

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

Date: 2/16/21

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 2/16/21 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.

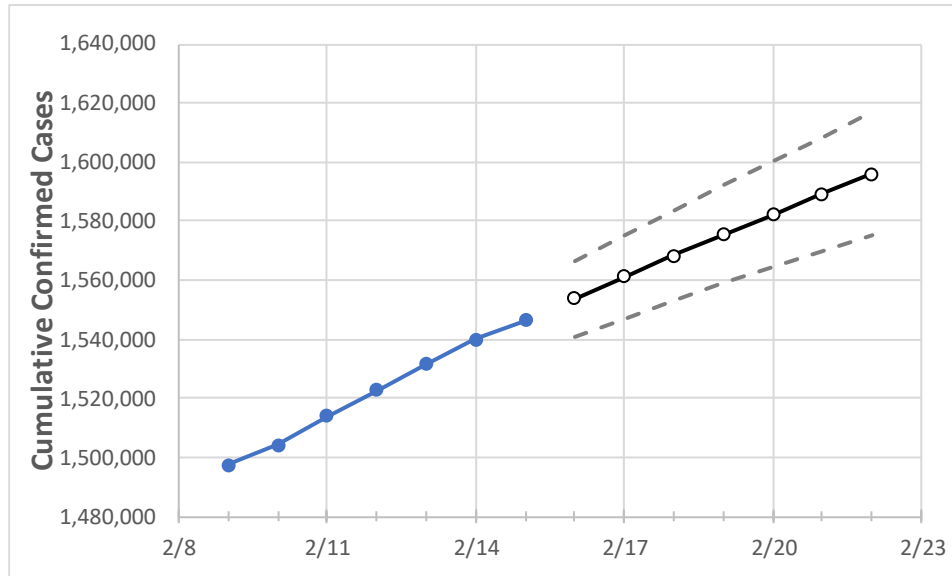
IEM's Modeling Lead

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:							
	2/12	2/13	2/14	2/15	2/16	2/17	2/18	2/19	2/20	2/21	2/22	

New York	1,522,785	1,531,540	1,539,870	1,546,408	1,553,863	1,561,138	1,568,419	1,575,521	1,582,286	1,589,135	1,595,900
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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:						
	2/12	2/13	2/14	2/15	2/16	2/17	2/18	2/19	2/20	2/21	2/22
Albany	19,832	19,908	19,982	20,033	20,096	20,158	20,215	20,270	20,323	20,372	20,421
Bronx	130,483	131,508	132,334	133,111	133,956	134,784	135,605	136,415	137,219	138,029	138,810
Dutchess	20,595	20,714	20,837	20,943	21,036	21,129	21,220	21,306	21,390	21,469	21,547
Erie	61,067	61,385	61,800	61,999	62,268	62,526	62,783	63,041	63,296	63,538	63,785
Kings	190,455	191,753	192,881	193,853	194,980	196,044	197,126	198,186	199,260	200,334	201,339
Monroe	50,240	50,363	50,550	50,697	50,839	50,976	51,112	51,239	51,363	51,485	51,605
Nassau	137,944	138,784	139,516	140,107	140,749	141,371	141,973	142,572	143,147	143,738	144,316
New York	93,185	93,885	94,575	95,177	95,747	96,325	96,903	97,471	98,035	98,588	99,132
Niagara	14,614	14,667	14,736	14,756	14,808	14,859	14,906	14,955	15,000	15,045	15,087
Onondaga	31,261	31,351	31,445	31,505	31,580	31,652	31,718	31,785	31,846	31,908	31,965
Orange	34,245	34,442	34,588	34,729	34,873	35,013	35,149	35,285	35,418	35,547	35,675
Putnam	7,802	7,844	7,878	7,911	7,942	7,972	8,002	8,031	8,059	8,086	8,113
Queens	192,278	193,517	194,714	195,745	196,797	197,838	198,820	199,823	200,813	201,781	202,742
Rensselaer	8,483	8,527	8,561	8,592	8,622	8,651	8,679	8,707	8,733	8,758	8,780
Richmond	52,801	53,112	53,403	53,646	53,864	54,076	54,290	54,497	54,703	54,905	55,106
Rockland	36,423	36,590	36,672	36,777	36,903	37,027	37,153	37,276	37,392	37,505	37,618
Saratoga	11,256	11,304	11,349	11,379	11,418	11,455	11,489	11,522	11,555	11,585	11,614
Schenectady	10,358	10,404	10,451	10,472	10,506	10,538	10,571	10,602	10,630	10,660	10,686
Suffolk	152,603	153,327	154,098	154,623	155,209	155,792	156,369	156,938	157,481	158,008	158,527
Sullivan	4,456	4,468	4,482	4,497	4,512	4,526	4,541	4,554	4,568	4,581	4,594
Tompkins	3,300	3,316	3,325	3,335	3,354	3,373	3,392	3,411	3,429	3,447	3,465
Ulster	9,382	9,426	9,464	9,498	9,534	9,568	9,600	9,632	9,663	9,692	9,722
Westchester	100,504	101,015	101,511	101,816	102,245	102,667	103,073	103,481	103,875	104,244	104,620

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:											
	2/12	2/13	2/14	2/15	2/17			2/19			2/21					
Albany	19,832	19,908	19,982	20,033	20,158	(4,032)	[968]	{484}	20,270	(4,054)	[973]	{486}	20,372	(4,074)	[978]	{489}
Bronx	130,483	131,508	132,334	133,111	134,784	(26,957)	[6,470]	{3,235}	136,415	(27,283)	[6,548]	{3,274}	138,029	(27,606)	[6,625]	{3,313}
Dutchess	20,595	20,714	20,837	20,943	21,129	(4,226)	[1,014]	{507}	21,306	(4,261)	[1,023]	{511}	21,469	(4,294)	[1,031]	{515}
Erie	61,067	61,385	61,800	61,999	62,526	(12,505)	[3,001]	{1,501}	63,041	(12,608)	[3,026]	{1,513}	63,538	(12,708)	[3,050]	{1,525}
Kings	190,455	191,753	192,881	193,853	196,044	(39,209)	[9,410]	{4,705}	198,186	(39,637)	[9,513]	{4,756}	200,334	(40,067)	[9,616]	{4,808}
Monroe	50,240	50,363	50,550	50,697	50,976	(10,195)	[2,447]	{1,223}	51,239	(10,248)	[2,459]	{1,230}	51,485	(10,297)	[2,471]	{1,236}
Nassau	137,944	138,784	139,516	140,107	141,371	(28,274)	[6,786]	{3,393}	142,572	(28,514)	[6,843]	{3,422}	143,738	(28,748)	[6,899]	{3,450}
New York	93,185	93,885	94,575	95,177	96,325	(19,265)	[4,624]	{2,312}	97,471	(19,494)	[4,679]	{2,339}	98,588	(19,718)	[4,732]	{2,366}
Niagara	14,614	14,667	14,736	14,756	14,859	(2,972)	[713]	{357}	14,955	(2,991)	[718]	{359}	15,045	(3,009)	[722]	{361}
Onondaga	31,261	31,351	31,445	31,505	31,652	(6,330)	[1,519]	{760}	31,785	(6,357)	[1,526]	{763}	31,908	(6,382)	[1,532]	{766}
Orange	34,245	34,442	34,588	34,729	35,013	(7,003)	[1,681]	{840}	35,285	(7,057)	[1,694]	{847}	35,547	(7,109)	[1,706]	{853}
Putnam	7,802	7,844	7,878	7,911	7,972	(1,594)	[383]	{191}	8,031	(1,606)	[385]	{193}	8,086	(1,617)	[388]	{194}
Queens	192,278	193,517	194,714	195,745	197,838	(39,568)	[9,496]	{4,748}	199,823	(39,965)	[9,592]	{4,796}	201,781	(40,356)	[9,685]	{4,843}
Rensselaer	8,483	8,527	8,561	8,592	8,651	(1,730)	[415]	{208}	8,707	(1,741)	[418]	{209}	8,758	(1,752)	[420]	{210}
Richmond	52,801	53,112	53,403	53,646	54,076	(10,815)	[2,596]	{1,298}	54,497	(10,899)	[2,616]	{1,308}	54,905	(10,981)	[2,635]	{1,318}
Rockland	36,423	36,590	36,672	36,777	37,027	(7,405)	[1,777]	{889}	37,276	(7,455)	[1,789]	{895}	37,505	(7,501)	[1,800]	{900}
Saratoga	11,256	11,304	11,349	11,379	11,455	(2,291)	[550]	{275}	11,522	(2,304)	[553]	{277}	11,585	(2,317)	[556]	{278}
Schenectady	10,358	10,404	10,451	10,472	10,538	(2,108)	[506]	{253}	10,602	(2,120)	[509]	{254}	10,660	(2,132)	[512]	{256}
Suffolk	152,603	153,327	154,098	154,623	155,792	(31,158)	[7,478]	{3,739}	156,938	(31,388)	[7,533]	{3,767}	158,008	(31,602)	[7,584]	{3,792}
Sullivan	4,456	4,468	4,482	4,497	4,526	(905)	[217]	{109}	4,554	(911)	[219]	{109}	4,581	(916)	[220]	{110}
Tompkins	3,300	3,316	3,325	3,335	3,373	(675)	[162]	{81}	3,411	(682)	[164]	{82}	3,447	(689)	[165]	{83}
Ulster	9,382	9,426	9,464	9,498	9,568	(1,914)	[459]	{230}	9,632	(1,926)	[462]	{231}	9,692	(1,938)	[465]	{233}
Westchester	100,504	101,015	101,511	101,816	102,667	(20,533)	[4,928]	{2,464}	103,481	(20,696)	[4,967]	{2,484}	104,244	(20,849)	[5,004]	{2,502}

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.