

IEM's AI Modeling: Short-term COVID-19 Projections

Date: 7/1/20

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

The projections shown in this document are based on data pulled in as of 7/1/20 11 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.

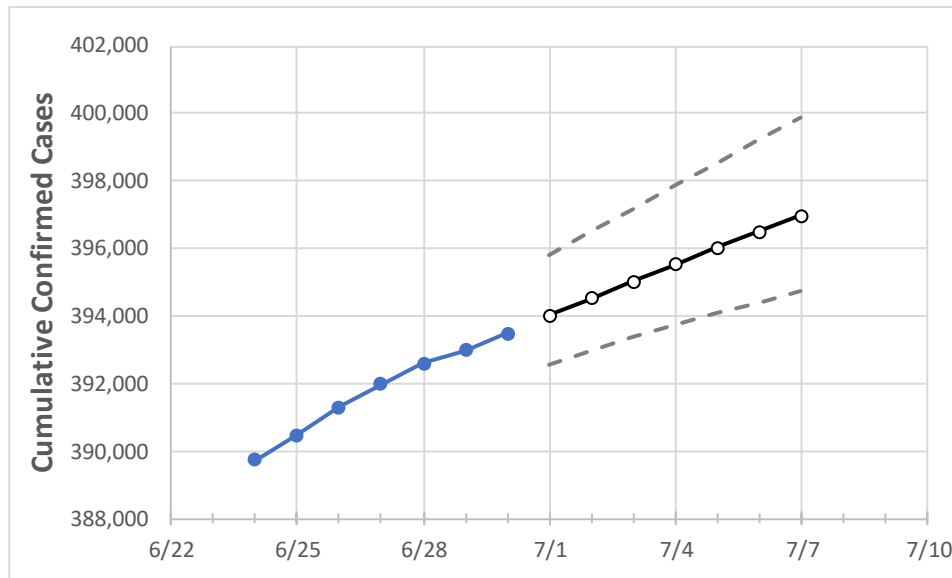
IEM's Modeling Lead

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:						
	6/27	6/28	6/29	6/30	7/1	7/2	7/3	7/4	7/5	7/6	7/7
New York	391,992	392,608	392,989	393,496	394,016	394,528	395,031	395,525	396,011	396,489	396,958

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:						
	6/27	6/28	6/29	6/30	7/1	7/2	7/3	7/4	7/5	7/6	7/7
Albany	2,091	2,097	2,099	2,102	2,105	2,108	2,111	2,115	2,118	2,120	2,123
Bronx	47,456	47,514	47,555	47,598	47,649	47,699	47,748	47,796	47,843	47,889	47,935
Dutchess	4,191	4,198	4,201	4,207	4,213	4,219	4,225	4,231	4,237	4,243	4,248
Erie	7,206	7,228	7,249	7,292	7,316	7,340	7,363	7,386	7,408	7,430	7,452
Kings	59,420	59,507	59,576	59,650	59,727	59,801	59,874	59,945	60,015	60,083	60,149
Monroe	3,676	3,690	3,709	3,742	3,763	3,783	3,804	3,824	3,845	3,866	3,886
Nassau	41,725	41,754	41,780	41,780	41,809	41,838	41,867	41,895	41,923	41,950	41,976
New York	28,331	28,380	28,401	28,447	28,491	28,534	28,577	28,620	28,662	28,703	28,744
Niagara	1,223	1,226	1,228	1,234	1,237	1,240	1,242	1,245	1,247	1,250	1,252
Onondaga	2,791	2,816	2,822	2,842	2,856	2,870	2,884	2,897	2,911	2,924	2,938
Orange	10,710	10,713	10,716	10,723	10,729	10,734	10,740	10,745	10,751	10,756	10,761
Putnam	1,319	1,323	1,325	1,326	1,327	1,329	1,330	1,332	1,333	1,334	1,336
Queens	65,175	65,276	65,325	65,391	65,467	65,542	65,616	65,688	65,759	65,828	65,896
Rensselaer	550	551	553	553	555	558	560	563	566	569	571
Richmond	14,052	14,073	14,082	14,093	14,104	14,115	14,126	14,137	14,148	14,158	14,168
Rockland	13,566	13,576	13,580	13,590	13,597	13,603	13,610	13,616	13,622	13,628	13,633
Saratoga	546	548	549	549	551	552	554	556	557	559	561
Schenectady	786	792	799	800	804	808	812	816	820	824	829
Suffolk	41,253	41,306	41,339	41,385	41,422	41,459	41,496	41,532	41,568	41,603	41,638
Sullivan	1,451	1,451	1,451	1,451	1,452	1,453	1,454	1,454	1,455	1,456	1,457
Tompkins	176	176	177	177	177	177	177	178	178	178	178
Ulster	1,773	1,778	1,780	1,781	1,783	1,785	1,787	1,789	1,791	1,792	1,794
Westchester	34,748	34,780	34,789	34,838	34,863	34,888	34,913	34,937	34,960	34,983	35,006

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:											
	6/27	6/28	6/29	6/30	7/2				7/4				7/6			
Albany	2,091	2,097	2,099	2,102	2,108	(422)	[101]	{51}	2,115	(423)	[101]	{51}	2,120	(424)	[102]	{51}
Bronx	47,456	47,514	47,555	47,598	47,699	(9,540)	[2,290]	{1,145}	47,796	(9,559)	[2,294]	{1,147}	47,889	(9,578)	[2,299]	{1,149}
Dutchess	4,191	4,198	4,201	4,207	4,219	(844)	[203]	{101}	4,231	(846)	[203]	{102}	4,243	(849)	[204]	{102}
Erie	7,206	7,228	7,249	7,292	7,340	(1,468)	[352]	{176}	7,386	(1,477)	[355]	{177}	7,430	(1,486)	[357]	{178}
Kings	59,420	59,507	59,576	59,650	59,801	(11,960)	[2,870]	{1,435}	59,945	(11,989)	[2,877]	{1,439}	60,083	(12,017)	[2,884]	{1,442}
Monroe	3,676	3,690	3,709	3,742	3,783	(757)	[182]	{91}	3,824	(765)	[184]	{92}	3,866	(773)	[186]	{93}
Nassau	41,725	41,754	41,780	41,780	41,838	(8,368)	[2,008]	{1,004}	41,895	(8,379)	[2,011]	{1,005}	41,950	(8,390)	[2,014]	{1,007}
New York	28,331	28,380	28,401	28,447	28,534	(5,707)	[1,370]	{685}	28,620	(5,724)	[1,374]	{687}	28,703	(5,741)	[1,378]	{689}
Niagara	1,223	1,226	1,228	1,234	1,240	(248)	[59]	{30}	1,245	(249)	[60]	{30}	1,250	(250)	[60]	{30}
Onondaga	2,791	2,816	2,822	2,842	2,870	(574)	[138]	{69}	2,897	(579)	[139]	{70}	2,924	(585)	[140]	{70}
Orange	10,710	10,713	10,716	10,723	10,734	(2,147)	[515]	{258}	10,745	(2,149)	[516]	{258}	10,756	(2,151)	[516]	{258}
Putnam	1,319	1,323	1,325	1,326	1,329	(266)	[64]	{32}	1,332	(266)	[64]	{32}	1,334	(267)	[64]	{32}
Queens	65,175	65,276	65,325	65,391	65,542	(13,108)	[3,146]	{1,573}	65,688	(13,138)	[3,153]	{1,577}	65,828	(13,166)	[3,160]	{1,580}
Rensselaer	550	551	553	553	558	(112)	[27]	{13}	563	(113)	[27]	{14}	569	(114)	[27]	{14}
Richmond	14,052	14,073	14,082	14,093	14,115	(2,823)	[678]	{339}	14,137	(2,827)	[679]	{339}	14,158	(2,832)	[680]	{340}
Rockland	13,566	13,576	13,580	13,590	13,603	(2,721)	[653]	{326}	13,616	(2,723)	[654]	{327}	13,628	(2,726)	[654]	{327}
Saratoga	546	548	549	549	552	(110)	[27]	{13}	556	(111)	[27]	{13}	559	(112)	[27]	{13}
Schenectady	786	792	799	800	808	(162)	[39]	{19}	816	(163)	[39]	{20}	824	(165)	[40]	{20}
Suffolk	41,253	41,306	41,339	41,385	41,459	(8,292)	[1,990]	{995}	41,532	(8,306)	[1,994]	{997}	41,603	(8,321)	[1,997]	{998}
Sullivan	1,451	1,451	1,451	1,451	1,453	(291)	[70]	{35}	1,454	(291)	[70]	{35}	1,456	(291)	[70]	{35}
Tompkins	176	176	177	177	177	(35)	[9]	{4}	178	(36)	[9]	{4}	178	(36)	[9]	{4}
Ulster	1,773	1,778	1,780	1,781	1,785	(357)	[86]	{43}	1,789	(358)	[86]	{43}	1,792	(358)	[86]	{43}
Westchester	34,748	34,780	34,789	34,838	34,888	(6,978)	[1,675]	{837}	34,937	(6,987)	[1,677]	{838}	34,983	(6,997)	[1,679]	{840}

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.