

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

Date: 7/9/20

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 7/9/20 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.

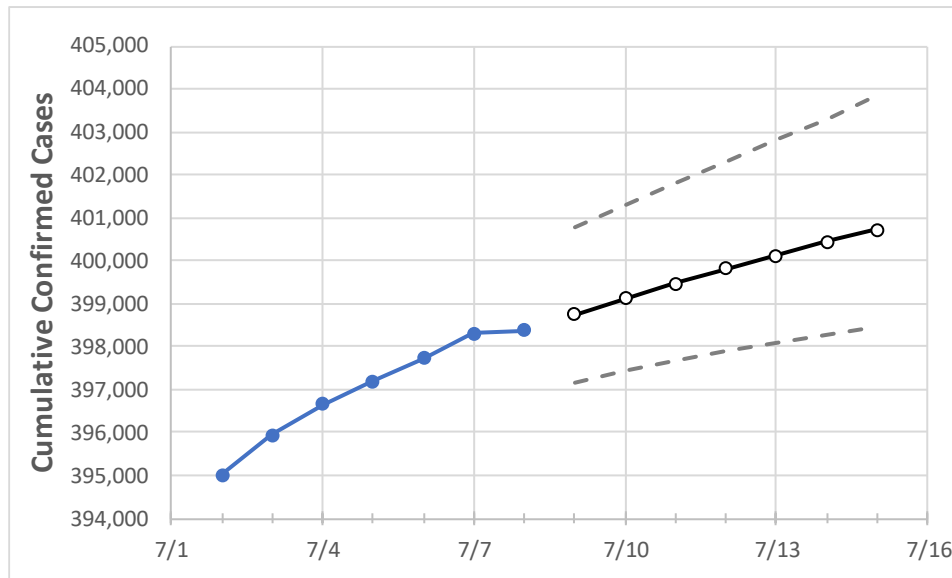
IEM's Modeling Lead

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:				
	7/5	7/6	7/7	7/8	7/9	7/10	7/11	7/12	7/13	7/14	7/15
New York	397,200	397,718	398,313	398,383	398,761	399,124	399,472	399,807	400,128	400,436	400,732

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:						
	7/5	7/6	7/7	7/8	7/9	7/10	7/11	7/12	7/13	7/14	7/15
Albany	2,152	2,160	2,164	2,175	2,183	2,191	2,200	2,208	2,217	2,226	2,236
Bronx	47,938	47,994	48,038	48,076	48,125	48,173	48,220	48,266	48,311	48,355	48,399
Dutchess	4,243	4,246	4,248	4,248	4,252	4,256	4,259	4,263	4,266	4,269	4,272
Erie	7,475	7,500	7,544	7,544	7,575	7,606	7,637	7,668	7,699	7,729	7,760
Kings	60,149	60,211	60,281	60,281	60,362	60,441	60,520	60,597	60,674	60,749	60,824
Monroe	3,953	3,974	4,004	4,004	4,040	4,077	4,115	4,154	4,193	4,233	4,275
Nassau	42,031	42,053	42,088	42,088	42,125	42,162	42,198	42,235	42,272	42,308	42,345
New York	28,804	28,870	28,920	28,920	28,980	29,040	29,101	29,161	29,223	29,285	29,347
Niagara	1,284	1,290	1,297	1,297	1,306	1,316	1,326	1,337	1,349	1,361	1,373
Onondaga	2,949	2,963	2,997	2,997	3,020	3,044	3,068	3,092	3,116	3,141	3,166
Orange	10,775	10,781	10,798	10,798	10,807	10,816	10,825	10,834	10,843	10,851	10,860
Putnam	1,336	1,337	1,340	1,340	1,342	1,343	1,345	1,347	1,348	1,350	1,351
Queens	65,876	65,928	66,024	66,024	66,100	66,176	66,250	66,323	66,395	66,465	66,535
Rensselaer	565	568	578	578	581	584	586	589	592	595	598
Richmond	14,202	14,213	14,225	14,225	14,241	14,258	14,274	14,290	14,307	14,323	14,340
Rockland	13,648	13,656	13,668	13,668	13,678	13,689	13,699	13,709	13,719	13,730	13,740
Saratoga	566	572	578	578	582	586	590	595	600	605	611
Schenectady	834	838	843	843	848	854	859	865	871	877	883
Suffolk	41,642	41,685	41,730	41,730	41,777	41,824	41,871	41,918	41,965	42,012	42,059
Sullivan	1,457	1,457	1,459	1,459	1,460	1,460	1,461	1,462	1,462	1,463	1,463
Tompkins	179	179	179	179	180	180	181	181	181	181	182
Ulster	1,834	1,840	1,843	1,843	1,851	1,859	1,868	1,877	1,887	1,898	1,910
Westchester	35,043	35,084	35,106	35,106	35,138	35,171	35,203	35,235	35,266	35,298	35,329

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:											
	7/5	7/6	7/7	7/8	7/10				7/12				7/14			
Albany	2,152	2,160	2,164	2,175	2,191	(438)	[105]	{53}	2,208	(442)	[106]	{53}	2,226	(445)	[107]	{53}
Bronx	47,938	47,994	48,038	48,076	48,173	(9,635)	[2,312]	{1,156}	48,266	(9,653)	[2,317]	{1,158}	48,355	(9,671)	[2,321]	{1,161}
Dutchess	4,243	4,246	4,248	4,248	4,256	(851)	[204]	{102}	4,263	(853)	[205]	{102}	4,269	(854)	[205]	{102}
Erie	7,475	7,500	7,544	7,544	7,606	(1,521)	[365]	{183}	7,668	(1,534)	[368]	{184}	7,729	(1,546)	[371]	{186}
Kings	60,149	60,211	60,281	60,281	60,441	(12,088)	[2,901]	{1,451}	60,597	(12,119)	[2,909]	{1,454}	60,749	(12,150)	[2,916]	{1,458}
Monroe	3,953	3,974	4,004	4,004	4,077	(815)	[196]	{98}	4,154	(831)	[199]	{100}	4,233	(847)	[203]	{102}
Nassau	42,031	42,053	42,088	42,088	42,162	(8,432)	[2,024]	{1,012}	42,235	(8,447)	[2,027]	{1,014}	42,308	(8,462)	[2,031]	{1,015}
New York	28,804	28,870	28,920	28,920	29,040	(5,808)	[1,394]	{697}	29,161	(5,832)	[1,400]	{700}	29,285	(5,857)	[1,406]	{703}
Niagara	1,284	1,290	1,297	1,297	1,316	(263)	[63]	{32}	1,337	(267)	[64]	{32}	1,361	(272)	[65]	{33}
Onondaga	2,949	2,963	2,997	2,997	3,044	(609)	[146]	{73}	3,092	(618)	[148]	{74}	3,141	(628)	[151]	{75}
Orange	10,775	10,781	10,798	10,798	10,816	(2,163)	[519]	{260}	10,834	(2,167)	[520]	{260}	10,851	(2,170)	[521]	{260}
Putnam	1,336	1,337	1,340	1,340	1,343	(269)	[64]	{32}	1,347	(269)	[65]	{32}	1,350	(270)	[65]	{32}
Queens	65,876	65,928	66,024	66,024	66,176	(13,235)	[3,176]	{1,588}	66,323	(13,265)	[3,183]	{1,592}	66,465	(13,293)	[3,190]	{1,595}
Rensselaer	565	568	578	578	584	(117)	[28]	{14}	589	(118)	[28]	{14}	595	(119)	[29]	{14}
Richmond	14,202	14,213	14,225	14,225	14,258	(2,852)	[684]	{342}	14,290	(2,858)	[686]	{343}	14,323	(2,865)	[688]	{344}
Rockland	13,648	13,656	13,668	13,668	13,689	(2,738)	[657]	{329}	13,709	(2,742)	[658]	{329}	13,730	(2,746)	[659]	{330}
Saratoga	566	572	578	578	586	(117)	[28]	{14}	595	(119)	[29]	{14}	605	(121)	[29]	{15}
Schenectady	834	838	843	843	854	(171)	[41]	{20}	865	(173)	[42]	{21}	877	(175)	[42]	{21}
Suffolk	41,642	41,685	41,730	41,730	41,824	(8,365)	[2,008]	{1,004}	41,918	(8,384)	[2,012]	{1,006}	42,012	(8,402)	[2,017]	{1,008}
Sullivan	1,457	1,457	1,459	1,459	1,460	(292)	[70]	{35}	1,462	(292)	[70]	{35}	1,463	(293)	[70]	{35}
Tompkins	179	179	179	179	180	(36)	[9]	{4}	181	(36)	[9]	{4}	181	(36)	[9]	{4}
Ulster	1,834	1,840	1,843	1,843	1,859	(372)	[89]	{45}	1,877	(375)	[90]	{45}	1,898	(380)	[91]	{46}
Westchester	35,043	35,084	35,106	35,106	35,171	(7,034)	[1,688]	{844}	35,235	(7,047)	[1,691]	{846}	35,298	(7,060)	[1,694]	{847}

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.