

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

Date: 7/15/20

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 7/15/20 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.

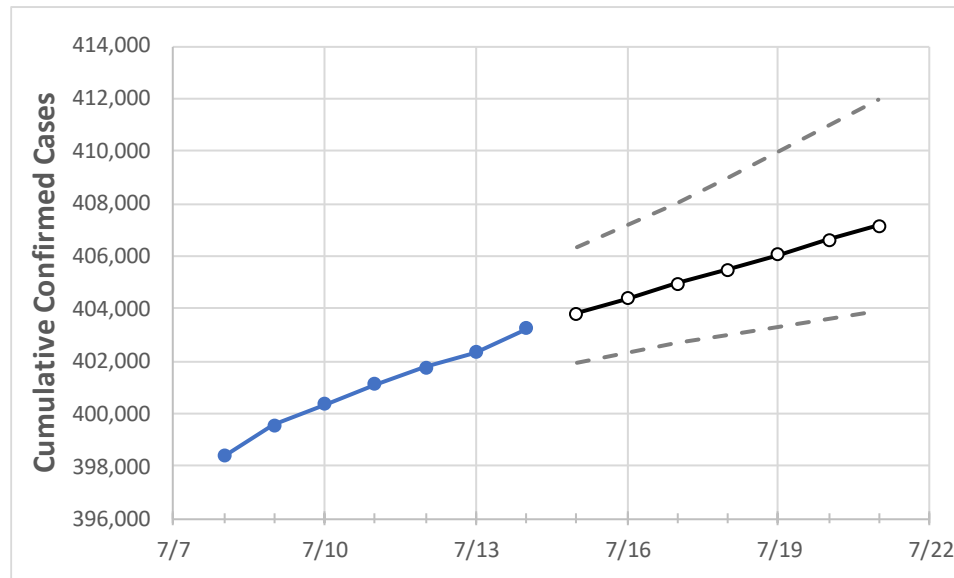
IEM's Modeling Lead

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:				
	7/11	7/12	7/13	7/14	7/15	7/16	7/17	7/18	7/19	7/20	7/21
New York	401,098	401,775	402,332	403,244	403,811	404,376	404,938	405,498	406,055	406,609	407,160

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:						
	7/11	7/12	7/13	7/14	7/15	7/16	7/17	7/18	7/19	7/20	7/21
Albany	2,208	2,219	2,225	2,247	2,257	2,268	2,279	2,290	2,302	2,314	2,326
Bronx	48,267	48,327	48,377	48,433	48,483	48,532	48,581	48,629	48,676	48,723	48,769
Dutchess	4,269	4,276	4,280	4,318	4,324	4,329	4,335	4,341	4,346	4,352	4,357
Erie	7,711	7,742	7,766	7,833	7,871	7,909	7,948	7,988	8,028	8,068	8,110
Kings	60,647	60,748	60,815	60,904	60,980	61,055	61,129	61,203	61,275	61,346	61,416
Monroe	4,153	4,177	4,200	4,247	4,280	4,313	4,346	4,379	4,413	4,446	4,480
Nassau	42,267	42,307	42,354	42,423	42,470	42,518	42,567	42,617	42,668	42,719	42,772
New York	29,165	29,237	29,302	29,363	29,423	29,483	29,543	29,603	29,662	29,722	29,783
Niagara	1,334	1,340	1,342	1,351	1,358	1,366	1,374	1,381	1,389	1,397	1,405
Onondaga	3,100	3,124	3,142	3,179	3,204	3,229	3,255	3,281	3,307	3,333	3,360
Orange	10,830	10,835	10,841	10,850	10,857	10,864	10,871	10,878	10,885	10,892	10,899
Putnam	1,361	1,363	1,365	1,376	1,380	1,385	1,389	1,394	1,399	1,405	1,411
Queens	66,323	66,410	66,466	66,544	66,616	66,688	66,758	66,829	66,899	66,968	67,037
Rensselaer	593	616	617	625	631	637	643	651	658	666	675
Richmond	14,308	14,329	14,341	14,372	14,392	14,412	14,433	14,453	14,474	14,495	14,517
Rockland	13,700	13,716	13,719	13,733	13,741	13,749	13,757	13,765	13,772	13,780	13,787
Saratoga	595	602	610	616	623	628	633	638	643	648	653
Schenectady	856	864	868	883	888	893	898	903	908	913	918
Suffolk	41,987	42,028	42,112	42,214	42,282	42,351	42,422	42,496	42,571	42,648	42,727
Sullivan	1,465	1,465	1,466	1,466	1,467	1,467	1,468	1,469	1,469	1,470	1,470
Tompkins	183	186	186	186	187	188	189	191	192	194	196
Ulster	1,855	1,859	1,862	1,872	1,876	1,880	1,884	1,889	1,893	1,897	1,901
Westchester	35,260	35,297	35,327	35,366	35,401	35,436	35,471	35,506	35,541	35,576	35,611

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:											
	7/11	7/12	7/13	7/14	7/16				7/18				7/20			
Albany	2,208	2,219	2,225	2,247	2,268	(454)	[109]	{54}	2,290	(458)	[110]	{55}	2,314	(463)	[111]	{56}
Bronx	48,267	48,327	48,377	48,433	48,532	(9,706)	[2,330]	{1,165}	48,629	(9,726)	[2,334]	{1,167}	48,723	(9,745)	[2,339]	{1,169}
Dutchess	4,269	4,276	4,280	4,318	4,329	(866)	[208]	{104}	4,341	(868)	[208]	{104}	4,352	(870)	[209]	{104}
Erie	7,711	7,742	7,766	7,833	7,909	(1,582)	[380]	{190}	7,988	(1,598)	[383]	{192}	8,068	(1,614)	[387]	{194}
Kings	60,647	60,748	60,815	60,904	61,055	(12,211)	[2,931]	{1,465}	61,203	(12,241)	[2,938]	{1,469}	61,346	(12,269)	[2,945]	{1,472}
Monroe	4,153	4,177	4,200	4,247	4,313	(863)	[207]	{104}	4,379	(876)	[210]	{105}	4,446	(889)	[213]	{107}
Nassau	42,267	42,307	42,354	42,423	42,518	(8,504)	[2,041]	{1,020}	42,617	(8,523)	[2,046]	{1,023}	42,719	(8,544)	[2,051]	{1,025}
New York	29,165	29,237	29,302	29,363	29,483	(5,897)	[1,415]	{708}	29,603	(5,921)	[1,421]	{710}	29,722	(5,944)	[1,427]	{713}
Niagara	1,334	1,340	1,342	1,351	1,366	(273)	[66]	{33}	1,381	(276)	[66]	{33}	1,397	(279)	[67]	{34}
Onondaga	3,100	3,124	3,142	3,179	3,229	(646)	[155]	{78}	3,281	(656)	[157]	{79}	3,333	(667)	[160]	{80}
Orange	10,830	10,835	10,841	10,850	10,864	(2,173)	[521]	{261}	10,878	(2,176)	[522]	{261}	10,892	(2,178)	[523]	{261}
Putnam	1,361	1,363	1,365	1,376	1,385	(277)	[66]	{33}	1,394	(279)	[67]	{33}	1,405	(281)	[67]	{34}
Queens	66,323	66,410	66,466	66,544	66,688	(13,338)	[3,201]	{1,601}	66,829	(13,366)	[3,208]	{1,604}	66,968	(13,394)	[3,214]	{1,607}
Rensselaer	593	616	617	625	637	(127)	[31]	{15}	651	(130)	[31]	{16}	666	(133)	[32]	{16}
Richmond	14,308	14,329	14,341	14,372	14,412	(2,882)	[692]	{346}	14,453	(2,891)	[694]	{347}	14,495	(2,899)	[696]	{348}
Rockland	13,700	13,716	13,719	13,733	13,749	(2,750)	[660]	{330}	13,765	(2,753)	[661]	{330}	13,780	(2,756)	[661]	{331}
Saratoga	595	602	610	616	628	(126)	[30]	{15}	638	(128)	[31]	{15}	648	(130)	[31]	{16}
Schenectady	856	864	868	883	893	(179)	[43]	{21}	903	(181)	[43]	{22}	913	(183)	[44]	{22}
Suffolk	41,987	42,028	42,112	42,214	42,351	(8,470)	[2,033]	{1,016}	42,496	(8,499)	[2,040]	{1,020}	42,648	(8,530)	[2,047]	{1,024}
Sullivan	1,465	1,465	1,466	1,466	1,467	(293)	[70]	{35}	1,469	(294)	[70]	{35}	1,470	(294)	[71]	{35}
Tompkins	183	186	186	186	188	(38)	[9]	{5}	191	(38)	[9]	{5}	194	(39)	[9]	{5}
Ulster	1,855	1,859	1,862	1,872	1,880	(376)	[90]	{45}	1,889	(378)	[91]	{45}	1,897	(379)	[91]	{46}
Westchester	35,260	35,297	35,327	35,366	35,436	(7,087)	[1,701]	{850}	35,506	(7,101)	[1,704]	{852}	35,576	(7,115)	[1,708]	{854}

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.