

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

Date: 2/17/21

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 2/17/21 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.

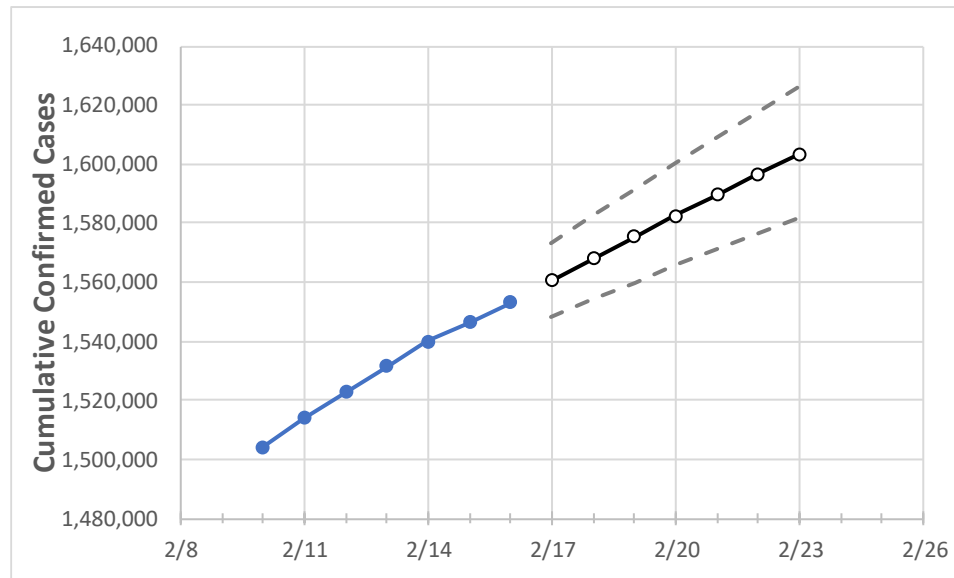
IEM's Modeling Lead

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:						
	2/13	2/14	2/15	2/16	2/17	2/18	2/19	2/20	2/21	2/22	2/23
New York	1,531,540	1,539,870	1,546,408	1,553,117	1,560,701	1,568,140	1,575,326	1,582,535	1,589,627	1,596,609	1,603,603

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:						
	2/13	2/14	2/15	2/16	2/17	2/18	2/19	2/20	2/21	2/22	2/23
Albany	19,908	19,982	20,033	20,090	20,151	20,210	20,266	20,319	20,369	20,419	20,464
Bronx	131,508	132,334	133,111	133,786	134,653	135,504	136,374	137,232	138,087	138,964	139,803
Dutchess	20,714	20,837	20,943	21,024	21,125	21,217	21,312	21,404	21,493	21,579	21,664
Erie	61,385	61,800	61,999	62,208	62,469	62,734	62,988	63,238	63,494	63,743	63,988
Kings	191,753	192,881	193,853	194,965	196,126	197,265	198,379	199,495	200,571	201,657	202,735
Monroe	50,363	50,550	50,697	50,830	50,969	51,105	51,236	51,363	51,488	51,611	51,729
Nassau	138,784	139,516	140,107	140,686	141,343	141,980	142,619	143,234	143,845	144,437	145,009
New York	93,885	94,575	95,177	95,669	96,257	96,858	97,446	98,043	98,635	99,236	99,790
Niagara	14,667	14,736	14,756	14,803	14,852	14,900	14,944	14,988	15,028	15,069	15,107
Onondaga	31,351	31,445	31,505	31,580	31,659	31,735	31,808	31,881	31,950	32,015	32,080
Orange	34,442	34,588	34,729	34,898	35,055	35,213	35,370	35,525	35,680	35,833	35,981
Putnam	7,844	7,878	7,911	7,943	7,979	8,015	8,051	8,085	8,119	8,152	8,185
Queens	193,517	194,714	195,745	196,889	197,948	199,000	200,025	201,053	202,062	203,075	204,047
Rensselaer	8,527	8,561	8,592	8,621	8,652	8,682	8,711	8,739	8,766	8,791	8,816
Richmond	53,112	53,403	53,646	53,879	54,133	54,384	54,625	54,872	55,116	55,356	55,592
Rockland	36,590	36,672	36,777	36,954	37,092	37,230	37,365	37,500	37,634	37,768	37,902
Saratoga	11,304	11,349	11,379	11,415	11,453	11,489	11,524	11,557	11,588	11,620	11,649
Schenectady	10,404	10,451	10,472	10,493	10,527	10,559	10,589	10,618	10,647	10,674	10,700
Suffolk	153,327	154,098	154,623	155,149	155,772	156,369	156,959	157,529	158,084	158,640	159,168
Sullivan	4,468	4,482	4,497	4,506	4,520	4,533	4,546	4,558	4,570	4,582	4,593
Tompkins	3,316	3,325	3,335	3,340	3,355	3,370	3,383	3,397	3,410	3,423	3,435
Ulster	9,426	9,464	9,498	9,541	9,584	9,625	9,667	9,707	9,747	9,786	9,826
Westchester	101,015	101,511	101,816	102,197	102,649	103,095	103,539	103,974	104,407	104,829	105,231

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:											
	2/13	2/14	2/15	2/16	2/18				2/20				2/22			
Albany	19,908	19,982	20,033	20,090	20,210	(4,042)	[970]	{485}	20,319	(4,064)	[975]	{488}	20,419	(4,084)	[980]	{490}
Bronx	131,508	132,334	133,111	133,786	135,504	(27,101)	[6,504]	{3,252}	137,232	(27,446)	[6,587]	{3,294}	138,964	(27,793)	[6,670]	{3,335}
Dutchess	20,714	20,837	20,943	21,024	21,217	(4,243)	[1,018]	{509}	21,404	(4,281)	[1,027]	{514}	21,579	(4,316)	[1,036]	{518}
Erie	61,385	61,800	61,999	62,208	62,734	(12,547)	[3,011]	{1,506}	63,238	(12,648)	[3,035]	{1,518}	63,743	(12,749)	[3,060]	{1,530}
Kings	191,753	192,881	193,853	194,965	197,265	(39,453)	[9,469]	{4,734}	199,495	(39,899)	[9,576]	{4,788}	201,657	(40,331)	[9,680]	{4,840}
Monroe	50,363	50,550	50,697	50,830	51,105	(10,221)	[2,453]	{1,227}	51,363	(10,273)	[2,465]	{1,233}	51,611	(10,322)	[2,477]	{1,239}
Nassau	138,784	139,516	140,107	140,686	141,980	(28,396)	[6,815]	{3,408}	143,234	(28,647)	[6,875]	{3,438}	144,437	(28,887)	[6,933]	{3,466}
New York	93,885	94,575	95,177	95,669	96,858	(19,372)	[4,649]	{2,325}	98,043	(19,609)	[4,706]	{2,353}	99,236	(19,847)	[4,763]	{2,382}
Niagara	14,667	14,736	14,756	14,803	14,900	(2,980)	[715]	{358}	14,988	(2,998)	[719]	{360}	15,069	(3,014)	[723]	{362}
Onondaga	31,351	31,445	31,505	31,580	31,735	(6,347)	[1,523]	{762}	31,881	(6,376)	[1,530]	{765}	32,015	(6,403)	[1,537]	{768}
Orange	34,442	34,588	34,729	34,898	35,213	(7,043)	[1,690]	{845}	35,525	(7,105)	[1,705]	{853}	35,833	(7,167)	[1,720]	{860}
Putnam	7,844	7,878	7,911	7,943	8,015	(1,603)	[385]	{192}	8,085	(1,617)	[388]	{194}	8,152	(1,630)	[391]	{196}
Queens	193,517	194,714	195,745	196,889	199,000	(39,800)	[9,552]	{4,776}	201,053	(40,211)	[9,651]	{4,825}	203,075	(40,615)	[9,748]	{4,874}
Rensselaer	8,527	8,561	8,592	8,621	8,682	(1,736)	[417]	{208}	8,739	(1,748)	[419]	{210}	8,791	(1,758)	[422]	{211}
Richmond	53,112	53,403	53,646	53,879	54,384	(10,877)	[2,610]	{1,305}	54,872	(10,974)	[2,634]	{1,317}	55,356	(11,071)	[2,657]	{1,329}
Rockland	36,590	36,672	36,777	36,954	37,230	(7,446)	[1,787]	{894}	37,500	(7,500)	[1,800]	{900}	37,768	(7,554)	[1,813]	{906}
Saratoga	11,304	11,349	11,379	11,415	11,489	(2,298)	[551]	{276}	11,557	(2,311)	[555]	{277}	11,620	(2,324)	[558]	{279}
Schenectady	10,404	10,451	10,472	10,493	10,559	(2,112)	[507]	{253}	10,618	(2,124)	[510]	{255}	10,674	(2,135)	[512]	{256}
Suffolk	153,327	154,098	154,623	155,149	156,369	(31,274)	[7,506]	{3,753}	157,529	(31,506)	[7,561]	{3,781}	158,640	(31,728)	[7,615]	{3,807}
Sullivan	4,468	4,482	4,497	4,506	4,533	(907)	[218]	{109}	4,558	(912)	[219]	{109}	4,582	(916)	[220]	{110}
Tompkins	3,316	3,325	3,335	3,340	3,370	(674)	[162]	{81}	3,397	(679)	[163]	{82}	3,423	(685)	[164]	{82}
Ulster	9,426	9,464	9,498	9,541	9,625	(1,925)	[462]	{231}	9,707	(1,941)	[466]	{233}	9,786	(1,957)	[470]	{235}
Westchester	101,015	101,511	101,816	102,197	103,095	(20,619)	[4,949]	{2,474}	103,974	(20,795)	[4,991]	{2,495}	104,829	(20,966)	[5,032]	{2,516}

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.