

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

Date: 8/26/20

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 8/26/20 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.

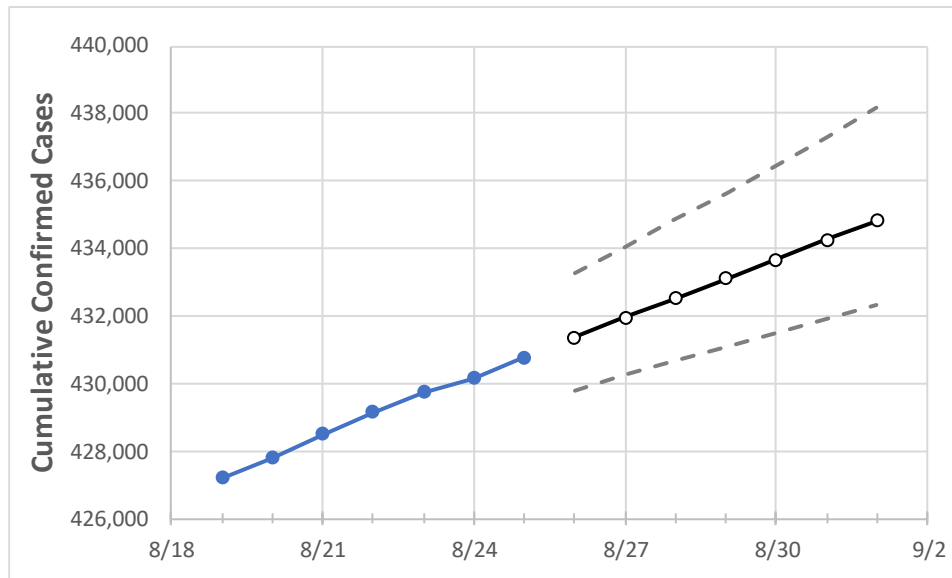
IEM's Modeling Lead

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:				
	8/22	8/23	8/24	8/25	8/26	8/27	8/28	8/29	8/30	8/31	9/1
New York	429,165	429,737	430,145	430,774	431,359	431,943	432,525	433,105	433,683	434,260	434,835

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:						
	8/22	8/23	8/24	8/25	8/26	8/27	8/28	8/29	8/30	8/31	9/1
Albany	2,693	2,699	2,701	2,711	2,715	2,719	2,723	2,727	2,731	2,734	2,738
Bronx	51,067	51,137	51,194	51,239	51,300	51,362	51,423	51,484	51,545	51,606	51,667
Dutchess	4,753	4,767	4,777	4,790	4,801	4,812	4,824	4,835	4,847	4,858	4,870
Erie	9,413	9,465	9,491	9,546	9,583	9,621	9,659	9,697	9,736	9,775	9,815
Kings	64,301	64,375	64,422	64,495	64,568	64,641	64,712	64,783	64,854	64,924	64,993
Monroe	5,297	5,317	5,330	5,348	5,367	5,385	5,403	5,420	5,438	5,455	5,472
Nassau	44,205	44,245	44,284	44,348	44,390	44,433	44,475	44,518	44,561	44,603	44,646
New York	31,708	31,752	31,796	31,837	31,884	31,931	31,978	32,025	32,071	32,116	32,162
Niagara	1,566	1,575	1,576	1,586	1,590	1,594	1,598	1,602	1,606	1,610	1,614
Onondaga	3,756	3,758	3,768	3,792	3,802	3,812	3,822	3,833	3,843	3,853	3,863
Orange	11,328	11,334	11,343	11,354	11,365	11,376	11,387	11,398	11,410	11,422	11,433
Putnam	1,473	1,474	1,475	1,480	1,481	1,483	1,484	1,486	1,487	1,489	1,490
Queens	69,623	69,694	69,745	69,805	69,878	69,950	70,022	70,095	70,167	70,238	70,310
Rensselaer	813	817	818	819	821	823	825	827	828	830	832
Richmond	15,142	15,162	15,177	15,189	15,202	15,216	15,229	15,242	15,255	15,267	15,280
Rockland	14,118	14,129	14,139	14,149	14,163	14,178	14,194	14,210	14,227	14,244	14,262
Saratoga	813	815	816	824	826	829	831	833	835	838	840
Schenectady	1,172	1,179	1,182	1,206	1,215	1,224	1,234	1,244	1,254	1,265	1,276
Suffolk	44,456	44,498	44,519	44,561	44,598	44,634	44,670	44,705	44,740	44,774	44,807
Sullivan	1,497	1,497	1,498	1,499	1,499	1,500	1,500	1,501	1,501	1,502	1,502
Tompkins	244	245	245	245	245	246	246	246	247	247	247
Ulster	2,126	2,127	2,134	2,137	2,140	2,143	2,146	2,149	2,152	2,155	2,158
Westchester	36,651	36,689	36,710	36,742	36,772	36,803	36,833	36,863	36,893	36,924	36,954

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:											
	8/22	8/23	8/24	8/25	8/27				8/29				8/31			
Albany	2,693	2,699	2,701	2,711	2,719	(544)	[131]	{65}	2,727	(545)	[131]	{65}	2,734	(547)	[131]	{66}
Bronx	51,067	51,137	51,194	51,239	51,362	(10,272)	[2,465]	{1,233}	51,484	(10,297)	[2,471]	{1,236}	51,606	(10,321)	[2,477]	{1,239}
Dutchess	4,753	4,767	4,777	4,790	4,812	(962)	[231]	{115}	4,835	(967)	[232]	{116}	4,858	(972)	[233]	{117}
Erie	9,413	9,465	9,491	9,546	9,621	(1,924)	[462]	{231}	9,697	(1,939)	[465]	{233}	9,775	(1,955)	[469]	{235}
Kings	64,301	64,375	64,422	64,495	64,641	(12,928)	[3,103]	{1,551}	64,783	(12,957)	[3,110]	{1,555}	64,924	(12,985)	[3,116]	{1,558}
Monroe	5,297	5,317	5,330	5,348	5,385	(1,077)	[258]	{129}	5,420	(1,084)	[260]	{130}	5,455	(1,091)	[262]	{131}
Nassau	44,205	44,245	44,284	44,348	44,433	(8,887)	[2,133]	{1,066}	44,518	(8,904)	[2,137]	{1,068}	44,603	(8,921)	[2,141]	{1,070}
New York	31,708	31,752	31,796	31,837	31,931	(6,386)	[1,533]	{766}	32,025	(6,405)	[1,537]	{769}	32,116	(6,423)	[1,542]	{771}
Niagara	1,566	1,575	1,576	1,586	1,594	(319)	[77]	{38}	1,602	(320)	[77]	{38}	1,610	(322)	[77]	{39}
Onondaga	3,756	3,758	3,768	3,792	3,812	(762)	[183]	{91}	3,833	(767)	[184]	{92}	3,853	(771)	[185]	{92}
Orange	11,328	11,334	11,343	11,354	11,376	(2,275)	[546]	{273}	11,398	(2,280)	[547]	{274}	11,422	(2,284)	[548]	{274}
Putnam	1,473	1,474	1,475	1,480	1,483	(297)	[71]	{36}	1,486	(297)	[71]	{36}	1,489	(298)	[71]	{36}
Queens	69,623	69,694	69,745	69,805	69,950	(13,990)	[3,358]	{1,679}	70,095	(14,019)	[3,365]	{1,682}	70,238	(14,048)	[3,371]	{1,686}
Rensselaer	813	817	818	819	823	(165)	[39]	{20}	827	(165)	[40]	{20}	830	(166)	[40]	{20}
Richmond	15,142	15,162	15,177	15,189	15,216	(3,043)	[730]	{365}	15,242	(3,048)	[732]	{366}	15,267	(3,053)	[733]	{366}
Rockland	14,118	14,129	14,139	14,149	14,178	(2,836)	[681]	{340}	14,210	(2,842)	[682]	{341}	14,244	(2,849)	[684]	{342}
Saratoga	813	815	816	824	829	(166)	[40]	{20}	833	(167)	[40]	{20}	838	(168)	[40]	{20}
Schenectady	1,172	1,179	1,182	1,206	1,224	(245)	[59]	{29}	1,244	(249)	[60]	{30}	1,265	(253)	[61]	{30}
Suffolk	44,456	44,498	44,519	44,561	44,634	(8,927)	[2,142]	{1,071}	44,705	(8,941)	[2,146]	{1,073}	44,774	(8,955)	[2,149]	{1,075}
Sullivan	1,497	1,497	1,498	1,499	1,500	(300)	[72]	{36}	1,501	(300)	[72]	{36}	1,502	(300)	[72]	{36}
Tompkins	244	245	245	245	246	(49)	[12]	{6}	246	(49)	[12]	{6}	247	(49)	[12]	{6}
Ulster	2,126	2,127	2,134	2,137	2,143	(429)	[103]	{51}	2,149	(430)	[103]	{52}	2,155	(431)	[103]	{52}
Westchester	36,651	36,689	36,710	36,742	36,803	(7,361)	[1,767]	{883}	36,863	(7,373)	[1,769]	{885}	36,924	(7,385)	[1,772]	{886}

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.