

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

Date: 9/21/20

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 9/21/20 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.

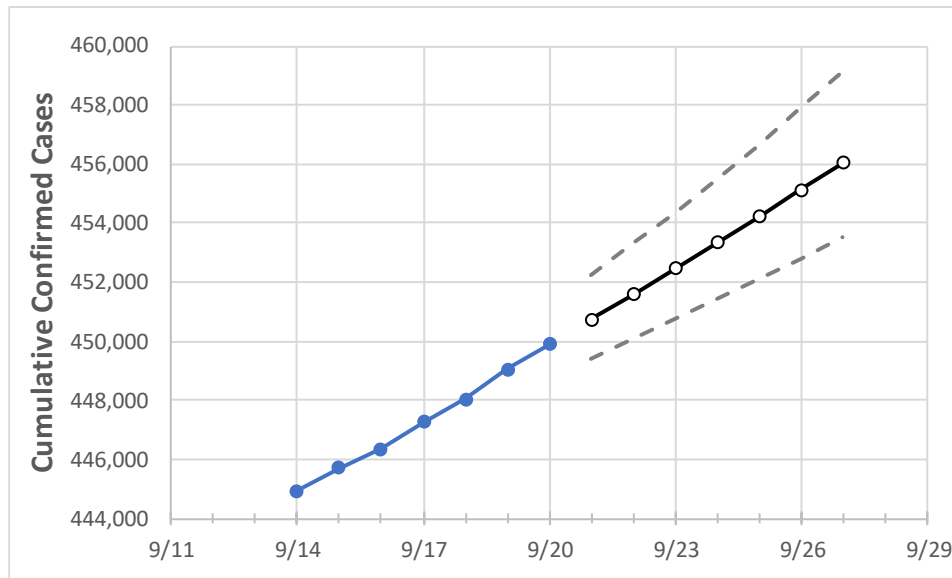
IEM's Modeling Lead

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:						
	9/17	9/18	9/19	9/20	9/21	9/22	9/23	9/24	9/25	9/26	9/27
New York	447,262	448,052	449,038	449,900	450,734	451,582	452,445	453,324	454,218	455,128	456,055

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:						
	9/17	9/18	9/19	9/20	9/21	9/22	9/23	9/24	9/25	9/26	9/27
Albany	2,969	2,979	3,006	3,016	3,031	3,047	3,064	3,081	3,100	3,119	3,140
Bronx	52,422	52,468	52,526	52,578	52,628	52,678	52,728	52,778	52,829	52,881	52,932
Dutchess	5,042	5,050	5,053	5,059	5,064	5,069	5,074	5,079	5,084	5,089	5,093
Erie	10,833	10,873	10,917	10,999	11,048	11,096	11,145	11,193	11,241	11,290	11,338
Kings	66,586	66,737	66,971	67,136	67,256	67,379	67,506	67,636	67,770	67,908	68,049
Monroe	5,839	5,857	5,876	5,894	5,919	5,944	5,969	5,996	6,022	6,049	6,077
Nassau	45,989	46,052	46,154	46,218	46,292	46,366	46,441	46,516	46,591	46,667	46,743
New York	32,892	32,938	33,011	33,070	33,120	33,170	33,222	33,275	33,329	33,384	33,440
Niagara	1,703	1,707	1,714	1,724	1,729	1,734	1,739	1,744	1,749	1,753	1,759
Onondaga	4,158	4,185	4,201	4,220	4,242	4,264	4,288	4,312	4,337	4,363	4,390
Orange	11,734	11,760	11,790	11,812	11,842	11,874	11,908	11,943	11,980	12,019	12,061
Putnam	1,567	1,569	1,573	1,574	1,576	1,578	1,579	1,581	1,582	1,584	1,585
Queens	71,392	71,474	71,577	71,682	71,765	71,849	71,935	72,022	72,110	72,200	72,292
Rensselaer	892	895	896	899	901	903	906	908	910	912	915
Richmond	15,666	15,689	15,713	15,730	15,751	15,773	15,795	15,816	15,838	15,859	15,881
Rockland	14,698	14,747	14,801	14,823	14,860	14,898	14,938	14,979	15,022	15,066	15,113
Saratoga	976	985	990	998	1,003	1,009	1,014	1,019	1,024	1,030	1,035
Schenectady	1,372	1,374	1,377	1,380	1,383	1,385	1,388	1,390	1,392	1,395	1,397
Suffolk	45,915	45,956	46,010	46,061	46,116	46,171	46,226	46,280	46,335	46,389	46,444
Sullivan	1,565	1,568	1,570	1,571	1,573	1,575	1,577	1,579	1,581	1,583	1,585
Tompkins	388	390	394	397	399	402	404	406	408	410	412
Ulster	2,231	2,235	2,239	2,242	2,244	2,246	2,249	2,251	2,253	2,255	2,258
Westchester	37,672	37,718	37,755	37,801	37,840	37,879	37,918	37,957	37,996	38,035	38,074

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:											
	9/17	9/18	9/19	9/20	9/22				9/24				9/26			
Albany	2,969	2,979	3,006	3,016	3,047	(609)	[146]	{73}	3,081	(616)	[148]	{74}	3,119	(624)	[150]	{75}
Bronx	52,422	52,468	52,526	52,578	52,678	(10,536)	[2,529]	{1,264}	52,778	(10,556)	[2,533]	{1,267}	52,881	(10,576)	[2,538]	{1,269}
Dutchess	5,042	5,050	5,053	5,059	5,069	(1,014)	[243]	{122}	5,079	(1,016)	[244]	{122}	5,089	(1,018)	[244]	{122}
Erie	10,833	10,873	10,917	10,999	11,096	(2,219)	[533]	{266}	11,193	(2,239)	[537]	{269}	11,290	(2,258)	[542]	{271}
Kings	66,586	66,737	66,971	67,136	67,379	(13,476)	[3,234]	{1,617}	67,636	(13,527)	[3,247]	{1,623}	67,908	(13,582)	[3,260]	{1,630}
Monroe	5,839	5,857	5,876	5,894	5,944	(1,189)	[285]	{143}	5,996	(1,199)	[288]	{144}	6,049	(1,210)	[290]	{145}
Nassau	45,989	46,052	46,154	46,218	46,366	(9,273)	[2,226]	{1,113}	46,516	(9,303)	[2,233]	{1,116}	46,667	(9,333)	[2,240]	{1,120}
New York	32,892	32,938	33,011	33,070	33,170	(6,634)	[1,592]	{796}	33,275	(6,655)	[1,597]	{799}	33,384	(6,677)	[1,602]	{801}
Niagara	1,703	1,707	1,714	1,724	1,734	(347)	[83]	{42}	1,744	(349)	[84]	{42}	1,753	(351)	[84]	{42}
Onondaga	4,158	4,185	4,201	4,220	4,264	(853)	[205]	{102}	4,312	(862)	[207]	{103}	4,363	(873)	[209]	{105}
Orange	11,734	11,760	11,790	11,812	11,874	(2,375)	[570]	{285}	11,943	(2,389)	[573]	{287}	12,019	(2,404)	[577]	{288}
Putnam	1,567	1,569	1,573	1,574	1,578	(316)	[76]	{38}	1,581	(316)	[76]	{38}	1,584	(317)	[76]	{38}
Queens	71,392	71,474	71,577	71,682	71,849	(14,370)	[3,449]	{1,724}	72,022	(14,404)	[3,457]	{1,729}	72,200	(14,440)	[3,466]	{1,733}
Rensselaer	892	895	896	899	903	(181)	[43]	{22}	908	(182)	[44]	{22}	912	(182)	[44]	{22}
Richmond	15,666	15,689	15,713	15,730	15,773	(3,155)	[757]	{379}	15,816	(3,163)	[759]	{380}	15,859	(3,172)	[761]	{381}
Rockland	14,698	14,747	14,801	14,823	14,898	(2,980)	[715]	{358}	14,979	(2,996)	[719]	{359}	15,066	(3,013)	[723]	{362}
Saratoga	976	985	990	998	1,009	(202)	[48]	{24}	1,019	(204)	[49]	{24}	1,030	(206)	[49]	{25}
Schenectady	1,372	1,374	1,377	1,380	1,385	(277)	[66]	{33}	1,390	(278)	[67]	{33}	1,395	(279)	[67]	{33}
Suffolk	45,915	45,956	46,010	46,061	46,171	(9,234)	[2,216]	{1,108}	46,280	(9,256)	[2,221]	{1,111}	46,389	(9,278)	[2,227]	{1,113}
Sullivan	1,565	1,568	1,570	1,571	1,575	(315)	[76]	{38}	1,579	(316)	[76]	{38}	1,583	(317)	[76]	{38}
Tompkins	388	390	394	397	402	(80)	[19]	{10}	406	(81)	[19]	{10}	410	(82)	[20]	{10}
Ulster	2,231	2,235	2,239	2,242	2,246	(449)	[108]	{54}	2,251	(450)	[108]	{54}	2,255	(451)	[108]	{54}
Westchester	37,672	37,718	37,755	37,801	37,879	(7,576)	[1,818]	{909}	37,957	(7,591)	[1,822]	{911}	38,035	(7,607)	[1,826]	{913}

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.