

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

Date: 11/1/21

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 11/1/21 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.

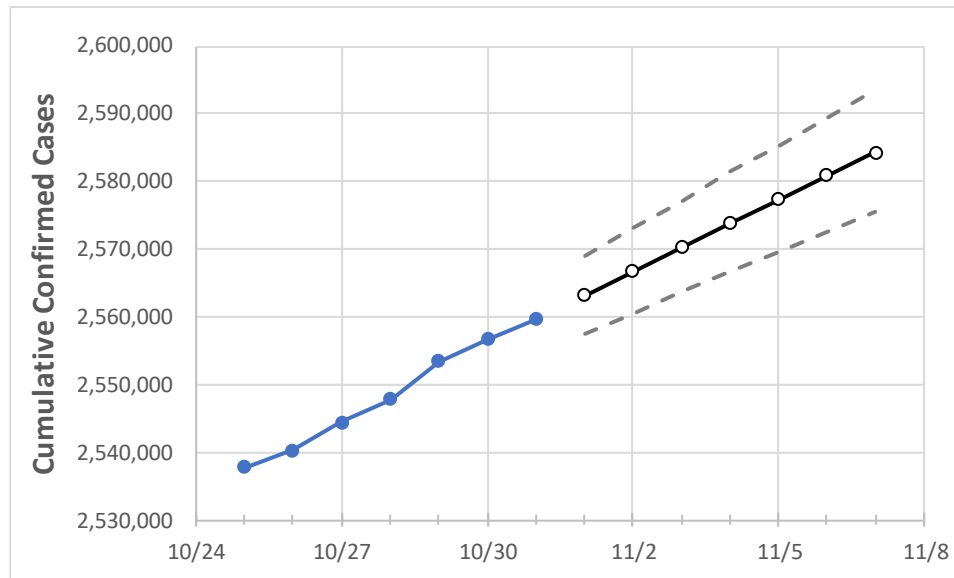
IEM's Modeling Lead

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:						
	10/28	10/29	10/30	10/31	11/1	11/2	11/3	11/4	11/5	11/6	11/7
New York	2,547,865	2,553,446	2,556,628	2,559,583	2,563,150	2,566,775	2,570,277	2,573,772	2,577,341	2,580,875	2,584,348

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:						
	10/28	10/29	10/30	10/31	11/1	11/2	11/3	11/4	11/5	11/6	11/7
Albany	31,373	31,485	31,574	31,649	31,735	31,819	31,904	31,991	32,074	32,164	32,250
Bronx	208,472	208,561	208,561	208,561	208,665	208,770	208,870	208,966	209,064	209,160	209,253
Dutchess	35,929	35,983	36,019	36,057	36,100	36,143	36,184	36,225	36,268	36,309	36,348
Erie	108,224	108,734	109,071	109,322	109,618	109,912	110,211	110,518	110,824	111,136	111,437
Kings	336,154	336,458	336,458	336,458	336,758	337,050	337,336	337,619	337,899	338,171	338,438
Monroe	85,673	85,993	86,230	86,489	86,713	86,934	87,168	87,396	87,628	87,859	88,098
Nassau	215,664	215,863	216,060	216,266	216,449	216,636	216,819	217,000	217,180	217,366	217,543
New York	169,180	169,321	169,504	169,665	169,816	169,965	170,117	170,263	170,413	170,559	170,707
Niagara	24,479	24,604	24,695	24,767	24,841	24,916	24,991	25,069	25,145	25,227	25,303
Onondaga	53,074	53,379	53,532	53,686	53,841	53,997	54,149	54,306	54,456	54,617	54,765
Orange	58,063	58,149	58,280	58,360	58,442	58,525	58,608	58,692	58,772	58,855	58,935
Putnam	12,600	12,620	12,632	12,643	12,658	12,672	12,687	12,701	12,715	12,729	12,743
Queens	316,680	316,837	316,837	316,837	317,008	317,181	317,345	317,510	317,664	317,821	317,974
Rensselaer	15,127	15,213	15,274	15,312	15,363	15,413	15,462	15,513	15,562	15,613	15,663
Richmond	89,535	89,609	89,609	89,609	89,691	89,771	89,849	89,927	90,004	90,082	90,157
Rockland	53,518	53,571	53,632	53,682	53,737	53,791	53,845	53,899	53,953	54,006	54,058
Saratoga	20,720	20,842	20,934	21,003	21,077	21,154	21,228	21,308	21,384	21,464	21,542
Schenectady	17,112	17,208	17,259	17,317	17,380	17,441	17,505	17,566	17,630	17,697	17,764
Suffolk	241,522	241,767	242,050	242,318	242,584	242,849	243,102	243,366	243,607	243,865	244,111
Sullivan	8,608	8,634	8,649	8,671	8,692	8,712	8,732	8,753	8,773	8,794	8,815
Tompkins	6,625	6,649	6,662	6,670	6,686	6,700	6,715	6,730	6,745	6,760	6,775
Ulster	17,458	17,499	17,530	17,557	17,586	17,616	17,645	17,674	17,704	17,734	17,763
Westchester	144,164	144,252	144,343	144,409	144,480	144,555	144,627	144,702	144,774	144,850	144,921

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:											
	10/28	10/29	10/30	10/31	11/2			11/4			11/6					
Albany	31,373	31,485	31,574	31,649	31,819	(6,364)	[1,527]	{764}	31,991	(6,398)	[1,536]	{768}	32,164	(6,433)	[1,544]	{772}
Bronx	208,472	208,561	208,561	208,561	208,770	(41,754)	[10,021]	{5,010}	208,966	(41,793)	[10,030]	{5,015}	209,160	(41,832)	[10,040]	{5,020}
Dutchess	35,929	35,983	36,019	36,057	36,143	(7,229)	[1,735]	{867}	36,225	(7,245)	[1,739]	{869}	36,309	(7,262)	[1,743]	{871}
Erie	108,224	108,734	109,071	109,322	109,912	(21,982)	[5,276]	{2,638}	110,518	(22,104)	[5,305]	{2,652}	111,136	(22,227)	[5,335]	{2,667}
Kings	336,154	336,458	336,458	336,458	337,050	(67,410)	[16,178]	{8,089}	337,619	(67,524)	[16,206]	{8,103}	338,171	(67,634)	[16,232]	{8,116}
Monroe	85,673	85,993	86,230	86,489	86,934	(17,387)	[4,173]	{2,086}	87,396	(17,479)	[4,195]	{2,098}	87,859	(17,572)	[4,217]	{2,109}
Nassau	215,664	215,863	216,060	216,266	216,636	(43,327)	[10,399]	{5,199}	217,000	(43,400)	[10,416]	{5,208}	217,366	(43,473)	[10,434]	{5,217}
New York	169,180	169,321	169,504	169,665	169,965	(33,993)	[8,158]	{4,079}	170,263	(34,053)	[8,173]	{4,086}	170,559	(34,112)	[8,187]	{4,093}
Niagara	24,479	24,604	24,695	24,767	24,916	(4,983)	[1,196]	{598}	25,069	(5,014)	[1,203]	{602}	25,227	(5,045)	[1,211]	{605}
Onondaga	53,074	53,379	53,532	53,686	53,997	(10,799)	[2,592]	{1,296}	54,306	(10,861)	[2,607]	{1,303}	54,617	(10,923)	[2,622]	{1,311}
Orange	58,063	58,149	58,280	58,360	58,525	(11,705)	[2,809]	{1,405}	58,692	(11,738)	[2,817]	{1,409}	58,855	(11,771)	[2,825]	{1,413}
Putnam	12,600	12,620	12,632	12,643	12,672	(2,534)	[608]	{304}	12,701	(2,540)	[610]	{305}	12,729	(2,546)	[611]	{306}
Queens	316,680	316,837	316,837	316,837	317,181	(63,436)	[15,225]	{7,612}	317,510	(63,502)	[15,240]	{7,620}	317,821	(63,564)	[15,255]	{7,628}
Rensselaer	15,127	15,213	15,274	15,312	15,413	(3,083)	[740]	{370}	15,513	(3,103)	[745]	{372}	15,613	(3,123)	[749]	{375}
Richmond	89,535	89,609	89,609	89,609	89,771	(17,954)	[4,309]	{2,155}	89,927	(17,985)	[4,317]	{2,158}	90,082	(18,016)	[4,324]	{2,162}
Rockland	53,518	53,571	53,632	53,682	53,791	(10,758)	[2,582]	{1,291}	53,899	(10,780)	[2,587]	{1,294}	54,006	(10,801)	[2,592]	{1,296}
Saratoga	20,720	20,842	20,934	21,003	21,154	(4,231)	[1,015]	{508}	21,308	(4,262)	[1,023]	{511}	21,464	(4,293)	[1,030]	{515}
Schenectady	17,112	17,208	17,259	17,317	17,441	(3,488)	[837]	{419}	17,566	(3,513)	[843]	{422}	17,697	(3,539)	[849]	{425}
Suffolk	241,522	241,767	242,050	242,318	242,849	(48,570)	[11,657]	{5,828}	243,366	(48,673)	[11,682]	{5,841}	243,865	(48,773)	[11,706]	{5,853}
Sullivan	8,608	8,634	8,649	8,671	8,712	(1,742)	[418]	{209}	8,753	(1,751)	[420]	{210}	8,794	(1,759)	[422]	{211}
Tompkins	6,625	6,649	6,662	6,670	6,700	(1,340)	[322]	{161}	6,730	(1,346)	[323]	{162}	6,760	(1,352)	[325]	{162}
Ulster	17,458	17,499	17,530	17,557	17,616	(3,523)	[846]	{423}	17,674	(3,535)	[848]	{424}	17,734	(3,547)	[851]	{426}
Westchester	144,164	144,252	144,343	144,409	144,555	(28,911)	[6,939]	{3,469}	144,702	(28,940)	[6,946]	{3,473}	144,850	(28,970)	[6,953]	{3,476}

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.