

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

Date: 1/7/21

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 1/7/21 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.

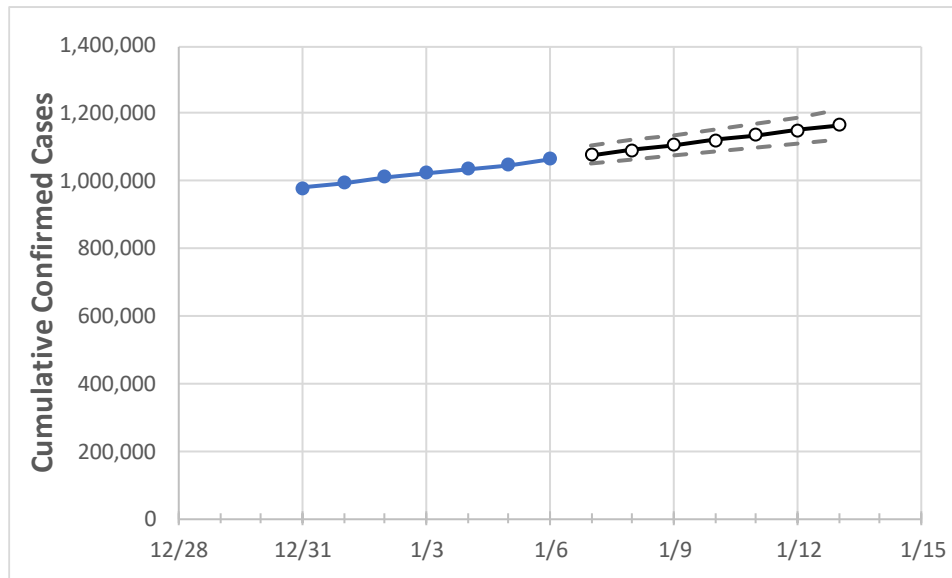
IEM's Modeling Lead

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:							
	1/3	1/4	1/5	1/6	1/7	1/8	1/9	1/10	1/11	1/12	1/13	
New York	1,023,897	1,035,139	1,048,281	1,064,297	1,078,158	1,091,889	1,105,968	1,120,424	1,135,035	1,150,072	1,165,426	

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:						
	1/3	1/4	1/5	1/6	1/7	1/8	1/9	1/10	1/11	1/12	1/13
Albany	12,405	12,593	12,852	13,112	13,374	13,640	13,911	14,186	14,465	14,745	15,031
Bronx	88,526	89,197	90,121	90,958	91,761	92,589	93,420	94,287	95,158	96,032	96,925
Dutchess	12,797	13,020	13,190	13,379	13,585	13,796	14,010	14,229	14,450	14,677	14,905
Erie	42,933	43,442	43,816	44,616	45,102	45,594	46,107	46,612	47,124	47,612	48,122
Kings	128,248	129,252	130,653	132,075	133,410	134,775	136,164	137,585	139,023	140,472	141,963
Monroe	35,778	36,258	36,705	37,330	37,880	38,433	38,985	39,535	40,076	40,626	41,176
Nassau	92,035	93,106	94,379	96,112	97,554	99,028	100,544	102,089	103,706	105,328	107,022
New York	62,989	63,434	64,189	64,781	65,375	65,966	66,559	67,165	67,760	68,363	68,984
Niagara	9,083	9,259	9,393	9,681	9,864	10,048	10,234	10,426	10,620	10,818	11,015
Onondaga	22,213	22,697	22,880	23,347	23,692	24,032	24,384	24,731	25,086	25,444	25,790
Orange	24,197	24,370	24,579	24,853	25,104	25,349	25,600	25,857	26,112	26,375	26,635
Putnam	5,084	5,162	5,235	5,320	5,398	5,479	5,559	5,640	5,721	5,804	5,889
Queens	130,228	131,464	133,083	134,670	136,168	137,665	139,187	140,754	142,327	143,971	145,591
Rensselaer	4,724	4,796	4,933	5,067	5,205	5,348	5,496	5,645	5,799	5,958	6,120
Richmond	36,639	37,042	37,680	38,243	38,729	39,222	39,725	40,238	40,756	41,282	41,820
Rockland	28,162	28,335	28,568	28,861	29,098	29,340	29,585	29,830	30,080	30,332	30,590
Saratoga	6,243	6,360	6,543	6,753	6,953	7,158	7,368	7,586	7,805	8,039	8,277
Schenectady	6,369	6,501	6,619	6,800	6,957	7,116	7,279	7,446	7,613	7,782	7,957
Suffolk	101,233	102,465	104,019	106,061	107,735	109,411	111,164	112,925	114,704	116,540	118,365
Sullivan	3,227	3,249	3,276	3,328	3,370	3,413	3,456	3,500	3,544	3,591	3,637
Tompkins	2,138	2,152	2,166	2,225	2,248	2,271	2,295	2,317	2,340	2,362	2,385
Ulster	6,019	6,089	6,186	6,304	6,401	6,503	6,601	6,702	6,807	6,915	7,024
Westchester	72,218	72,762	73,381	74,157	74,874	75,602	76,337	77,077	77,811	78,575	79,322

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:											
	1/3	1/4	1/5	1/6	1/8				1/10				1/12			
Albany	12,405	12,593	12,852	13,112	13,640	(2,728)	[655]	{327}	14,186	(2,837)	[681]	{340}	14,745	(2,949)	[708]	{354}
Bronx	88,526	89,197	90,121	90,958	92,589	(18,518)	[4,444]	{2,222}	94,287	(18,857)	[4,526]	{2,263}	96,032	(19,206)	[4,610]	{2,305}
Dutchess	12,797	13,020	13,190	13,379	13,796	(2,759)	[662]	{331}	14,229	(2,846)	[683]	{342}	14,677	(2,935)	[705]	{352}
Erie	42,933	43,442	43,816	44,616	45,594	(9,119)	[2,189]	{1,094}	46,612	(9,322)	[2,237]	{1,119}	47,612	(9,522)	[2,285]	{1,143}
Kings	128,248	129,252	130,653	132,075	134,775	(26,955)	[6,469]	{3,235}	137,585	(27,517)	[6,604]	{3,302}	140,472	(28,094)	[6,743]	{3,371}
Monroe	35,778	36,258	36,705	37,330	38,433	(7,687)	[1,845]	{922}	39,535	(7,907)	[1,898]	{949}	40,626	(8,125)	[1,950]	{975}
Nassau	92,035	93,106	94,379	96,112	99,028	(19,806)	[4,753]	{2,377}	102,089	(20,418)	[4,900]	{2,450}	105,328	(21,066)	[5,056]	{2,528}
New York	62,989	63,434	64,189	64,781	65,966	(13,193)	[3,166]	{1,583}	67,165	(13,433)	[3,224]	{1,612}	68,363	(13,673)	[3,281]	{1,641}
Niagara	9,083	9,259	9,393	9,681	10,048	(2,010)	[482]	{241}	10,426	(2,085)	[500]	{250}	10,818	(2,164)	[519]	{260}
Onondaga	22,213	22,697	22,880	23,347	24,032	(4,806)	[1,154]	{577}	24,731	(4,946)	[1,187]	{594}	25,444	(5,089)	[1,221]	{611}
Orange	24,197	24,370	24,579	24,853	25,349	(5,070)	[1,217]	{608}	25,857	(5,171)	[1,241]	{621}	26,375	(5,275)	[1,266]	{633}
Putnam	5,084	5,162	5,235	5,320	5,479	(1,096)	[263]	{131}	5,640	(1,128)	[271]	{135}	5,804	(1,161)	[279]	{139}
Queens	130,228	131,464	133,083	134,670	137,665	(27,533)	[6,608]	{3,304}	140,754	(28,151)	[6,756]	{3,378}	143,971	(28,794)	[6,911]	{3,455}
Rensselaer	4,724	4,796	4,933	5,067	5,348	(1,070)	[257]	{128}	5,645	(1,129)	[271]	{135}	5,958	(1,192)	[286]	{143}
Richmond	36,639	37,042	37,680	38,243	39,222	(7,844)	[1,883]	{941}	40,238	(8,048)	[1,931]	{966}	41,282	(8,256)	[1,982]	{991}
Rockland	28,162	28,335	28,568	28,861	29,340	(5,868)	[1,408]	{704}	29,830	(5,966)	[1,432]	{716}	30,332	(6,066)	[1,456]	{728}
Saratoga	6,243	6,360	6,543	6,753	7,158	(1,432)	[344]	{172}	7,586	(1,517)	[364]	{182}	8,039	(1,608)	[386]	{193}
Schenectady	6,369	6,501	6,619	6,800	7,116	(1,423)	[342]	{171}	7,446	(1,489)	[357]	{179}	7,782	(1,556)	[374]	{187}
Suffolk	101,233	102,465	104,019	106,061	109,411	(21,882)	[5,252]	{2,626}	112,925	(22,585)	[5,420]	{2,710}	116,540	(23,308)	[5,594]	{2,797}
Sullivan	3,227	3,249	3,276	3,328	3,413	(683)	[164]	{82}	3,500	(700)	[168]	{84}	3,591	(718)	[172]	{86}
Tompkins	2,138	2,152	2,166	2,225	2,271	(454)	[109]	{55}	2,317	(463)	[111]	{56}	2,362	(472)	[113]	{57}
Ulster	6,019	6,089	6,186	6,304	6,503	(1,301)	[312]	{156}	6,702	(1,340)	[322]	{161}	6,915	(1,383)	[332]	{166}
Westchester	72,218	72,762	73,381	74,157	75,602	(15,120)	[3,629]	{1,814}	77,077	(15,415)	[3,700]	{1,850}	78,575	(15,715)	[3,772]	{1,886}

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.