781) [1,867] {934}		

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.