

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

Date: 4/20/21

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 4/20/21 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.

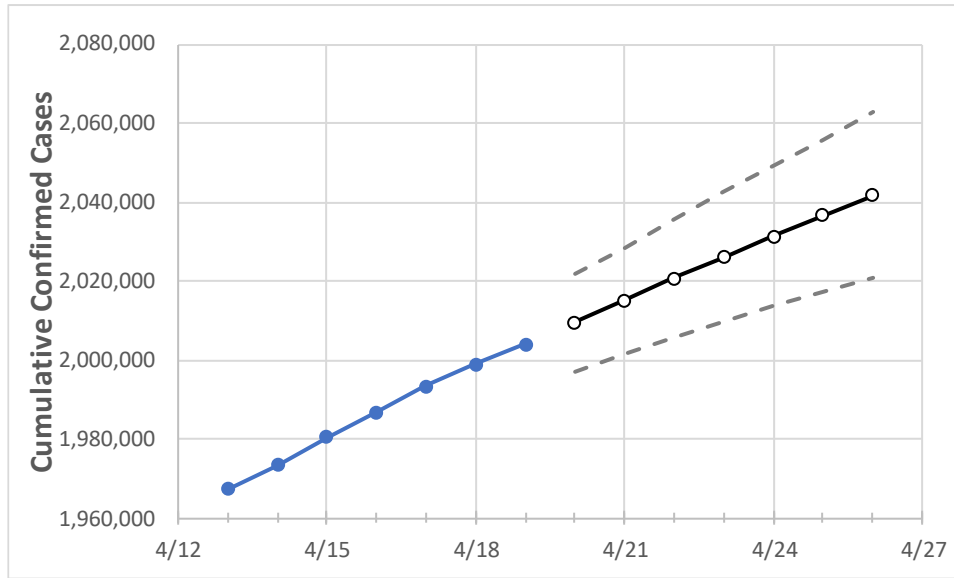
IEM's Modeling Lead

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:						
	4/16	4/17	4/18	4/19	4/20	4/21	4/22	4/23	4/24	4/25	4/26
New York	1,986,681	1,993,271	1,998,912	2,003,938	2,009,657	2,015,170	2,020,724	2,026,095	2,031,422	2,036,639	2,041,654

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:							
	4/16	4/17	4/18	4/19	4/20	4/21	4/22	4/23	4/24	4/25	4/26	
Albany	23,535	23,609	23,679	23,718	23,773	23,828	23,882	23,936	23,990	24,044	24,098	
Bronx	174,059	174,406	174,852	175,323	175,726	176,124	176,509	176,871	177,228	177,580	177,921	
Dutchess	27,813	27,902	27,982	28,027	28,105	28,181	28,254	28,326	28,397	28,467	28,535	
Erie	81,531	82,158	82,588	82,901	83,384	83,871	84,359	84,842	85,331	85,817	86,305	
Kings	263,202	263,918	264,753	265,709	266,574	267,427	268,276	269,104	269,930	270,736	271,526	
Monroe	60,528	60,881	61,114	61,314	61,601	61,890	62,184	62,486	62,794	63,111	63,426	
Nassau	176,399	177,001	177,344	177,656	178,068	178,459	178,851	179,225	179,593	179,953	180,300	
New York	131,328	131,895	132,296	132,551	132,913	133,272	133,624	133,965	134,278	134,599	134,916	
Niagara	18,090	18,211	18,314	18,367	18,474	18,581	18,691	18,801	18,910	19,023	19,139	
Onondaga	35,790	35,941	36,061	36,119	36,222	36,328	36,435	36,546	36,655	36,765	36,874	
Orange	45,884	46,021	46,133	46,223	46,337	46,446	46,552	46,655	46,756	46,852	46,944	
Putnam	10,134	10,186	10,217	10,231	10,257	10,282	10,307	10,331	10,355	10,378	10,400	
Queens	262,173	262,764	263,513	264,360	265,095	265,800	266,505	267,190	267,852	268,494	269,124	
Rensselaer	10,592	10,642	10,679	10,709	10,742	10,775	10,808	10,841	10,875	10,907	10,940	
Richmond	70,320	70,501	70,701	70,965	71,181	71,394	71,601	71,808	72,004	72,199	72,386	
Rockland	45,527	45,651	45,700	45,739	45,821	45,895	45,968	46,040	46,108	46,175	46,238	
Saratoga	14,323	14,380	14,418	14,454	14,502	14,549	14,595	14,640	14,684	14,729	14,771	
Schenectady	12,357	12,395	12,420	12,435	12,465	12,494	12,523	12,553	12,582	12,610	12,639	
Suffolk	192,541	193,151	193,546	193,919	194,394	194,856	195,306	195,745	196,180	196,588	196,994	
Sullivan	6,102	6,126	6,153	6,167	6,195	6,224	6,252	6,279	6,306	6,334	6,361	
Tompkins	4,040	4,050	4,058	4,064	4,069	4,075	4,080	4,084	4,089	4,093	4,098	
Ulster	12,919	12,972	13,039	13,082	13,127	13,170	13,211	13,253	13,293	13,331	13,368	
Westchester	125,172	125,487	125,726	125,913	126,157	126,394	126,626	126,850	127,066	127,282	127,487	

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:											
	4/16	4/17	4/18	4/19	4/21				4/23				4/25			
Albany	23,535	23,609	23,679	23,718	23,828	(4,766)	[1,144]	{572}	23,936	(4,787)	[1,149]	{574}	24,044	(4,809)	[1,154]	{577}
Bronx	174,059	174,406	174,852	175,323	176,124	(35,225)	[8,454]	{4,227}	176,871	(35,374)	[8,490]	{4,245}	177,580	(35,516)	[8,524]	{4,262}
Dutchess	27,813	27,902	27,982	28,027	28,181	(5,636)	[1,353]	{676}	28,326	(5,665)	[1,360]	{680}	28,467	(5,693)	[1,366]	{683}
Erie	81,531	82,158	82,588	82,901	83,871	(16,774)	[4,026]	{2,013}	84,842	(16,968)	[4,072]	{2,036}	85,817	(17,163)	[4,119]	{2,060}
Kings	263,202	263,918	264,753	265,709	267,427	(53,485)	[12,836]	{6,418}	269,104	(53,821)	[12,917]	{6,459}	270,736	(54,147)	[12,995]	{6,498}
Monroe	60,528	60,881	61,114	61,314	61,890	(12,378)	[2,971]	{1,485}	62,486	(12,497)	[2,999]	{1,500}	63,111	(12,622)	[3,029]	{1,515}
Nassau	176,399	177,001	177,344	177,656	178,459	(35,692)	[8,566]	{4,283}	179,225	(35,845)	[8,603]	{4,301}	179,953	(35,991)	[8,638]	{4,319}
New York	131,328	131,895	132,296	132,551	133,272	(26,654)	[6,397]	{3,199}	133,965	(26,793)	[6,430]	{3,215}	134,599	(26,920)	[6,461]	{3,230}
Niagara	18,090	18,211	18,314	18,367	18,581	(3,716)	[892]	{446}	18,801	(3,760)	[902]	{451}	19,023	(3,805)	[913]	{457}
Onondaga	35,790	35,941	36,061	36,119	36,328	(7,266)	[1,744]	{872}	36,546	(7,309)	[1,754]	{877}	36,765	(7,353)	[1,765]	{882}
Orange	45,884	46,021	46,133	46,223	46,446	(9,289)	[2,229]	{1,115}	46,655	(9,331)	[2,239]	{1,120}	46,852	(9,370)	[2,249]	{1,124}
Putnam	10,134	10,186	10,217	10,231	10,282	(2,056)	[494]	{247}	10,331	(2,066)	[496]	{248}	10,378	(2,076)	[498]	{249}
Queens	262,173	262,764	263,513	264,360	265,800	(53,160)	[12,758]	{6,379}	267,190	(53,438)	[12,825]	{6,413}	268,494	(53,699)	[12,888]	{6,444}
Rensselaer	10,592	10,642	10,679	10,709	10,775	(2,155)	[517]	{259}	10,841	(2,168)	[520]	{260}	10,907	(2,181)	[524]	{262}
Richmond	70,320	70,501	70,701	70,965	71,394	(14,279)	[3,427]	{1,713}	71,808	(14,362)	[3,447]	{1,723}	72,199	(14,440)	[3,466]	{1,733}
Rockland	45,527	45,651	45,700	45,739	45,895	(9,179)	[2,203]	{1,101}	46,040	(9,208)	[2,210]	{1,105}	46,175	(9,235)	[2,216]	{1,108}
Saratoga	14,323	14,380	14,418	14,454	14,549	(2,910)	[698]	{349}	14,640	(2,928)	[703]	{351}	14,729	(2,946)	[707]	{353}
Schenectady	12,357	12,395	12,420	12,435	12,494	(2,499)	[600]	{300}	12,553	(2,511)	[603]	{301}	12,610	(2,522)	[605]	{303}
Suffolk	192,541	193,151	193,546	193,919	194,856	(38,971)	[9,353]	{4,677}	195,745	(39,149)	[9,396]	{4,698}	196,588	(39,318)	[9,436]	{4,718}
Sullivan	6,102	6,126	6,153	6,167	6,224	(1,245)	[299]	{149}	6,279	(1,256)	[301]	{151}	6,334	(1,267)	[304]	{152}
Tompkins	4,040	4,050	4,058	4,064	4,075	(815)	[196]	{98}	4,084	(817)	[196]	{98}	4,093	(819)	[196]	{98}
Ulster	12,919	12,972	13,039	13,082	13,170	(2,634)	[632]	{316}	13,253	(2,651)	[636]	{318}	13,331	(2,666)	[640]	{320}
Westchester	125,172	125,487	125,726	125,913	126,394	(25,279)	[6,067]	{3,033}	126,850	(25,370)	[6,089]	{3,044}	127,282	(25,456)	[6,110]	{3,055}

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.