

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

Date: 4/5/21

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 4/5/21 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.

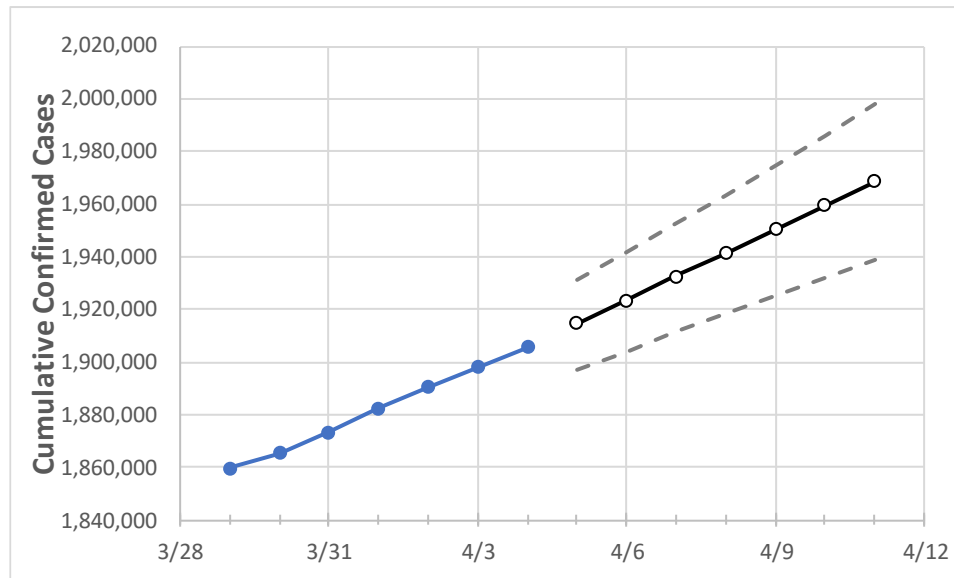
IEM's Modeling Lead

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:						
	4/1	4/2	4/3	4/4	4/5	4/6	4/7	4/8	4/9	4/10	4/11
New York	1,882,308	1,890,346	1,898,101	1,905,737	1,914,584	1,923,466	1,932,440	1,941,406	1,950,494	1,959,436	1,968,522

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:						
	4/1	4/2	4/3	4/4	4/5	4/6	4/7	4/8	4/9	4/10	4/11
Albany	22,696	22,738	22,799	22,855	22,921	22,987	23,054	23,121	23,189	23,257	23,327
Bronx	165,792	166,550	167,221	167,901	168,658	169,433	170,189	170,966	171,750	172,514	173,304
Dutchess	26,230	26,329	26,450	26,573	26,707	26,841	26,976	27,110	27,245	27,379	27,513
Erie	74,496	74,919	75,400	75,876	76,384	76,909	77,446	78,007	78,580	79,185	79,807
Kings	247,752	248,953	249,957	251,097	252,231	253,352	254,452	255,521	256,578	257,632	258,654
Monroe	56,881	57,101	57,350	57,538	57,751	57,971	58,199	58,435	58,675	58,923	59,174
Nassau	168,246	168,884	169,535	170,179	170,823	171,470	172,121	172,775	173,429	174,088	174,749
New York	124,020	124,656	125,259	125,851	126,553	127,243	127,939	128,646	129,328	130,024	130,716
Niagara	16,639	16,713	16,800	16,900	16,983	17,070	17,162	17,257	17,358	17,462	17,571
Onondaga	34,328	34,438	34,531	34,629	34,718	34,808	34,900	34,996	35,095	35,195	35,299
Orange	43,483	43,686	43,893	44,048	44,269	44,489	44,712	44,932	45,151	45,370	45,593
Putnam	9,563	9,627	9,679	9,729	9,782	9,836	9,891	9,947	10,004	10,061	10,121
Queens	247,653	248,788	249,836	250,990	252,305	253,595	254,885	256,166	257,471	258,793	260,089
Rensselaer	10,053	10,091	10,137	10,181	10,225	10,270	10,315	10,361	10,409	10,458	10,507
Richmond	66,184	66,501	66,793	67,083	67,428	67,775	68,122	68,475	68,820	69,181	69,534
Rockland	43,718	43,886	44,052	44,150	44,301	44,451	44,601	44,749	44,896	45,047	45,193
Saratoga	13,449	13,533	13,599	13,668	13,739	13,812	13,887	13,964	14,043	14,124	14,207
Schenectady	11,854	11,894	11,917	11,951	11,991	12,032	12,073	12,115	12,157	12,199	12,243
Suffolk	183,206	183,912	184,645	185,345	186,087	186,839	187,591	188,354	189,120	189,888	190,659
Sullivan	5,576	5,622	5,664	5,691	5,733	5,776	5,820	5,866	5,912	5,960	6,009
Tompkins	3,913	3,925	3,932	3,944	3,959	3,975	3,990	4,006	4,022	4,037	4,052
Ulster	12,058	12,126	12,205	12,271	12,354	12,436	12,520	12,604	12,689	12,774	12,861
Westchester	120,316	120,734	121,124	121,507	121,951	122,396	122,847	123,298	123,743	124,204	124,662

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:											
	4/1	4/2	4/3	4/4	4/6			4/8			4/10					
Albany	22,696	22,738	22,799	22,855	22,987	(4,597)	{1,103}	{552}	23,121	(4,624)	{1,110}	{555}	23,257	(4,651)	{1,116}	{558}
Bronx	165,792	166,550	167,221	167,901	169,433	(33,887)	{8,133}	{4,066}	170,966	(34,193)	{8,206}	{4,103}	172,514	(34,503)	{8,281}	{4,140}
Dutchess	26,230	26,329	26,450	26,573	26,841	(5,368)	{1,288}	{644}	27,110	(5,422)	{1,301}	{651}	27,379	(5,476)	{1,314}	{657}
Erie	74,496	74,919	75,400	75,876	76,909	(15,382)	{3,692}	{1,846}	78,007	(15,601)	{3,744}	{1,872}	79,185	(15,837)	{3,801}	{1,900}
Kings	247,752	248,953	249,957	251,097	253,352	(50,670)	{12,161}	{6,080}	255,521	(51,104)	{12,265}	{6,133}	257,632	(51,526)	{12,366}	{6,183}
Monroe	56,881	57,101	57,350	57,538	57,971	(11,594)	{2,783}	{1,391}	58,435	(11,687)	{2,805}	{1,402}	58,923	(11,785)	{2,828}	{1,414}
Nassau	168,246	168,884	169,535	170,179	171,470	(34,294)	{8,231}	{4,115}	172,775	(34,555)	{8,293}	{4,147}	174,088	(34,818)	{8,356}	{4,178}
New York	124,020	124,656	125,259	125,851	127,243	(25,449)	{6,108}	{3,054}	128,646	(25,729)	{6,175}	{3,088}	130,024	(26,005)	{6,241}	{3,121}
Niagara	16,639	16,713	16,800	16,900	17,070	(3,414)	{819}	{410}	17,257	(3,451)	{828}	{414}	17,462	(3,492)	{838}	{419}
Onondaga	34,328	34,438	34,531	34,629	34,808	(6,962)	{1,671}	{835}	34,996	(6,999)	{1,680}	{840}	35,195	(7,039)	{1,689}	{845}
Orange	43,483	43,686	43,893	44,048	44,489	(8,898)	{2,135}	{1,068}	44,932	(8,986)	{2,157}	{1,078}	45,370	(9,074)	{2,178}	{1,089}
Putnam	9,563	9,627	9,679	9,729	9,836	(1,967)	{472}	{236}	9,947	(1,989)	{477}	{239}	10,061	(2,012)	{483}	{241}
Queens	247,653	248,788	249,836	250,990	253,595	(50,719)	{12,173}	{6,086}	256,166	(51,233)	{12,296}	{6,148}	258,793	(51,759)	{12,422}	{6,211}
Rensselaer	10,053	10,091	10,137	10,181	10,270	(2,054)	{493}	{246}	10,361	(2,072)	{497}	{249}	10,458	(2,092)	{502}	{251}
Richmond	66,184	66,501	66,793	67,083	67,775	(13,555)	{3,253}	{1,627}	68,475	(13,695)	{3,287}	{1,643}	69,181	(13,836)	{3,321}	{1,660}
Rockland	43,718	43,886	44,052	44,150	44,451	(8,890)	{2,134}	{1,067}	44,749	(8,950)	{2,148}	{1,074}	45,047	(9,009)	{2,162}	{1,081}
Saratoga	13,449	13,533	13,599	13,668	13,812	(2,762)	{663}	{331}	13,964	(2,793)	{670}	{335}	14,124	(2,825)	{678}	{339}
Schenectady	11,854	11,894	11,917	11,951	12,032	(2,406)	{578}	{289}	12,115	(2,423)	{582}	{291}	12,199	(2,440)	{586}	{293}
Suffolk	183,206	183,912	184,645	185,345	186,839	(37,368)	{8,968}	{4,484}	188,354	(37,671)	{9,041}	{4,520}	189,888	(37,978)	{9,115}	{4,557}
Sullivan	5,576	5,622	5,664	5,691	5,776	(1,155)	{277}	{139}	5,866	(1,173)	{282}	{141}	5,960	(1,192)	{286}	{143}
Tompkins	3,913	3,925	3,932	3,944	3,975	(795)	{191}	{95}	4,006	(801)	{192}	{96}	4,037	(807)	{194}	{97}
Ulster	12,058	12,126	12,205	12,271	12,436	(2,487)	{597}	{298}	12,604	(2,521)	{605}	{303}	12,774	(2,555)	{613}	{307}
Westchester	120,316	120,734	121,124	121,507	122,396	(24,479)	{5,875}	{2,937}	123,298	(24,660)	{5,918}	{2,959}	124,204	(24,841)	{5,962}	{2,981}

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.