

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

Date: 11/24/20

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 11/24/20 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.

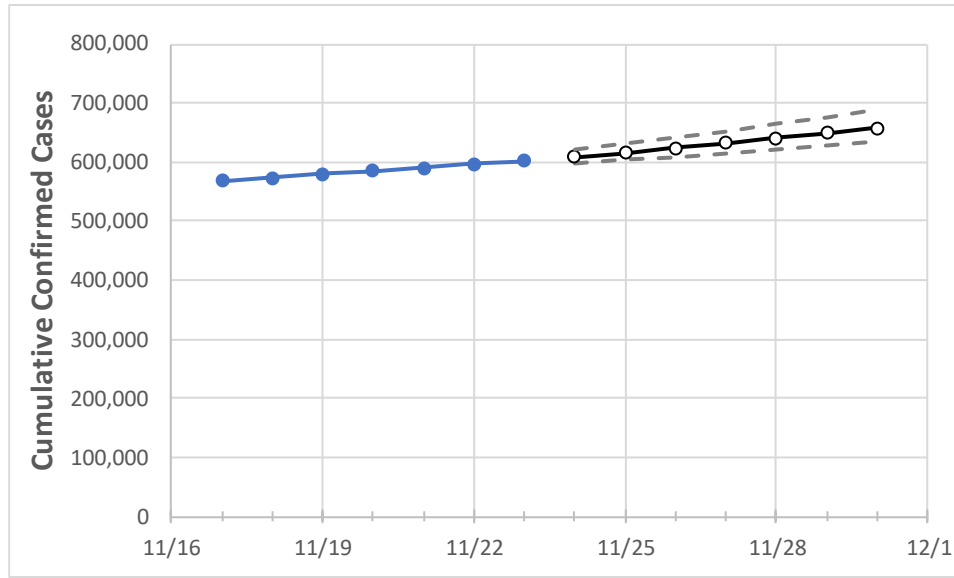
IEM's Modeling Lead

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:					
	11/20	11/21	11/22	11/23	11/24	11/25	11/26	11/27	11/28	11/29	11/30
New York	584,850	590,823	596,214	602,120	609,088	616,371	623,985	631,946	640,268	648,967	658,060

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:						
	11/20	11/21	11/22	11/23	11/24	11/25	11/26	11/27	11/28	11/29	11/30
Albany	4,906	5,013	5,108	5,148	5,239	5,333	5,432	5,535	5,643	5,756	5,874
Bronx	60,233	60,635	60,979	61,316	61,721	62,147	62,593	63,060	63,551	64,065	64,604
Dutchess	6,493	6,569	6,634	6,728	6,824	6,925	7,033	7,148	7,270	7,399	7,536
Erie	20,103	20,554	21,075	21,572	22,271	23,015	23,807	24,650	25,547	26,502	27,518
Kings	83,608	84,130	84,609	85,108	85,663	86,234	86,822	87,426	88,048	88,688	89,346
Monroe	11,733	12,092	12,406	12,771	13,159	13,568	13,999	14,452	14,929	15,431	15,959
Nassau	55,875	56,269	56,706	57,127	57,661	58,221	58,809	59,426	60,074	60,754	61,468
New York	41,620	41,996	42,354	42,664	43,094	43,542	44,009	44,495	45,000	45,526	46,074
Niagara	3,023	3,088	3,152	3,213	3,299	3,391	3,489	3,592	3,702	3,819	3,943
Onondaga	8,735	8,947	9,160	9,362	9,642	9,936	10,247	10,574	10,920	11,283	11,667
Orange	15,677	15,799	15,872	15,987	16,114	16,245	16,379	16,517	16,658	16,803	16,952
Putnam	2,308	2,356	2,362	2,472	2,502	2,534	2,568	2,603	2,641	2,680	2,721
Queens	84,843	85,284	85,777	86,246	86,863	87,501	88,162	88,846	89,555	90,290	91,050
Rensselaer	1,449	1,494	1,515	1,528	1,561	1,596	1,633	1,673	1,715	1,761	1,809
Richmond	20,586	20,790	21,046	21,213	21,458	21,711	21,975	22,249	22,533	22,828	23,134
Rockland	20,351	20,511	20,602	20,708	20,832	20,958	21,085	21,213	21,343	21,475	21,607
Saratoga	1,842	1,875	1,904	1,969	2,004	2,040	2,077	2,117	2,158	2,201	2,246
Schenectady	1,997	2,062	2,073	2,136	2,171	2,209	2,248	2,290	2,334	2,381	2,430
Suffolk	55,329	55,807	56,339	56,865	57,524	58,225	58,970	59,763	60,607	61,503	62,457
Sullivan	2,044	2,065	2,078	2,093	2,107	2,121	2,135	2,150	2,165	2,180	2,196
Tompkins	848	876	904	936	954	972	992	1,013	1,034	1,057	1,081
Ulster	2,969	3,004	3,023	3,073	3,116	3,163	3,212	3,265	3,322	3,383	3,448
Westchester	46,064	46,469	46,841	47,262	47,770	48,306	48,871	49,467	50,095	50,757	51,455

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:											
	11/20	11/21	11/22	11/23	11/25			11/27			11/29					
Albany	4,906	5,013	5,108	5,148	5,333	(1,067)	[256]	{128}	5,535	(1,107)	[266]	{133}	5,756	(1,151)	[276]	{138}
Bronx	60,233	60,635	60,979	61,316	62,147	(12,429)	[2,983]	{1,492}	63,060	(12,612)	[3,027]	{1,513}	64,065	(12,813)	[3,075]	{1,538}
Dutchess	6,493	6,569	6,634	6,728	6,925	(1,385)	[332]	{166}	7,148	(1,430)	[343]	{172}	7,399	(1,480)	[355]	{178}
Erie	20,103	20,554	21,075	21,572	23,015	(4,603)	[1,105]	{552}	24,650	(4,930)	[1,183]	{592}	26,502	(5,300)	[1,272]	{636}
Kings	83,608	84,130	84,609	85,108	86,234	(17,247)	[4,139]	{2,070}	87,426	(17,485)	[4,196]	{2,098}	88,688	(17,738)	[4,257]	{2,129}
Monroe	11,733	12,092	12,406	12,771	13,568	(2,714)	[651]	{326}	14,452	(2,890)	[694]	{347}	15,431	(3,086)	[741]	{370}
Nassau	55,875	56,269	56,706	57,127	58,221	(11,644)	[2,795]	{1,397}	59,426	(11,885)	[2,852]	{1,426}	60,754	(12,151)	[2,916]	{1,458}
New York	41,620	41,996	42,354	42,664	43,542	(8,708)	[2,090]	{1,045}	44,495	(8,899)	[2,136]	{1,068}	45,526	(9,105)	[2,185]	{1,093}
Niagara	3,023	3,088	3,152	3,213	3,391	(678)	[163]	{81}	3,592	(718)	[172]	{86}	3,819	(764)	[183]	{92}
Onondaga	8,735	8,947	9,160	9,362	9,936	(1,987)	[477]	{238}	10,574	(2,115)	[508]	{254}	11,283	(2,257)	[542]	{271}
Orange	15,677	15,799	15,872	15,987	16,245	(3,249)	[780]	{390}	16,517	(3,303)	[793]	{396}	16,803	(3,361)	[807]	{403}
Putnam	2,308	2,356	2,362	2,472	2,534	(507)	[122]	{61}	2,603	(521)	[125]	{62}	2,680	(536)	[129]	{64}
Queens	84,843	85,284	85,777	86,246	87,501	(17,500)	[4,200]	{2,100}	88,846	(17,769)	[4,265]	{2,132}	90,290	(18,058)	[4,334]	{2,167}
Rensselaer	1,449	1,494	1,515	1,528	1,596	(319)	[77]	{38}	1,673	(335)	[80]	{40}	1,761	(352)	[85]	{42}
Richmond	20,586	20,790	21,046	21,213	21,711	(4,342)	[1,042]	{521}	22,249	(4,450)	[1,068]	{534}	22,828	(4,566)	[1,096]	{548}
Rockland	20,351	20,511	20,602	20,708	20,958	(4,192)	[1,006]	{503}	21,213	(4,243)	[1,018]	{509}	21,475	(4,295)	[1,031]	{515}
Saratoga	1,842	1,875	1,904	1,969	2,040	(408)	[98]	{49}	2,117	(423)	[102]	{51}	2,201	(440)	[106]	{53}
Schenectady	1,997	2,062	2,073	2,136	2,209	(442)	[106]	{53}	2,290	(458)	[110]	{55}	2,381	(476)	[114]	{57}
Suffolk	55,329	55,807	56,339	56,865	58,225	(11,645)	[2,795]	{1,397}	59,763	(11,953)	[2,869]	{1,434}	61,503	(12,301)	[2,952]	{1,476}
Sullivan	2,044	2,065	2,078	2,093	2,121	(424)	[102]	{51}	2,150	(430)	[103]	{52}	2,180	(436)	[105]	{52}
Tompkins	848	876	904	936	972	(194)	[47]	{23}	1,013	(203)	[49]	{24}	1,057	(211)	[51]	{25}
Ulster	2,969	3,004	3,023	3,073	3,163	(633)	[152]	{76}	3,265	(653)	[157]	{78}	3,383	(677)	[162]	{81}
Westchester	46,064	46,469	46,841	47,262	48,306	(9,661)	[2,319]	{1,159}	49,467	(9,893)	[2,374]	{1,187}	50,757	(10,151)	[2,436]	{1,218}

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.