

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

Date: 3/2/22

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 3/2/22 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.

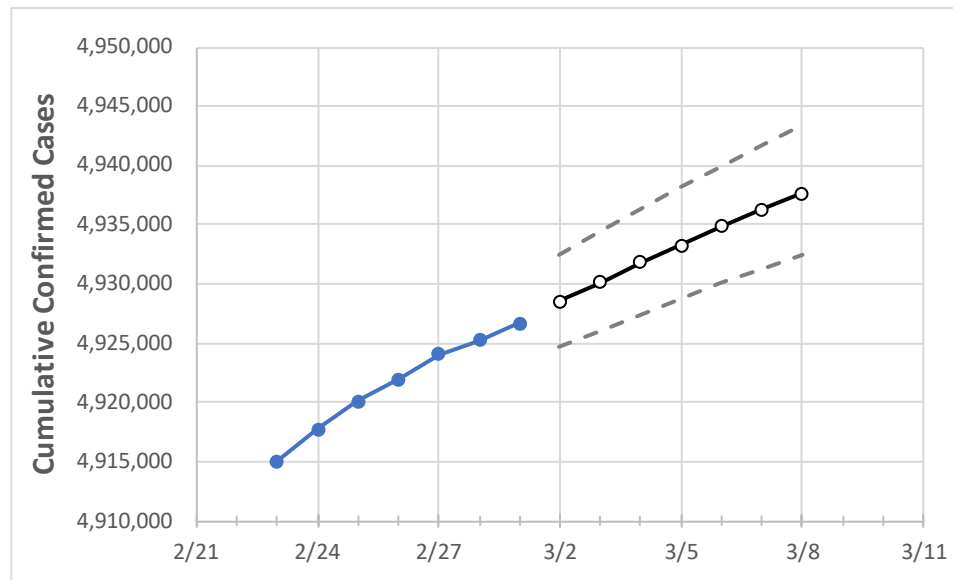
IEM's Modeling Lead

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:							
	2/26	2/27	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	
New York	4,921,916	4,924,032	4,925,221	4,926,708	4,928,500	4,930,182	4,931,802	4,933,281	4,934,857	4,936,311	4,937,694	

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:						
	2/26	2/27	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8
Albany	57,886	57,904	57,922	57,952	57,979	58,006	58,032	58,056	58,079	58,102	58,124
Bronx	404,204	404,304	404,334	404,379	404,456	404,533	404,600	404,664	404,734	404,796	404,858
Dutchess	63,148	63,162	63,182	63,189	63,210	63,230	63,248	63,267	63,284	63,300	63,317
Erie	205,584	205,629	205,702	205,766	205,844	205,915	205,984	206,053	206,117	206,180	206,240
Kings	685,426	685,689	685,853	685,975	686,174	686,364	686,537	686,704	686,873	687,031	687,180
Monroe	149,161	149,210	149,251	149,286	149,338	149,387	149,432	149,476	149,520	149,563	149,600
Nassau	398,082	398,199	398,278	398,376	398,472	398,562	398,650	398,732	398,811	398,890	398,958
New York	401,978	402,200	402,298	402,430	402,629	402,805	402,983	403,150	403,335	403,491	403,650
Niagara	47,154	47,179	47,197	47,212	47,231	47,250	47,268	47,286	47,302	47,319	47,334
Onondaga	106,883	106,938	107,001	107,100	107,178	107,255	107,323	107,396	107,462	107,527	107,586
Orange	108,659	108,693	108,728	108,762	108,797	108,830	108,863	108,892	108,922	108,950	108,976
Putnam	23,289	23,294	23,302	23,307	23,316	23,324	23,332	23,340	23,349	23,356	23,362
Queens	634,200	634,339	634,435	634,520	634,646	634,770	634,887	635,004	635,108	635,216	635,313
Rensselaer	30,789	30,802	30,812	30,822	30,844	30,866	30,884	30,905	30,924	30,944	30,962
Richmond	163,991	164,033	164,069	164,094	164,131	164,166	164,200	164,231	164,261	164,291	164,319
Rockland	91,135	91,154	91,166	91,180	91,198	91,214	91,230	91,244	91,259	91,273	91,286
Saratoga	45,028	45,059	45,072	45,101	45,130	45,159	45,185	45,213	45,237	45,263	45,287
Schenectady	32,300	32,316	32,326	32,333	32,352	32,370	32,387	32,403	32,419	32,436	32,450
Suffolk	422,402	422,503	422,575	422,642	422,734	422,824	422,905	422,986	423,062	423,137	423,209
Sullivan	18,167	18,172	18,176	18,178	18,186	18,194	18,202	18,209	18,216	18,223	18,229
Tompkins	17,361	17,395	17,396	17,418	17,439	17,461	17,482	17,502	17,524	17,543	17,560
Ulster	30,780	30,799	30,812	30,826	30,847	30,868	30,888	30,907	30,927	30,945	30,963
Westchester	246,426	246,496	246,551	246,611	246,687	246,761	246,828	246,897	246,959	247,030	247,087

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:											
	2/26	2/27	2/28	3/1	3/3			3/5			3/7					
Albany	57,886	57,904	57,922	57,952	58,006	(11,601)	[2,784]	{1,392}	58,056	(11,611)	[2,787]	{1,393}	58,102	(11,620)	[2,789]	{1,394}
Bronx	404,204	404,304	404,334	404,379	404,533	(80,907)	[19,418]	{9,709}	404,664	(80,933)	[19,424]	{9,712}	404,796	(80,959)	[19,430]	{9,715}
Dutchess	63,148	63,162	63,182	63,189	63,230	(12,646)	[3,035]	{1,518}	63,267	(12,653)	[3,037]	{1,518}	63,300	(12,660)	[3,038]	{1,519}
Erie	205,584	205,629	205,702	205,766	205,915	(41,183)	[9,884]	{4,942}	206,053	(41,211)	[9,891]	{4,945}	206,180	(41,236)	[9,897]	{4,948}
Kings	685,426	685,689	685,853	685,975	686,364	(137,273)	[32,945]	{16,473}	686,704	(137,341)	[32,962]	{16,481}	687,031	(137,406)	[32,978]	{16,489}
Monroe	149,161	149,210	149,251	149,286	149,387	(29,877)	[7,171]	{3,585}	149,476	(29,895)	[7,175]	{3,587}	149,563	(29,913)	[7,179]	{3,590}
Nassau	398,082	398,199	398,278	398,376	398,562	(79,712)	[19,131]	{9,565}	398,732	(79,746)	[19,139]	{9,570}	398,890	(79,778)	[19,147]	{9,573}
New York	401,978	402,200	402,298	402,430	402,805	(80,561)	[19,335]	{9,667}	403,150	(80,630)	[19,351]	{9,676}	403,491	(80,698)	[19,368]	{9,684}
Niagara	47,154	47,179	47,197	47,212	47,250	(9,450)	[2,268]	{1,134}	47,286	(9,457)	[2,270]	{1,135}	47,319	(9,464)	[2,271]	{1,136}
Onondaga	106,883	106,938	107,001	107,100	107,255	(21,451)	[5,148]	{2,574}	107,396	(21,479)	[5,155]	{2,578}	107,527	(21,505)	[5,161]	{2,581}
Orange	108,659	108,693	108,728	108,762	108,830	(21,766)	[5,224]	{2,612}	108,892	(21,778)	[5,227]	{2,613}	108,950	(21,790)	[5,230]	{2,615}
Putnam	23,289	23,294	23,302	23,307	23,324	(4,665)	[1,120]	{560}	23,340	(4,668)	[1,120]	{560}	23,356	(4,671)	[1,121]	{561}
Queens	634,200	634,339	634,435	634,520	634,770	(126,954)	[30,469]	{15,234}	635,004	(127,001)	[30,480]	{15,240}	635,216	(127,043)	[30,490]	{15,245}
Rensselaer	30,789	30,802	30,812	30,822	30,866	(6,173)	[1,482]	{741}	30,905	(6,181)	[1,483]	{742}	30,944	(6,189)	[1,485]	{743}
Richmond	163,991	164,033	164,069	164,094	164,166	(32,833)	[7,880]	{3,940}	164,231	(32,846)	[7,883]	{3,942}	164,291	(32,858)	[7,886]	{3,943}
Rockland	91,135	91,154	91,166	91,180	91,214	(18,243)	[4,378]	{2,189}	91,244	(18,249)	[4,380]	{2,190}	91,273	(18,255)	[4,381]	{2,191}
Saratoga	45,028	45,059	45,072	45,101	45,159	(9,032)	[2,168]	{1,084}	45,213	(9,043)	[2,170]	{1,085}	45,263	(9,053)	[2,173]	{1,086}
Schenectady	32,300	32,316	32,326	32,333	32,370	(6,474)	[1,554]	{777}	32,403	(6,481)	[1,555]	{778}	32,436	(6,487)	[1,557]	{778}
Suffolk	422,402	422,503	422,575	422,642	422,824	(84,565)	[20,296]	{10,148}	422,986	(84,597)	[20,303]	{10,152}	423,137	(84,627)	[20,311]	{10,155}
Sullivan	18,167	18,172	18,176	18,178	18,194	(3,639)	[873]	{437}	18,209	(3,642)	[874]	{437}	18,223	(3,645)	[875]	{437}
Tompkins	17,361	17,395	17,396	17,418	17,461	(3,492)	[838]	{419}	17,502	(3,500)	[840]	{420}	17,543	(3,509)	[842]	{421}
Ulster	30,780	30,799	30,812	30,826	30,868	(6,174)	[1,482]	{741}	30,907	(6,181)	[1,484]	{742}	30,945	(6,189)	[1,485]	{743}
Westchester	246,426	246,496	246,551	246,611	246,761	(49,352)	[11,845]	{5,922}	246,897	(49,379)	[11,851]	{5,926}	247,030	(49,406)	[11,857]	{5,929}

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.