

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

Date: 1/19/21

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 1/19/21 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.

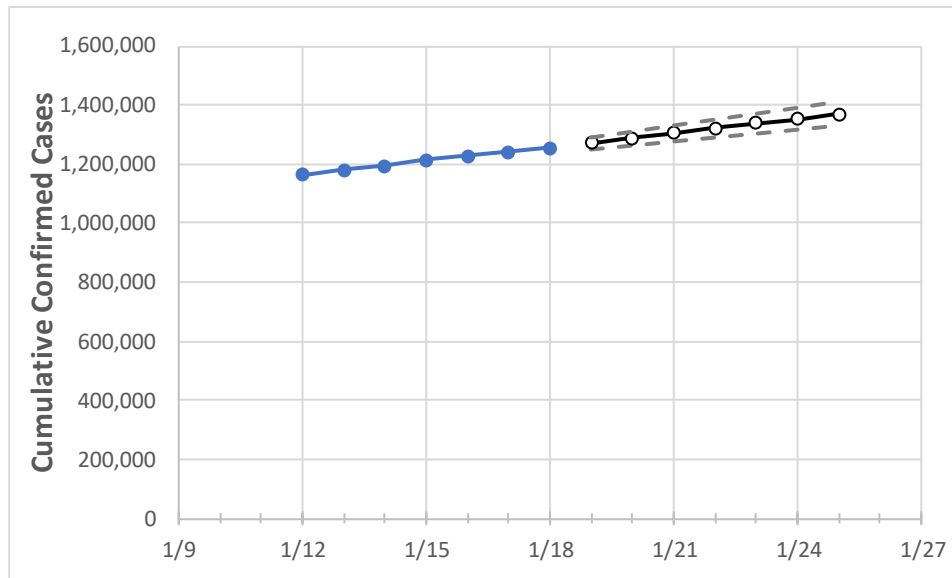
IEM's Modeling Lead

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:						
	1/15	1/16	1/17	1/18	1/19	1/20	1/21	1/22	1/23	1/24	1/25
New York	1,212,922	1,228,867	1,242,561	1,255,971	1,272,093	1,288,538	1,305,011	1,321,392	1,337,866	1,354,261	1,370,787

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 10%, and are often within 5%, of actual confirmed cases.

New York Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	1/15	1/16	1/17	1/18	1/19	1/20	1/21	1/22	1/23	1/24	1/25
Albany	15,520	15,771	15,981	16,168	16,418	16,663	16,908	17,152	17,397	17,639	17,883
Bronx	101,553	102,739	103,869	105,175	106,510	107,876	109,282	110,698	112,174	113,664	115,196
Dutchess	15,873	16,115	16,327	16,541	16,817	17,095	17,380	17,668	17,955	18,249	18,543
Erie	50,227	50,716	51,384	51,718	52,328	52,929	53,518	54,128	54,732	55,355	55,990
Kings	148,501	150,376	151,971	153,838	155,851	157,911	160,007	162,145	164,308	166,490	168,734
Monroe	42,774	43,226	43,659	44,007	44,517	45,021	45,496	45,981	46,446	46,910	47,379
Nassau	109,984	111,393	112,702	113,812	115,305	116,782	118,284	119,756	121,230	122,739	124,230
New York	72,735	73,634	74,452	75,319	76,314	77,330	78,367	79,447	80,530	81,651	82,808
Niagara	11,534	11,664	11,822	11,933	12,122	12,308	12,488	12,680	12,865	13,054	13,237
Onondaga	26,544	26,954	27,190	27,492	27,811	28,127	28,448	28,757	29,072	29,377	29,677
Orange	27,862	28,168	28,386	28,574	28,894	29,210	29,535	29,859	30,187	30,521	30,853
Putnam	6,203	6,294	6,386	6,447	6,542	6,636	6,735	6,831	6,929	7,024	7,122
Queens	151,581	153,424	155,059	156,940	158,967	160,995	163,052	165,168	167,305	169,494	171,670
Rensselaer	6,454	6,596	6,693	6,772	6,914	7,054	7,197	7,340	7,480	7,618	7,759
Richmond	43,322	43,785	44,210	44,737	45,278	45,823	46,362	46,909	47,452	48,009	48,557
Rockland	31,061	31,346	31,509	31,668	31,910	32,150	32,393	32,636	32,880	33,121	33,356
Saratoga	8,653	8,839	8,984	9,140	9,324	9,510	9,699	9,881	10,067	10,247	10,430
Schenectady	8,183	8,347	8,480	8,587	8,734	8,880	9,025	9,171	9,315	9,459	9,605
Suffolk	122,597	124,384	125,925	127,287	129,055	130,831	132,641	134,432	136,229	138,011	139,822
Sullivan	3,713	3,751	3,765	3,798	3,837	3,877	3,916	3,955	3,995	4,035	4,075
Tompkins	2,528	2,572	2,613	2,641	2,678	2,716	2,753	2,794	2,834	2,873	2,914
Ulster	7,337	7,448	7,548	7,642	7,759	7,876	7,994	8,116	8,236	8,362	8,488
Westchester	81,982	82,933	83,708	84,420	85,331	86,222	87,138	88,057	89,003	89,956	90,924

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:											
	1/15	1/16	1/17	1/18	1/20				1/22				1/24			
Albany	15,520	15,771	15,981	16,168	16,663	(3,333)	[800]	{400}	17,152	(3,430)	[823]	{412}	17,639	(3,528)	[847]	{423}
Bronx	101,553	102,739	103,869	105,175	107,876	(21,575)	[5,178]	{2,589}	110,698	(22,140)	[5,314]	{2,657}	113,664	(22,733)	[5,456]	{2,728}
Dutchess	15,873	16,115	16,327	16,541	17,095	(3,419)	[821]	{410}	17,668	(3,534)	[848]	{424}	18,249	(3,650)	[876]	{438}
Erie	50,227	50,716	51,384	51,718	52,929	(10,586)	[2,541]	{1,270}	54,128	(10,826)	[2,598]	{1,299}	55,355	(11,071)	[2,657]	{1,329}
Kings	148,501	150,376	151,971	153,838	157,911	(31,582)	[7,580]	{3,790}	162,145	(32,429)	[7,783]	{3,891}	166,490	(33,298)	[7,992]	{3,996}
Monroe	42,774	43,226	43,659	44,007	45,021	(9,004)	[2,161]	{1,080}	45,981	(9,196)	[2,207]	{1,104}	46,910	(9,382)	[2,252]	{1,126}
Nassau	109,984	111,393	112,702	113,812	116,782	(23,356)	[5,606]	{2,803}	119,756	(23,951)	[5,748]	{2,874}	122,739	(24,548)	[5,891]	{2,946}
New York	72,735	73,634	74,452	75,319	77,330	(15,466)	[3,712]	{1,856}	79,447	(15,889)	[3,813]	{1,907}	81,651	(16,330)	[3,919]	{1,960}
Niagara	11,534	11,664	11,822	11,933	12,308	(2,462)	[591]	{295}	12,680	(2,536)	[609]	{304}	13,054	(2,611)	[627]	{313}
Onondaga	26,544	26,954	27,190	27,492	28,127	(5,625)	[1,350]	{675}	28,757	(5,751)	[1,380]	{690}	29,377	(5,875)	[1,410]	{705}
Orange	27,862	28,168	28,386	28,574	29,210	(5,842)	[1,402]	{701}	29,859	(5,972)	[1,433]	{717}	30,521	(6,104)	[1,465]	{733}
Putnam	6,203	6,294	6,386	6,447	6,636	(1,327)	[319]	{159}	6,831	(1,366)	[328]	{164}	7,024	(1,405)	[337]	{169}
Queens	151,581	153,424	155,059	156,940	160,995	(32,199)	[7,728]	{3,864}	165,168	(33,034)	[7,928]	{3,964}	169,494	(33,899)	[8,136]	{4,068}
Rensselaer	6,454	6,596	6,693	6,772	7,054	(1,411)	[339]	{169}	7,340	(1,468)	[352]	{176}	7,618	(1,524)	[366]	{183}
Richmond	43,322	43,785	44,210	44,737	45,823	(9,165)	[2,200]	{1,100}	46,909	(9,382)	[2,252]	{1,126}	48,009	(9,602)	[2,304]	{1,152}
Rockland	31,061	31,346	31,509	31,668	32,150	(6,430)	[1,543]	{772}	32,636	(6,527)	[1,567]	{783}	33,121	(6,624)	[1,590]	{795}
Saratoga	8,653	8,839	8,984	9,140	9,510	(1,902)	[456]	{228}	9,881	(1,976)	[474]	{237}	10,247	(2,049)	[492]	{246}
Schenectady	8,183	8,347	8,480	8,587	8,880	(1,776)	[426]	{213}	9,171	(1,834)	[440]	{220}	9,459	(1,892)	[454]	{227}
Suffolk	122,597	124,384	125,925	127,287	130,831	(26,166)	[6,280]	{3,140}	134,432	(26,886)	[6,453]	{3,226}	138,011	(27,602)	[6,625]	{3,312}
Sullivan	3,713	3,751	3,765	3,798	3,877	(775)	[186]	{93}	3,955	(791)	[190]	{95}	4,035	(807)	[194]	{97}
Tompkins	2,528	2,572	2,613	2,641	2,716	(543)	[130]	{65}	2,794	(559)	[134]	{67}	2,873	(575)	[138]	{69}
Ulster	7,337	7,448	7,548	7,642	7,876	(1,575)	[378]	{189}	8,116	(1,623)	[390]	{195}	8,362	(1,672)	[401]	{201}
Westchester	81,982	82,933	83,708	84,420	86,222	(17,244)	[4,139]	{2,069}	88,057	(17,611)	[4,227]	{2,113}	89,956	(17,991)	[4,318]	{2,159}

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.