

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

Date: 1/4/21

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 1/4/21 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.

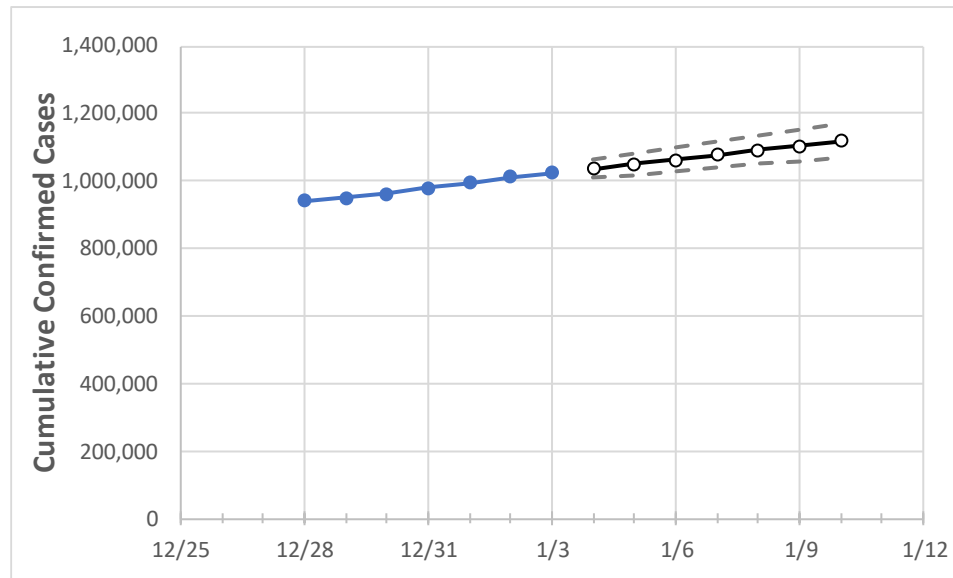
IEM's Modeling Lead

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:						
	12/31	1/1	1/2	1/3	1/4	1/5	1/6	1/7	1/8	1/9	1/10
New York	978,783	995,816	1,011,665	1,023,897	1,036,821	1,049,978	1,063,359	1,077,013	1,091,025	1,104,830	1,119,145

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:						
	12/31	1/1	1/2	1/3	1/4	1/5	1/6	1/7	1/8	1/9	1/10
Albany	11,585	11,917	12,199	12,405	12,661	12,925	13,197	13,472	13,750	14,037	14,326
Bronx	85,385	86,505	87,727	88,526	89,337	90,160	91,006	91,889	92,773	93,684	94,620
Dutchess	12,082	12,379	12,601	12,797	12,999	13,206	13,417	13,633	13,846	14,062	14,286
Erie	41,252	41,988	42,465	42,933	43,384	43,839	44,300	44,763	45,231	45,700	46,161
Kings	123,847	125,467	127,067	128,248	129,556	130,898	132,233	133,639	135,021	136,437	137,864
Monroe	33,754	34,592	35,214	35,778	36,373	36,965	37,566	38,160	38,765	39,349	39,953
Nassau	87,904	89,460	90,869	92,035	93,373	94,742	96,128	97,557	99,022	100,553	102,100
New York	60,942	61,676	62,494	62,989	63,564	64,140	64,718	65,289	65,874	66,466	67,064
Niagara	8,444	8,745	8,901	9,083	9,252	9,425	9,602	9,780	9,965	10,150	10,333
Onondaga	21,146	21,508	21,926	22,213	22,550	22,889	23,220	23,558	23,891	24,229	24,573
Orange	23,357	23,679	24,033	24,197	24,440	24,686	24,935	25,192	25,454	25,714	25,981
Putnam	4,831	4,937	5,025	5,084	5,159	5,235	5,312	5,390	5,471	5,551	5,634
Queens	125,401	127,132	128,917	130,228	131,600	133,001	134,437	135,884	137,320	138,837	140,344
Rensselaer	4,269	4,415	4,575	4,724	4,865	5,011	5,163	5,321	5,483	5,650	5,824
Richmond	35,022	35,646	36,221	36,639	37,067	37,501	37,944	38,396	38,847	39,296	39,770
Rockland	27,510	27,768	28,011	28,162	28,381	28,606	28,829	29,059	29,290	29,519	29,757
Saratoga	5,588	5,796	6,060	6,243	6,434	6,631	6,833	7,041	7,262	7,489	7,723
Schenectady	5,913	6,076	6,229	6,369	6,523	6,681	6,845	7,010	7,180	7,354	7,528
Suffolk	96,057	97,931	99,717	101,233	102,788	104,366	105,935	107,587	109,257	110,932	112,651
Sullivan	3,106	3,169	3,218	3,227	3,273	3,319	3,367	3,415	3,464	3,515	3,567
Tompkins	2,079	2,114	2,133	2,138	2,160	2,181	2,203	2,224	2,246	2,267	2,288
Ulster	5,679	5,816	5,935	6,019	6,115	6,215	6,315	6,418	6,522	6,627	6,735
Westchester	69,661	70,614	71,627	72,218	72,948	73,694	74,447	75,209	75,963	76,762	77,555

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:											
	12/31	1/1	1/2	1/3	1/5				1/7				1/9			
Albany	11,585	11,917	12,199	12,405	12,925	(2,585)	[620]	{310}	13,472	(2,694)	[647]	{323}	14,037	(2,807)	[674]	{337}
Bronx	85,385	86,505	87,727	88,526	90,160	(18,032)	[4,328]	{2,164}	91,889	(18,378)	[4,411]	{2,205}	93,684	(18,737)	[4,497]	{2,248}
Dutchess	12,082	12,379	12,601	12,797	13,206	(2,641)	[634]	{317}	13,633	(2,727)	[654]	{327}	14,062	(2,812)	[675]	{337}
Erie	41,252	41,988	42,465	42,933	43,839	(8,768)	[2,104]	{1,052}	44,763	(8,953)	[2,149]	{1,074}	45,700	(9,140)	[2,194]	{1,097}
Kings	123,847	125,467	127,067	128,248	130,898	(26,180)	[6,283]	{3,142}	133,639	(26,728)	[6,415]	{3,207}	136,437	(27,287)	[6,549]	{3,274}
Monroe	33,754	34,592	35,214	35,778	36,965	(7,393)	[1,774]	{887}	38,160	(7,632)	[1,832]	{916}	39,349	(7,870)	[1,889]	{944}
Nassau	87,904	89,460	90,869	92,035	94,742	(18,948)	[4,548]	{2,274}	97,557	(19,511)	[4,683]	{2,341}	100,553	(20,111)	[4,827]	{2,413}
New York	60,942	61,676	62,494	62,989	64,140	(12,828)	[3,079]	{1,539}	65,289	(13,058)	[3,134]	{1,567}	66,466	(13,293)	[3,190]	{1,595}
Niagara	8,444	8,745	8,901	9,083	9,425	(1,885)	[452]	{226}	9,780	(1,956)	[469]	{235}	10,150	(2,030)	[487]	{244}
Onondaga	21,146	21,508	21,926	22,213	22,889	(4,578)	[1,099]	{549}	23,558	(4,712)	[1,131]	{565}	24,229	(4,846)	[1,163]	{581}
Orange	23,357	23,679	24,033	24,197	24,686	(4,937)	[1,185]	{592}	25,192	(5,038)	[1,209]	{605}	25,714	(5,143)	[1,234]	{617}
Putnam	4,831	4,937	5,025	5,084	5,235	(1,047)	[251]	{126}	5,390	(1,078)	[259]	{129}	5,551	(1,110)	[266]	{133}
Queens	125,401	127,132	128,917	130,228	133,001	(26,600)	[6,384]	{3,192}	135,884	(27,177)	[6,522]	{3,261}	138,837	(27,767)	[6,664]	{3,332}
Rensselaer	4,269	4,415	4,575	4,724	5,011	(1,002)	[241]	{120}	5,321	(1,064)	[255]	{128}	5,650	(1,130)	[271]	{136}
Richmond	35,022	35,646	36,221	36,639	37,501	(7,500)	[1,800]	{900}	38,396	(7,679)	[1,843]	{922}	39,296	(7,859)	[1,886]	{943}
Rockland	27,510	27,768	28,011	28,162	28,606	(5,721)	[1,373]	{687}	29,059	(5,812)	[1,395]	{697}	29,519	(5,904)	[1,417]	{708}
Saratoga	5,588	5,796	6,060	6,243	6,631	(1,326)	[318]	{159}	7,041	(1,408)	[338]	{169}	7,489	(1,498)	[359]	{180}
Schenectady	5,913	6,076	6,229	6,369	6,681	(1,336)	[321]	{160}	7,010	(1,402)	[337]	{168}	7,354	(1,471)	[353]	{176}
Suffolk	96,057	97,931	99,717	101,233	104,366	(20,873)	[5,010]	{2,505}	107,587	(21,517)	[5,164]	{2,582}	110,932	(22,186)	[5,325]	{2,662}
Sullivan	3,106	3,169	3,218	3,227	3,319	(664)	[159]	{80}	3,415	(683)	[164]	{82}	3,515	(703)	[169]	{84}
Tompkins	2,079	2,114	2,133	2,138	2,181	(436)	[105]	{52}	2,224	(445)	[107]	{53}	2,267	(453)	[109]	{54}
Ulster	5,679	5,816	5,935	6,019	6,215	(1,243)	[298]	{149}	6,418	(1,284)	[308]	{154}	6,627	(1,325)	[318]	{159}
Westchester	69,661	70,614	71,627	72,218	73,694	(14,739)	[3,537]	{1,769}	75,209	(15,042)	[3,610]	{1,805}	76,762	(15,352)	[3,685]	{1,842}

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.