

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 9/23/20**

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 9/23/20 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.

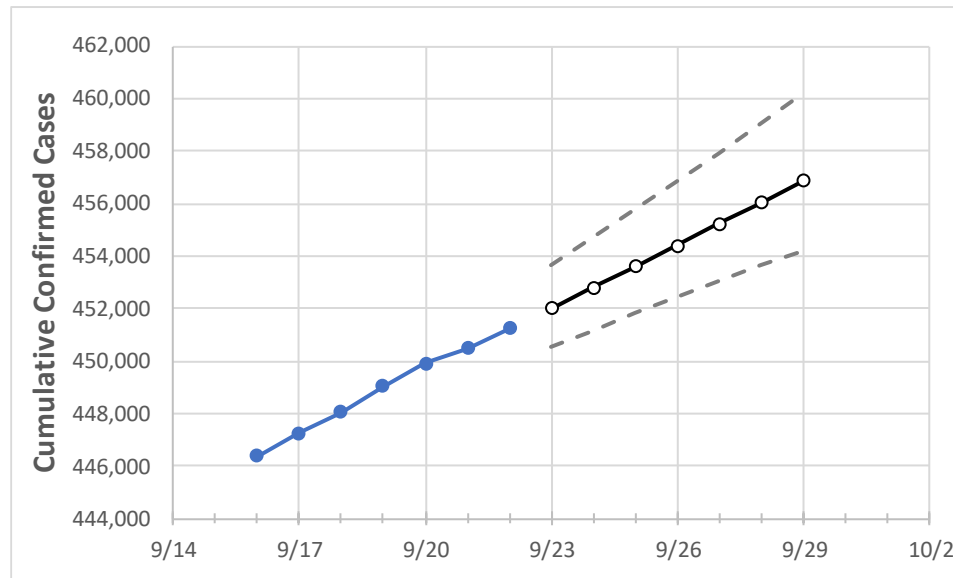
IEM's Modeling Lead

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:						
	9/19	9/20	9/21	9/22	9/23	9/24	9/25	9/26	9/27	9/28	9/29
New York	449,038	449,900	450,473	451,227	452,013	452,805	453,603	454,408	455,219	456,036	456,860

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 20%, and are often within 10%, of actual confirmed cases.

New York Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	9/19	9/20	9/21	9/22	9/23	9/24	9/25	9/26	9/27	9/28	9/29
Albany	3,006	3,016	3,024	3,037	3,053	3,069	3,086	3,104	3,122	3,142	3,161
Bronx	52,526	52,578	52,619	52,666	52,714	52,762	52,811	52,859	52,908	52,956	53,005
Dutchess	5,053	5,059	5,076	5,084	5,090	5,096	5,102	5,108	5,114	5,119	5,125
Erie	10,917	10,999	11,042	11,082	11,128	11,175	11,221	11,267	11,312	11,358	11,403
Kings	66,971	67,136	67,227	67,391	67,508	67,629	67,751	67,877	68,005	68,136	68,270
Monroe	5,876	5,894	5,911	5,925	5,947	5,969	5,991	6,013	6,036	6,058	6,081
Nassau	46,154	46,218	46,259	46,325	46,394	46,462	46,531	46,599	46,668	46,736	46,804
New York	33,011	33,070	33,105	33,146	33,197	33,249	33,302	33,356	33,410	33,465	33,521
Niagara	1,714	1,724	1,728	1,733	1,738	1,743	1,748	1,753	1,758	1,763	1,768
Onondaga	4,201	4,220	4,231	4,253	4,273	4,294	4,314	4,336	4,358	4,380	4,403
Orange	11,790	11,812	11,822	11,835	11,859	11,883	11,909	11,934	11,961	11,988	12,016
Putnam	1,573	1,574	1,577	1,583	1,585	1,587	1,589	1,591	1,593	1,595	1,597
Queens	71,577	71,682	71,752	71,818	71,898	71,979	72,061	72,144	72,228	72,314	72,400
Rensselaer	896	899	901	901	903	905	907	910	912	914	916
Richmond	15,713	15,730	15,753	15,786	15,809	15,832	15,856	15,880	15,903	15,927	15,952
Rockland	14,801	14,823	14,833	14,891	14,926	14,962	14,999	15,038	15,077	15,118	15,160
Saratoga	990	998	1,004	1,006	1,010	1,015	1,019	1,024	1,028	1,032	1,036
Schenectady	1,377	1,380	1,383	1,383	1,386	1,388	1,391	1,393	1,396	1,398	1,400
Suffolk	46,010	46,061	46,109	46,176	46,231	46,285	46,339	46,393	46,447	46,501	46,554
Sullivan	1,570	1,571	1,573	1,573	1,575	1,577	1,579	1,581	1,583	1,585	1,587
Tompkins	394	397	398	399	401	403	404	406	407	409	410
Ulster	2,239	2,242	2,243	2,244	2,246	2,248	2,249	2,251	2,253	2,255	2,257
Westchester	37,755	37,801	37,837	37,866	37,903	37,939	37,975	38,011	38,047	38,082	38,118

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:											
	9/19	9/20	9/21	9/22	9/24				9/26				9/28			
Albany	3,006	3,016	3,024	3,037	3,069	(614)	[147]	{74}	3,104	(621)	[149]	{74}	3,142	(628)	[151]	{75}
Bronx	52,526	52,578	52,619	52,666	52,762	(10,552)	[2,533]	{1,266}	52,859	(10,572)	[2,537]	{1,269}	52,956	(10,591)	[2,542]	{1,271}
Dutchess	5,053	5,059	5,076	5,084	5,096	(1,019)	[245]	{122}	5,108	(1,022)	[245]	{123}	5,119	(1,024)	[246]	{123}
Erie	10,917	10,999	11,042	11,082	11,175	(2,235)	[536]	{268}	11,267	(2,253)	[541]	{270}	11,358	(2,272)	[545]	{273}
Kings	66,971	67,136	67,227	67,391	67,629	(13,526)	[3,246]	{1,623}	67,877	(13,575)	[3,258]	{1,629}	68,136	(13,627)	[3,271]	{1,635}
Monroe	5,876	5,894	5,911	5,925	5,969	(1,194)	[286]	{143}	6,013	(1,203)	[289]	{144}	6,058	(1,212)	[291]	{145}
Nassau	46,154	46,218	46,259	46,325	46,462	(9,292)	[2,230]	{1,115}	46,599	(9,320)	[2,237]	{1,118}	46,736	(9,347)	[2,243]	{1,122}
New York	33,011	33,070	33,105	33,146	33,249	(6,650)	[1,596]	{798}	33,356	(6,671)	[1,601]	{801}	33,465	(6,693)	[1,606]	{803}
Niagara	1,714	1,724	1,728	1,733	1,743	(349)	[84]	{42}	1,753	(351)	[84]	{42}	1,763	(353)	[85]	{42}
Onondaga	4,201	4,220	4,231	4,253	4,294	(859)	[206]	{103}	4,336	(867)	[208]	{104}	4,380	(876)	[210]	{105}
Orange	11,790	11,812	11,822	11,835	11,883	(2,377)	[570]	{285}	11,934	(2,387)	[573]	{286}	11,988	(2,398)	[575]	{288}
Putnam	1,573	1,574	1,577	1,583	1,587	(317)	[76]	{38}	1,591	(318)	[76]	{38}	1,595	(319)	[77]	{38}
Queens	71,577	71,682	71,752	71,818	71,979	(14,396)	[3,455]	{1,728}	72,144	(14,429)	[3,463]	{1,731}	72,314	(14,463)	[3,471]	{1,736}
Rensselaer	896	899	901	901	905	(181)	[43]	{22}	910	(182)	[44]	{22}	914	(183)	[44]	{22}
Richmond	15,713	15,730	15,753	15,786	15,832	(3,166)	[760]	{380}	15,880	(3,176)	[762]	{381}	15,927	(3,185)	[765]	{382}
Rockland	14,801	14,823	14,833	14,891	14,962	(2,992)	[718]	{359}	15,038	(3,008)	[722]	{361}	15,118	(3,024)	[726]	{363}
Saratoga	990	998	1,004	1,006	1,015	(203)	[49]	{24}	1,024	(205)	[49]	{25}	1,032	(206)	[50]	{25}
Schenectady	1,377	1,380	1,383	1,383	1,388	(278)	[67]	{33}	1,393	(279)	[67]	{33}	1,398	(280)	[67]	{34}
Suffolk	46,010	46,061	46,109	46,176	46,285	(9,257)	[2,222]	{1,111}	46,393	(9,279)	[2,227]	{1,113}	46,501	(9,300)	[2,232]	{1,116}
Sullivan	1,570	1,571	1,573	1,573	1,577	(315)	[76]	{38}	1,581	(316)	[76]	{38}	1,585	(317)	[76]	{38}
Tompkins	394	397	398	399	403	(81)	[19]	{10}	406	(81)	[19]	{10}	409	(82)	[20]	{10}
Ulster	2,239	2,242	2,243	2,244	2,248	(450)	[108]	{54}	2,251	(450)	[108]	{54}	2,255	(451)	[108]	{54}
Westchester	37,755	37,801	37,837	37,866	37,939	(7,588)	[1,821]	{911}	38,011	(7,602)	[1,825]	{912}	38,082	(7,616)	[1,828]	{914}

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.