

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

Date: 10/29/20

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 10/29/20 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.

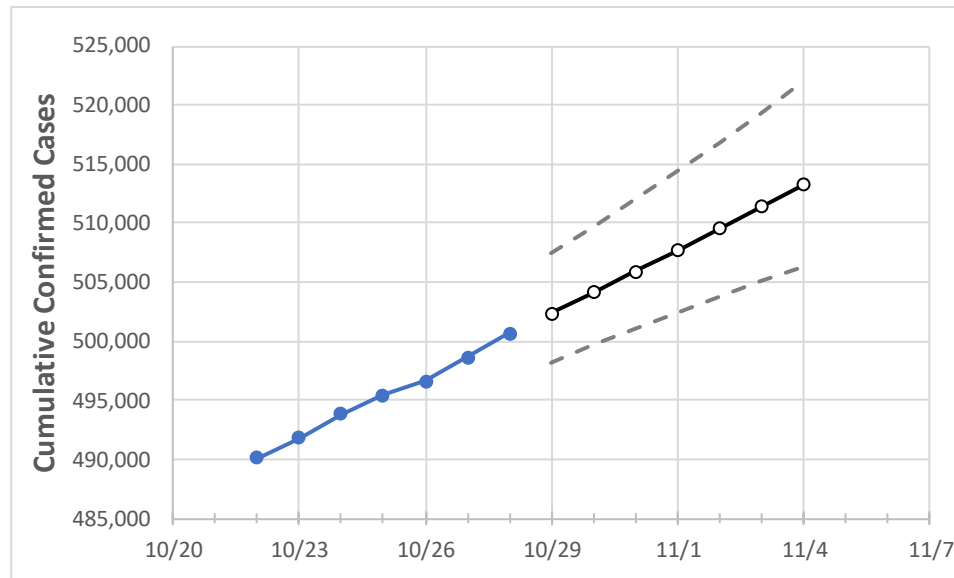
IEM's Modeling Lead

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:					
	10/25	10/26	10/27	10/28	10/29	10/30	10/31	11/1	11/2	11/3	11/4
New York	495,464	496,655	498,646	500,677	502,394	504,136	505,903	507,696	509,515	511,360	513,231

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:						
	10/25	10/26	10/27	10/28	10/29	10/30	10/31	11/1	11/2	11/3	11/4
Albany	3,577	3,590	3,613	3,627	3,648	3,670	3,692	3,714	3,737	3,760	3,783
Bronx	55,011	55,086	55,213	55,354	55,458	55,564	55,672	55,784	55,898	56,014	56,134
Dutchess	5,438	5,450	5,465	5,472	5,487	5,502	5,518	5,534	5,550	5,567	5,584
Erie	12,819	12,855	12,971	13,021	13,074	13,127	13,181	13,235	13,290	13,346	13,402
Kings	74,553	74,703	74,903	75,169	75,370	75,570	75,769	75,968	76,167	76,365	76,562
Monroe	7,111	7,174	7,256	7,312	7,387	7,465	7,547	7,633	7,723	7,816	7,914
Nassau	49,312	49,377	49,496	49,663	49,771	49,881	49,992	50,105	50,219	50,334	50,451
New York	35,723	35,789	35,897	36,076	36,199	36,327	36,458	36,593	36,732	36,875	37,022
Niagara	2,041	2,050	2,065	2,075	2,088	2,101	2,114	2,128	2,142	2,157	2,172
Onondaga	5,309	5,337	5,399	5,454	5,500	5,548	5,597	5,648	5,700	5,753	5,808
Orange	13,457	13,475	13,548	13,597	13,633	13,670	13,706	13,741	13,777	13,813	13,848
Putnam	1,794	1,800	1,805	1,812	1,820	1,827	1,835	1,843	1,851	1,860	1,869
Queens	76,220	76,316	76,523	76,696	76,855	77,017	77,179	77,344	77,511	77,679	77,849
Rensselaer	1,080	1,088	1,094	1,099	1,107	1,115	1,123	1,132	1,141	1,150	1,160
Richmond	17,048	17,085	17,174	17,252	17,309	17,367	17,426	17,487	17,550	17,614	17,680
Rockland	17,685	17,760	17,832	17,943	18,015	18,087	18,160	18,233	18,307	18,381	18,455
Saratoga	1,308	1,319	1,334	1,345	1,359	1,374	1,389	1,405	1,422	1,439	1,457
Schenectady	1,546	1,549	1,564	1,570	1,579	1,588	1,598	1,608	1,618	1,630	1,641
Suffolk	48,663	48,717	48,829	48,998	49,099	49,201	49,306	49,413	49,522	49,633	49,747
Sullivan	1,743	1,750	1,765	1,779	1,789	1,800	1,812	1,825	1,838	1,853	1,868
Tompkins	603	606	609	619	627	636	645	654	663	673	682
Ulster	2,471	2,500	2,515	2,518	2,527	2,536	2,546	2,556	2,566	2,576	2,587
Westchester	40,131	40,202	40,322	40,438	40,551	40,668	40,789	40,913	41,041	41,173	41,309

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:								
	10/25	10/26	10/27	10/28	10/30			11/1			11/3		
Albany	3,577	3,590	3,613	3,627	3,670	(734)	[176] {88}	3,714	(743)	[178] {89}	3,760	(752)	[180] {90}
Bronx	55,011	55,086	55,213	55,354	55,564	(11,113)	[2,667] {1,334}	55,784	(11,157)	[2,678] {1,339}	56,014	(11,203)	[2,689] {1,344}
Dutchess	5,438	5,450	5,465	5,472	5,502	(1,100)	[264] {132}	5,534	(1,107)	[266] {133}	5,567	(1,113)	[267] {134}
Erie	12,819	12,855	12,971	13,021	13,127	(2,625)	[630] {315}	13,235	(2,647)	[635] {318}	13,346	(2,669)	[641] {320}
Kings	74,553	74,703	74,903	75,169	75,570	(15,114)	[3,627] {1,814}	75,968	(15,194)	[3,646] {1,823}	76,365	(15,273)	[3,666] {1,833}
Monroe	7,111	7,174	7,256	7,312	7,465	(1,493)	[358] {179}	7,633	(1,527)	[366] {183}	7,816	(1,563)	[375] {188}
Nassau	49,312	49,377	49,496	49,663	49,881	(9,976)	[2,394] {1,197}	50,105	(10,021)	[2,405] {1,203}	50,334	(10,067)	[2,416] {1,208}
New York	35,723	35,789	35,897	36,076	36,327	(7,265)	[1,744] {872}	36,593	(7,319)	[1,756] {878}	36,875	(7,375)	[1,770] {885}
Niagara	2,041	2,050	2,065	2,075	2,101	(420)	[101] {50}	2,128	(426)	[102] {51}	2,157	(431)	[104] {52}
Onondaga	5,309	5,337	5,399	5,454	5,548	(1,110)	[266] {133}	5,648	(1,130)	[271] {136}	5,753	(1,151)	[276] {138}
Orange	13,457	13,475	13,548	13,597	13,670	(2,734)	[656] {328}	13,741	(2,748)	[660] {330}	13,813	(2,763)	[663] {332}
Putnam	1,794	1,800	1,805	1,812	1,827	(365)	[88] {44}	1,843	(369)	[88] {44}	1,860	(372)	[89] {45}
Queens	76,220	76,316	76,523	76,696	77,017	(15,403)	[3,697] {1,848}	77,344	(15,469)	[3,713] {1,856}	77,679	(15,536)	[3,729] {1,864}
Rensselaer	1,080	1,088	1,094	1,099	1,115	(223)	[54] {27}	1,132	(226)	[54] {27}	1,150	(230)	[55] {28}
Richmond	17,048	17,085	17,174	17,252	17,367	(3,473)	[834] {417}	17,487	(3,497)	[839] {420}	17,614	(3,523)	[845] {423}
Rockland	17,685	17,760	17,832	17,943	18,087	(3,617)	[868] {434}	18,233	(3,647)	[875] {438}	18,381	(3,676)	[882] {441}
Saratoga	1,308	1,319	1,334	1,345	1,374	(275)	[66] {33}	1,405	(281)	[67] {34}	1,439	(288)	[69] {35}
Schenectady	1,546	1,549	1,564	1,570	1,588	(318)	[76] {38}	1,608	(322)	[77] {39}	1,630	(326)	[78] {39}
Suffolk	48,663	48,717	48,829	48,998	49,201	(9,840)	[2,362] {1,181}	49,413	(9,883)	[2,372] {1,186}	49,633	(9,927)	[2,382] {1,191}
Sullivan	1,743	1,750	1,765	1,779	1,800	(360)	[86] {43}	1,825	(365)	[88] {44}	1,853	(371)	[89] {44}
Tompkins	603	606	609	619	636	(127)	[31] {15}	654	(131)	[31] {16}	673	(135)	[32] {16}
Ulster	2,471	2,500	2,515	2,518	2,536	(507)	[122] {61}	2,556	(511)	[123] {61}	2,576	(515)	[124] {62}
Westchester	40,131	40,202	40,322	40,438	40,668	(8,134)	[1,952] {976}	40,913	(8,183)	[1,964] {982}	41,173	(8,235)	[1,976] {988}

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.