

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

Date: 3/23/21

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 3/23/21 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.

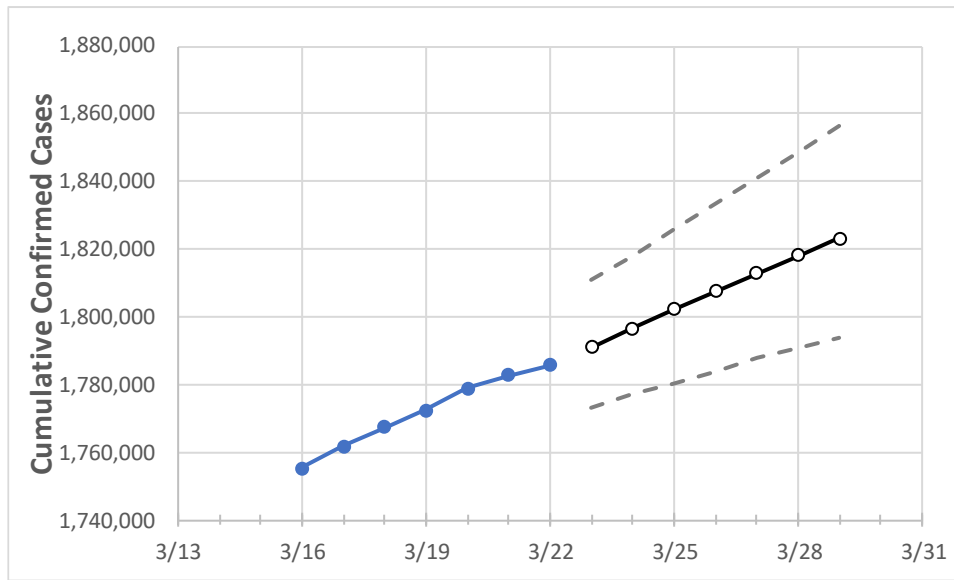
IEM's Modeling Lead

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:						
	3/19	3/20	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28	3/29

New York 1,772,367 1,779,034 1,782,769 1,785,565 1,791,118 1,796,647 1,802,209 1,807,656 1,812,837 1,818,068 1,823,195

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:							
	3/19	3/20	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28	3/29	
Albany	21,867	21,914	21,982	22,024	22,074	22,123	22,173	22,221	22,269	22,316	22,364	
Bronx	155,795	156,250	156,250	156,250	156,663	157,054	157,431	157,808	158,172	158,519	158,855	
Dutchess	24,409	24,571	24,744	24,862	25,005	25,150	25,296	25,445	25,598	25,752	25,909	
Erie	69,594	69,936	70,323	70,520	70,773	71,027	71,283	71,540	71,801	72,064	72,327	
Kings	230,188	231,077	231,077	231,077	231,883	232,689	233,445	234,190	234,921	235,627	236,316	
Monroe	54,800	54,934	55,119	55,213	55,332	55,455	55,576	55,699	55,820	55,940	56,065	
Nassau	160,103	160,800	161,408	161,948	162,571	163,195	163,818	164,443	165,072	165,700	166,326	
New York	113,370	113,760	113,760	113,760	114,136	114,497	114,860	115,203	115,546	115,871	116,192	
Niagara	15,936	15,965	16,009	16,050	16,083	16,116	16,148	16,180	16,213	16,245	16,277	
Onondaga	33,441	33,504	33,584	33,617	33,670	33,723	33,777	33,830	33,884	33,935	33,988	
Orange	40,499	40,780	40,993	41,137	41,353	41,571	41,798	42,022	42,245	42,473	42,708	
Putnam	8,994	9,033	9,079	9,106	9,145	9,185	9,224	9,264	9,304	9,345	9,386	
Queens	229,999	230,868	230,868	230,868	231,703	232,539	233,374	234,197	234,993	235,796	236,571	
Rensselaer	9,601	9,625	9,657	9,679	9,708	9,737	9,766	9,794	9,822	9,850	9,878	
Richmond	61,712	61,922	61,922	61,922	62,115	62,303	62,492	62,675	62,852	63,026	63,195	
Rockland	41,729	41,858	41,990	42,077	42,227	42,377	42,524	42,671	42,817	42,962	43,104	
Saratoga	12,714	12,774	12,834	12,870	12,913	12,956	12,999	13,043	13,086	13,131	13,174	
Schenectady	11,356	11,381	11,407	11,430	11,456	11,482	11,508	11,534	11,560	11,585	11,610	
Suffolk	174,032	174,799	175,528	176,140	176,819	177,499	178,186	178,876	179,588	180,293	181,003	
Sullivan	5,153	5,186	5,216	5,231	5,259	5,288	5,317	5,348	5,379	5,410	5,441	
Tompkins	3,699	3,718	3,730	3,736	3,753	3,770	3,788	3,806	3,824	3,844	3,863	
Ulster	11,037	11,123	11,203	11,274	11,353	11,436	11,520	11,608	11,698	11,790	11,885	
Westchester	114,802	115,222	115,563	115,935	116,306	116,678	117,045	117,410	117,774	118,134	118,499	

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:											
	3/19	3/20	3/21	3/22	3/24			3/26			3/28					
Albany	21,867	21,914	21,982	22,024	22,123	(4,425)	[1,062]	{531}	22,221	(4,444)	[1,067]	{533}	22,316	(4,463)	[1,071]	{536}
Bronx	155,795	156,250	156,250	156,250	157,054	(31,411)	[7,539]	{3,769}	157,808	(31,562)	[7,575]	{3,787}	158,519	(31,704)	[7,609]	{3,804}
Dutchess	24,409	24,571	24,744	24,862	25,150	(5,030)	[1,207]	{604}	25,445	(5,089)	[1,221]	{611}	25,752	(5,150)	[1,236]	{618}
Erie	69,594	69,936	70,323	70,520	71,027	(14,205)	[3,409]	{1,705}	71,540	(14,308)	[3,434]	{1,717}	72,064	(14,413)	[3,459]	{1,730}
Kings	230,188	231,077	231,077	231,077	232,689	(46,538)	[11,169]	{5,585}	234,190	(46,838)	[11,241]	{5,621}	235,627	(47,125)	[11,310]	{5,655}
Monroe	54,800	54,934	55,119	55,213	55,455	(11,091)	[2,662]	{1,331}	55,699	(11,140)	[2,674]	{1,337}	55,940	(11,188)	[2,685]	{1,343}
Nassau	160,103	160,800	161,408	161,948	163,195	(32,639)	[7,833]	{3,917}	164,443	(32,889)	[7,893]	{3,947}	165,700	(33,140)	[7,954]	{3,977}
New York	113,370	113,760	113,760	113,760	114,497	(22,899)	[5,496]	{2,748}	115,203	(23,041)	[5,530]	{2,765}	115,871	(23,174)	[5,562]	{2,781}
Niagara	15,936	15,965	16,009	16,050	16,116	(3,223)	[774]	{387}	16,180	(3,236)	[777]	{388}	16,245	(3,249)	[780]	{390}
Onondaga	33,441	33,504	33,584	33,617	33,723	(6,745)	[1,619]	{809}	33,830	(6,766)	[1,624]	{812}	33,935	(6,787)	[1,629]	{814}
Orange	40,499	40,780	40,993	41,137	41,571	(8,314)	[1,995]	{998}	42,022	(8,404)	[2,017]	{1,009}	42,473	(8,495)	[2,039]	{1,019}
Putnam	8,994	9,033	9,079	9,106	9,185	(1,837)	[441]	{220}	9,264	(1,853)	[445]	{222}	9,345	(1,869)	[449]	{224}
Queens	229,999	230,868	230,868	230,868	232,539	(46,508)	[11,162]	{5,581}	234,197	(46,839)	[11,241]	{5,621}	235,796	(47,159)	[11,318]	{5,659}
Rensselaer	9,601	9,625	9,657	9,679	9,737	(1,947)	[467]	{234}	9,794	(1,959)	[470]	{235}	9,850	(1,970)	[473]	{236}
Richmond	61,712	61,922	61,922	61,922	62,303	(12,461)	[2,991]	{1,495}	62,675	(12,535)	[3,008]	{1,504}	63,026	(12,605)	[3,025]	{1,513}
Rockland	41,729	41,858	41,990	42,077	42,377	(8,475)	[2,034]	{1,017}	42,671	(8,534)	[2,048]	{1,024}	42,962	(8,592)	[2,062]	{1,031}
Saratoga	12,714	12,774	12,834	12,870	12,956	(2,591)	[622]	{311}	13,043	(2,609)	[626]	{313}	13,131	(2,626)	[630]	{315}
Schenectady	11,356	11,381	11,407	11,430	11,482	(2,296)	[551]	{276}	11,534	(2,307)	[554]	{277}	11,585	(2,317)	[556]	{278}
Suffolk	174,032	174,799	175,528	176,140	177,499	(35,500)	[8,520]	{4,260}	178,876	(35,775)	[8,586]	{4,293}	180,293	(36,059)	[8,654]	{4,327}
Sullivan	5,153	5,186	5,216	5,231	5,288	(1,058)	[254]	{127}	5,348	(1,070)	[257]	{128}	5,410	(1,082)	[260]	{130}
Tompkins	3,699	3,718	3,730	3,736	3,770	(754)	[181]	{90}	3,806	(761)	[183]	{91}	3,844	(769)	[184]	{92}
Ulster	11,037	11,123	11,203	11,274	11,436	(2,287)	[549]	{274}	11,608	(2,322)	[557]	{279}	11,790	(2,358)	[566]	{283}
Westchester	114,802	115,222	115,563	115,935	116,678	(23,336)	[5,601]	{2,800}	117,410	(23,482)	[5,636]	{2,818}	118,134	(23,627)	[5,670]	{2,835}

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.