

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

Date: 11/19/20

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 11/19/20 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.

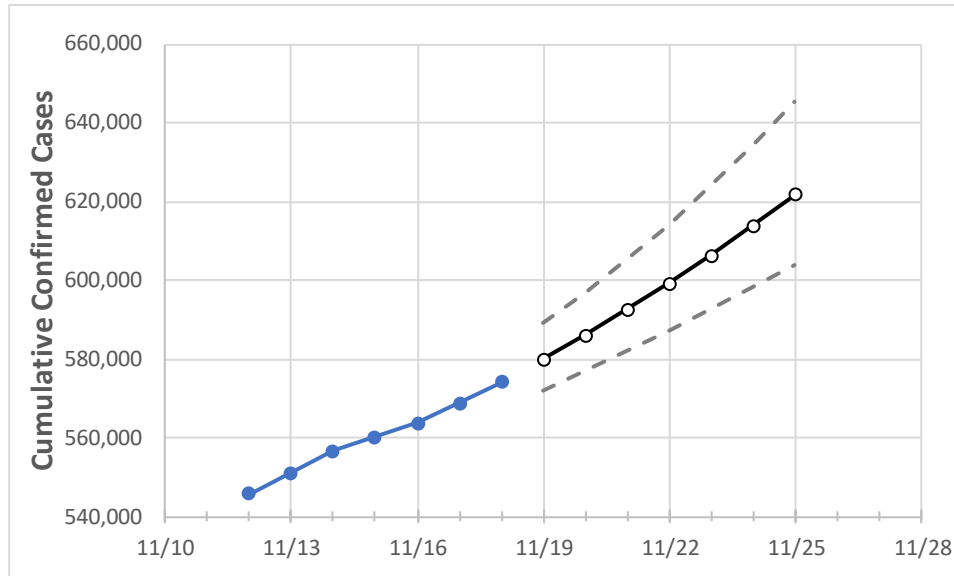
IEM's Modeling Lead

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:						
	11/15	11/16	11/17	11/18	11/19	11/20	11/21	11/22	11/23	11/24	11/25
New York	560,200	563,690	568,778	574,072	579,913	586,047	592,488	599,253	606,359	613,822	621,661

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:						
	11/15	11/16	11/17	11/18	11/19	11/20	11/21	11/22	11/23	11/24	11/25
Albany	4,529	4,572	4,653	4,730	4,806	4,886	4,969	5,056	5,148	5,244	5,345
Bronx	58,712	58,905	59,265	59,548	59,872	60,211	60,567	60,941	61,333	61,745	62,177
Dutchess	6,185	6,224	6,308	6,386	6,473	6,566	6,667	6,776	6,893	7,019	7,155
Erie	17,746	18,018	18,410	18,983	19,590	20,248	20,959	21,729	22,562	23,463	24,438
Kings	81,371	81,686	82,090	82,543	83,021	83,513	84,017	84,536	85,069	85,617	86,180
Monroe	10,453	10,680	10,891	11,148	11,452	11,772	12,109	12,464	12,839	13,233	13,649
Nassau	54,014	54,309	54,715	55,112	55,596	56,112	56,662	57,247	57,871	58,535	59,242
New York	39,975	40,226	40,587	40,908	41,308	41,731	42,178	42,650	43,150	43,679	44,237
Niagara	2,708	2,753	2,798	2,869	2,937	3,009	3,085	3,167	3,252	3,343	3,440
Onondaga	7,749	7,892	8,084	8,301	8,537	8,787	9,053	9,335	9,634	9,952	10,289
Orange	15,124	15,182	15,283	15,412	15,532	15,656	15,784	15,917	16,055	16,197	16,343
Putnam	2,153	2,186	2,243	2,269	2,315	2,365	2,420	2,480	2,545	2,615	2,692
Queens	82,356	82,775	83,311	83,809	84,415	85,057	85,738	86,459	87,225	88,036	88,895
Rensselaer	1,321	1,333	1,364	1,389	1,416	1,446	1,477	1,511	1,547	1,586	1,628
Richmond	19,642	19,749	20,022	20,214	20,454	20,707	20,975	21,258	21,558	21,875	22,210
Rockland	19,843	19,904	20,044	20,176	20,309	20,445	20,586	20,729	20,877	21,028	21,184
Saratoga	1,680	1,694	1,741	1,769	1,794	1,820	1,847	1,874	1,903	1,932	1,963
Schenectady	1,871	1,890	1,920	1,950	1,981	2,014	2,048	2,085	2,124	2,166	2,210
Suffolk	53,308	53,653	54,055	54,485	55,122	55,817	56,577	57,406	58,312	59,301	60,381
Sullivan	1,979	1,981	1,993	2,008	2,016	2,024	2,031	2,039	2,046	2,054	2,062
Tompkins	806	811	820	828	840	853	867	880	895	910	926
Ulster	2,788	2,800	2,835	2,865	2,899	2,935	2,974	3,016	3,062	3,111	3,164
Westchester	44,346	44,576	44,975	45,335	45,772	46,238	46,734	47,262	47,824	48,422	49,059

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:											
	11/15	11/16	11/17	11/18	11/20			11/22			11/24					
Albany	4,529	4,572	4,653	4,730	4,886	(977)	[235]	{117}	5,056	(1,011)	[243]	{121}	5,244	(1,049)	[252]	{126}
Bronx	58,712	58,905	59,265	59,548	60,211	(12,042)	[2,890]	{1,445}	60,941	(12,188)	[2,925]	{1,463}	61,745	(12,349)	[2,964]	{1,482}
Dutchess	6,185	6,224	6,308	6,386	6,566	(1,313)	[315]	{158}	6,776	(1,355)	[325]	{163}	7,019	(1,404)	[337]	{168}
Erie	17,746	18,018	18,410	18,983	20,248	(4,050)	[972]	{486}	21,729	(4,346)	[1,043]	{522}	23,463	(4,693)	[1,126]	{563}
Kings	81,371	81,686	82,090	82,543	83,513	(16,703)	[4,009]	{2,004}	84,536	(16,907)	[4,058]	{2,029}	85,617	(17,123)	[4,110]	{2,055}
Monroe	10,453	10,680	10,891	11,148	11,772	(2,354)	[565]	{283}	12,464	(2,493)	[598]	{299}	13,233	(2,647)	[635]	{318}
Nassau	54,014	54,309	54,715	55,112	56,112	(11,222)	[2,693]	{1,347}	57,247	(11,449)	[2,748]	{1,374}	58,535	(11,707)	[2,810]	{1,405}
New York	39,975	40,226	40,587	40,908	41,731	(8,346)	[2,003]	{1,002}	42,650	(8,530)	[2,047]	{1,024}	43,679	(8,736)	[2,097]	{1,048}
Niagara	2,708	2,753	2,798	2,869	3,009	(602)	[144]	{72}	3,167	(633)	[152]	{76}	3,343	(669)	[160]	{80}
Onondaga	7,749	7,892	8,084	8,301	8,787	(1,757)	[422]	{211}	9,335	(1,867)	[448]	{224}	9,952	(1,990)	[478]	{239}
Orange	15,124	15,182	15,283	15,412	15,656	(3,131)	[751]	{376}	15,917	(3,183)	[764]	{382}	16,197	(3,239)	[777]	{389}
Putnam	2,153	2,186	2,243	2,269	2,365	(473)	[114]	{57}	2,480	(496)	[119]	{60}	2,615	(523)	[126]	{63}
Queens	82,356	82,775	83,311	83,809	85,057	(17,011)	[4,083]	{2,041}	86,459	(17,292)	[4,150]	{2,075}	88,036	(17,607)	[4,226]	{2,113}
Rensselaer	1,321	1,333	1,364	1,389	1,446	(289)	[69]	{35}	1,511	(302)	[73]	{36}	1,586	(317)	[76]	{38}
Richmond	19,642	19,749	20,022	20,214	20,707	(4,141)	[994]	{497}	21,258	(4,252)	[1,020]	{510}	21,875	(4,375)	[1,050]	{525}
Rockland	19,843	19,904	20,044	20,176	20,445	(4,089)	[981]	{491}	20,729	(4,146)	[995]	{498}	21,028	(4,206)	[1,009]	{505}
Saratoga	1,680	1,694	1,741	1,769	1,820	(364)	[87]	{44}	1,874	(375)	[90]	{45}	1,932	(386)	[93]	{46}
Schenectady	1,871	1,890	1,920	1,950	2,014	(403)	[97]	{48}	2,085	(417)	[100]	{50}	2,166	(433)	[104]	{52}
Suffolk	53,308	53,653	54,055	54,485	55,817	(11,163)	[2,679]	{1,340}	57,406	(11,481)	[2,755]	{1,378}	59,301	(11,860)	[2,846]	{1,423}
Sullivan	1,979	1,981	1,993	2,008	2,024	(405)	[97]	{49}	2,039	(408)	[98]	{49}	2,054	(411)	[99]	{49}
Tompkins	806	811	820	828	853	(171)	[41]	{20}	880	(176)	[42]	{21}	910	(182)	[44]	{22}
Ulster	2,788	2,800	2,835	2,865	2,935	(587)	[141]	{70}	3,016	(603)	[145]	{72}	3,111	(622)	[149]	{75}
Westchester	44,346	44,576	44,975	45,335	46,238	(9,248)	[2,219]	{1,110}	47,262	(9,452)	[2,269]	{1,134}	48,422	(9,684)	[2,324]	{1,162}

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.