

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

Date: 3/22/22

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 3/22/22 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.

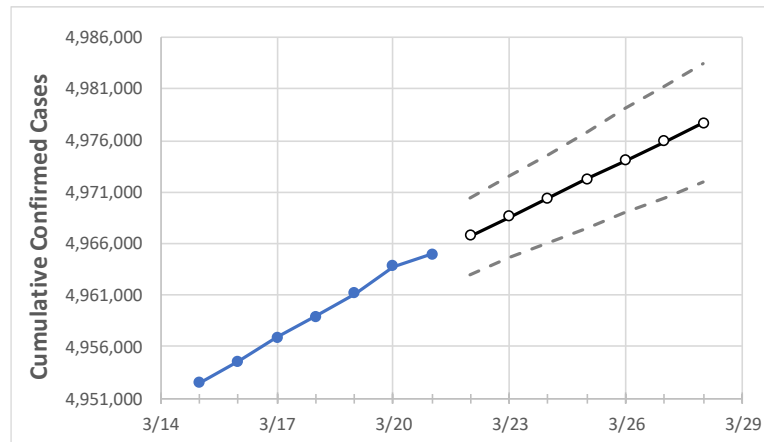
IEM's Modeling Lead

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:						
	3/18	3/19	3/20	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28
New York	4,958,932	4,961,120	4,963,787	4,964,964	4,966,758	4,968,607	4,970,418	4,972,243	4,974,044	4,975,878	4,977,671

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:						
	3/18	3/19	3/20	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28
Albany	58,415	58,442	58,466	58,482	58,504	58,525	58,546	58,568	58,589	58,610	58,630
Bronx	405,627	405,739	405,851	405,910	405,976	406,046	406,117	406,183	406,252	406,321	406,387
Dutchess	63,530	63,558	63,577	63,584	63,601	63,617	63,633	63,648	63,664	63,680	63,695
Erie	206,954	207,048	207,109	207,147	207,207	207,265	207,321	207,379	207,437	207,491	207,548
Kings	690,231	690,600	690,968	691,197	691,471	691,762	692,033	692,324	692,608	692,896	693,194
Monroe	150,122	150,174	150,213	150,251	150,293	150,335	150,377	150,418	150,460	150,502	150,542
Nassau	400,265	400,447	400,564	400,664	400,776	400,891	401,001	401,112	401,225	401,336	401,449
New York	406,997	407,429	407,791	407,976	408,269	408,576	408,874	409,173	409,485	409,791	410,100
Niagara	47,491	47,506	47,534	47,554	47,570	47,586	47,602	47,617	47,633	47,649	47,664
Onondaga	109,206	109,421	109,547	109,618	109,753	109,890	110,029	110,171	110,312	110,451	110,602
Orange	109,253	109,253	109,253	109,253	109,290	109,327	109,365	109,402	109,440	109,478	109,515
Putnam	23,416	23,434	23,436	23,437	23,443	23,448	23,453	23,457	23,462	23,468	23,472
Queens	636,987	637,161	637,321	637,430	637,558	637,679	637,802	637,924	638,048	638,170	638,286
Rensselaer	31,079	31,093	31,115	31,124	31,134	31,144	31,154	31,164	31,173	31,183	31,192
Richmond	164,773	164,812	164,850	164,877	164,910	164,943	164,974	165,007	165,038	165,069	165,099
Rockland	91,629	91,671	91,700	91,718	91,746	91,772	91,799	91,827	91,855	91,882	91,909
Saratoga	45,609	45,629	45,648	45,661	45,684	45,707	45,729	45,751	45,773	45,795	45,815
Schenectady	32,587	32,607	32,610	32,613	32,623	32,634	32,644	32,654	32,664	32,674	32,684
Suffolk	424,214	424,357	424,453	424,512	424,595	424,675	424,756	424,833	424,912	424,992	425,068
Sullivan	18,276	18,283	18,285	18,286	18,290	18,293	18,297	18,301	18,304	18,307	18,310
Tompkins	17,883	17,923	17,939	17,943	17,968	17,992	18,015	18,041	18,066	18,091	18,115
Ulster	31,114	31,142	31,340	31,350	31,379	31,408	31,434	31,461	31,492	31,521	31,547
Westchester	248,324	248,604	248,706	248,766	248,875	248,985	249,094	249,207	249,316	249,432	249,547

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:											
	3/18	3/19	3/20	3/21	3/23				3/25				3/27			
Albany	58,415	58,442	58,466	58,482	58,525	(11,705)	[2,809]	{1,405}	58,568	(11,714)	[2,811]	{1,406}	58,610	(11,722)	[2,813]	{1,407}
Bronx	405,627	405,739	405,851	405,910	406,046	(81,209)	[19,490]	{9,745}	406,183	(81,237)	[19,497]	{9,748}	406,321	(81,264)	[19,503]	{9,752}
Dutchess	63,530	63,558	63,577	63,584	63,617	(12,723)	[3,054]	{1,527}	63,648	(12,730)	[3,055]	{1,528}	63,680	(12,736)	[3,057]	{1,528}
Erie	206,954	207,048	207,109	207,147	207,265	(41,453)	[9,949]	{4,974}	207,379	(41,476)	[9,954]	{4,977}	207,491	(41,498)	[9,960]	{4,980}
Kings	690,231	690,600	690,968	691,197	691,762	(138,352)	[33,205]	{16,602}	692,324	(138,465)	[33,232]	{16,616}	692,896	(138,579)	[33,259]	{16,630}
Monroe	150,122	150,174	150,213	150,251	150,335	(30,067)	[7,216]	{3,608}	150,418	(30,084)	[7,220]	{3,610}	150,502	(30,100)	[7,224]	{3,612}
Nassau	400,265	400,447	400,564	400,664	400,891	(80,178)	[19,243]	{9,621}	401,112	(80,222)	[19,253]	{9,627}	401,336	(80,267)	[19,264]	{9,632}
New York	406,997	407,429	407,791	407,976	408,576	(81,715)	[19,612]	{9,806}	409,173	(81,835)	[19,640]	{9,820}	409,791	(81,958)	[19,670]	{9,835}
Niagara	47,491	47,506	47,534	47,554	47,586	(9,517)	[2,284]	{1,142}	47,617	(9,523)	[2,286]	{1,143}	47,649	(9,530)	[2,287]	{1,144}
Onondaga	109,206	109,421	109,547	109,618	109,890	(21,978)	[5,275]	{2,637}	110,171	(22,034)	[5,288]	{2,644}	110,451	(22,090)	[5,302]	{2,651}
Orange	109,253	109,253	109,253	109,253	109,327	(21,865)	[5,248]	{2,624}	109,402	(21,880)	[5,251]	{2,626}	109,478	(21,896)	[5,255]	{2,627}
Putnam	23,416	23,434	23,436	23,437	23,448	(4,690)	[1,125]	{563}	23,457	(4,691)	[1,126]	{563}	23,468	(4,694)	[1,126]	{563}
Queens	636,987	637,161	637,321	637,430	637,679	(127,536)	[30,609]	{15,304}	637,924	(127,585)	[30,620]	{15,310}	638,170	(127,634)	[30,632]	{15,316}
Rensselaer	31,079	31,093	31,115	31,124	31,144	(6,229)	[1,495]	{747}	31,164	(6,233)	[1,496]	{748}	31,183	(6,237)	[1,497]	{748}
Richmond	164,773	164,812	164,850	164,877	164,943	(32,989)	[7,917]	{3,959}	165,007	(33,001)	[7,920]	{3,960}	165,069	(33,014)	[7,923]	{3,962}
Rockland	91,629	91,671	91,700	91,718	91,772	(18,354)	[4,405]	{2,203}	91,827	(18,365)	[4,408]	{2,204}	91,882	(18,376)	[4,410]	{2,205}
Saratoga	45,609	45,629	45,648	45,661	45,707	(9,141)	[2,194]	{1,097}	45,751	(9,150)	[2,196]	{1,098}	45,795	(9,159)	[2,198]	{1,099}
Schenectady	32,587	32,607	32,610	32,613	32,634	(6,527)	[1,566]	{783}	32,654	(6,531)	[1,567]	{784}	32,674	(6,535)	[1,568]	{784}
Suffolk	424,214	424,357	424,453	424,512	424,675	(84,935)	[20,384]	{10,192}	424,833	(84,967)	[20,392]	{10,196}	424,992	(84,998)	[20,400]	{10,200}
Sullivan	18,276	18,283	18,285	18,286	18,293	(3,659)	[878]	{439}	18,301	(3,660)	[878]	{439}	18,307	(3,661)	[879]	{439}
Tompkins	17,883	17,923	17,939	17,943	17,992	(3,598)	[864]	{432}	18,041	(3,608)	[866]	{433}	18,091	(3,618)	[868]	{434}
Ulster	31,114	31,142	31,340	31,350	31,408	(6,282)	[1,508]	{754}	31,461	(6,292)	[1,510]	{755}	31,521	(6,304)	[1,513]	{756}
Westchester	248,324	248,604	248,706	248,766	248,985	(49,797)	[11,951]	{5,976}	249,207	(49,841)	[11,962]	{5,981}	249,432	(49,886)	[11,973]	{5,986}

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.