

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

Date: 11/23/20

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 11/23/20 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.

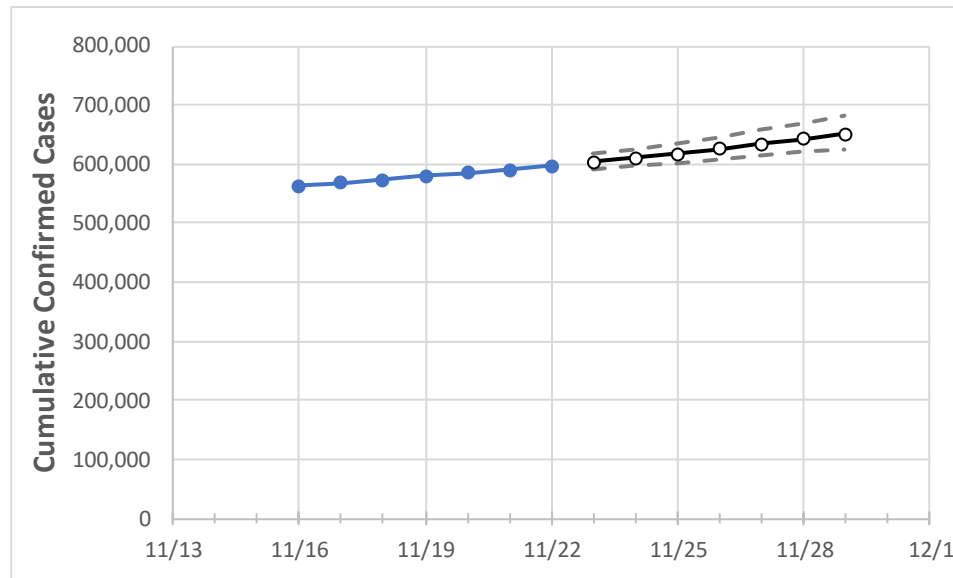
IEM's Modeling Lead

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:						
	11/19	11/20	11/21	11/22	11/23	11/24	11/25	11/26	11/27	11/28	11/29
New York	579,382	584,850	590,823	596,214	602,956	610,022	617,429	625,191	633,326	641,851	650,784

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:						
	11/19	11/20	11/21	11/22	11/23	11/24	11/25	11/26	11/27	11/28	11/29
Albany	4,822	4,906	5,013	5,108	5,206	5,309	5,418	5,532	5,653	5,780	5,913
Bronx	59,856	60,233	60,635	60,979	61,374	61,790	62,226	62,686	63,169	63,677	64,211
Dutchess	6,439	6,493	6,569	6,634	6,729	6,830	6,938	7,053	7,174	7,304	7,442
Erie	19,473	20,103	20,554	21,075	21,778	22,530	23,336	24,198	25,121	26,109	27,166
Kings	83,083	83,608	84,130	84,609	85,151	85,708	86,282	86,873	87,482	88,108	88,752
Monroe	11,444	11,733	12,092	12,406	12,773	13,159	13,567	13,996	14,448	14,924	15,426
Nassau	55,486	55,875	56,269	56,706	57,232	57,785	58,368	58,982	59,628	60,309	61,026
New York	41,263	41,620	41,996	42,354	42,793	43,252	43,733	44,237	44,765	45,317	45,896
Niagara	2,934	3,023	3,088	3,152	3,236	3,326	3,422	3,524	3,632	3,748	3,871
Onondaga	8,494	8,735	8,947	9,160	9,429	9,714	10,014	10,331	10,665	11,018	11,390
Orange	15,566	15,677	15,799	15,872	16,000	16,132	16,267	16,406	16,550	16,697	16,849
Putnam	2,306	2,308	2,356	2,362	2,388	2,416	2,444	2,474	2,504	2,536	2,569
Queens	84,269	84,843	85,284	85,777	86,391	87,030	87,695	88,387	89,107	89,857	90,637
Rensselaer	1,411	1,449	1,494	1,515	1,551	1,590	1,632	1,677	1,726	1,778	1,835
Richmond	20,398	20,586	20,790	21,046	21,296	21,558	21,832	22,118	22,417	22,730	23,056
Rockland	20,263	20,351	20,511	20,602	20,730	20,861	20,994	21,129	21,266	21,406	21,547
Saratoga	1,804	1,842	1,875	1,904	1,935	1,968	2,002	2,037	2,073	2,111	2,151
Schenectady	1,983	1,997	2,062	2,073	2,105	2,139	2,175	2,212	2,252	2,293	2,336
Suffolk	54,916	55,329	55,807	56,339	56,968	57,638	58,350	59,107	59,913	60,771	61,682
Sullivan	2,031	2,044	2,065	2,078	2,091	2,104	2,118	2,131	2,146	2,160	2,175
Tompkins	840	848	876	904	919	935	952	969	987	1,006	1,026
Ulster	2,937	2,969	3,004	3,023	3,069	3,118	3,171	3,229	3,290	3,357	3,428
Westchester	45,672	46,064	46,469	46,841	47,327	47,839	48,379	48,948	49,548	50,180	50,845

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:											
	11/19	11/20	11/21	11/22	11/24				11/26				11/28			
Albany	4,822	4,906	5,013	5,108	5,309	(1,062)	[255]	{127}	5,532	(1,106)	[266]	{133}	5,780	(1,156)	[277]	{139}
Bronx	59,856	60,233	60,635	60,979	61,790	(12,358)	[2,966]	{1,483}	62,686	(12,537)	[3,009]	{1,504}	63,677	(12,735)	[3,056]	{1,528}
Dutchess	6,439	6,493	6,569	6,634	6,830	(1,366)	[328]	{164}	7,053	(1,411)	[339]	{169}	7,304	(1,461)	[351]	{175}
Erie	19,473	20,103	20,554	21,075	22,530	(4,506)	[1,081]	{541}	24,198	(4,840)	[1,162]	{581}	26,109	(5,222)	[1,253]	{627}
Kings	83,083	83,608	84,130	84,609	85,708	(17,142)	[4,114]	{2,057}	86,873	(17,375)	[4,170]	{2,085}	88,108	(17,622)	[4,229]	{2,115}
Monroe	11,444	11,733	12,092	12,406	13,159	(2,632)	[632]	{316}	13,996	(2,799)	[672]	{336}	14,924	(2,985)	[716]	{358}
Nassau	55,486	55,875	56,269	56,706	57,785	(11,557)	[2,774]	{1,387}	58,982	(11,796)	[2,831]	{1,416}	60,309	(12,062)	[2,895]	{1,447}
New York	41,263	41,620	41,996	42,354	43,252	(8,650)	[2,076]	{1,038}	44,237	(8,847)	[2,123]	{1,062}	45,317	(9,063)	[2,175]	{1,088}
Niagara	2,934	3,023	3,088	3,152	3,326	(665)	[160]	{80}	3,524	(705)	[169]	{85}	3,748	(750)	[180]	{90}
Onondaga	8,494	8,735	8,947	9,160	9,714	(1,943)	[466]	{233}	10,331	(2,066)	[496]	{248}	11,018	(2,204)	[529]	{264}
Orange	15,566	15,677	15,799	15,872	16,132	(3,226)	[774]	{387}	16,406	(3,281)	[787]	{394}	16,697	(3,339)	[801]	{401}
Putnam	2,306	2,308	2,356	2,362	2,416	(483)	[116]	{58}	2,474	(495)	[119]	{59}	2,536	(507)	[122]	{61}
Queens	84,269	84,843	85,284	85,777	87,030	(17,406)	[4,177]	{2,089}	88,387	(17,677)	[4,243]	{2,121}	89,857	(17,971)	[4,313]	{2,157}
Rensselaer	1,411	1,449	1,494	1,515	1,590	(318)	[76]	{38}	1,677	(335)	[81]	{40}	1,778	(356)	[85]	{43}
Richmond	20,398	20,586	20,790	21,046	21,558	(4,312)	[1,035]	{517}	22,118	(4,424)	[1,062]	{531}	22,730	(4,546)	[1,091]	{546}
Rockland	20,263	20,351	20,511	20,602	20,861	(4,172)	[1,001]	{501}	21,129	(4,226)	[1,014]	{507}	21,406	(4,281)	[1,027]	{514}
Saratoga	1,804	1,842	1,875	1,904	1,968	(394)	[94]	{47}	2,037	(407)	[98]	{49}	2,111	(422)	[101]	{51}
Schenectady	1,983	1,997	2,062	2,073	2,139	(428)	[103]	{51}	2,212	(442)	[106]	{53}	2,293	(459)	[110]	{55}
Suffolk	54,916	55,329	55,807	56,339	57,638	(11,528)	[2,767]	{1,383}	59,107	(11,821)	[2,837]	{1,419}	60,771	(12,154)	[2,917]	{1,458}
Sullivan	2,031	2,044	2,065	2,078	2,104	(421)	[101]	{50}	2,131	(426)	[102]	{51}	2,160	(432)	[104]	{52}
Tompkins	840	848	876	904	935	(187)	[45]	{22}	969	(194)	[47]	{23}	1,006	(201)	[48]	{24}
Ulster	2,937	2,969	3,004	3,023	3,118	(624)	[150]	{75}	3,229	(646)	[155]	{77}	3,357	(671)	[161]	{81}
Westchester	45,672	46,064	46,469	46,841	47,839	(9,568)	[2,296]	{1,148}	48,948	(9,790)	[2,350]	{1,175}	50,180	(10,036)	[2,409]	{1,204}

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.