

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

Date: 3/8/22

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 3/8/22 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.

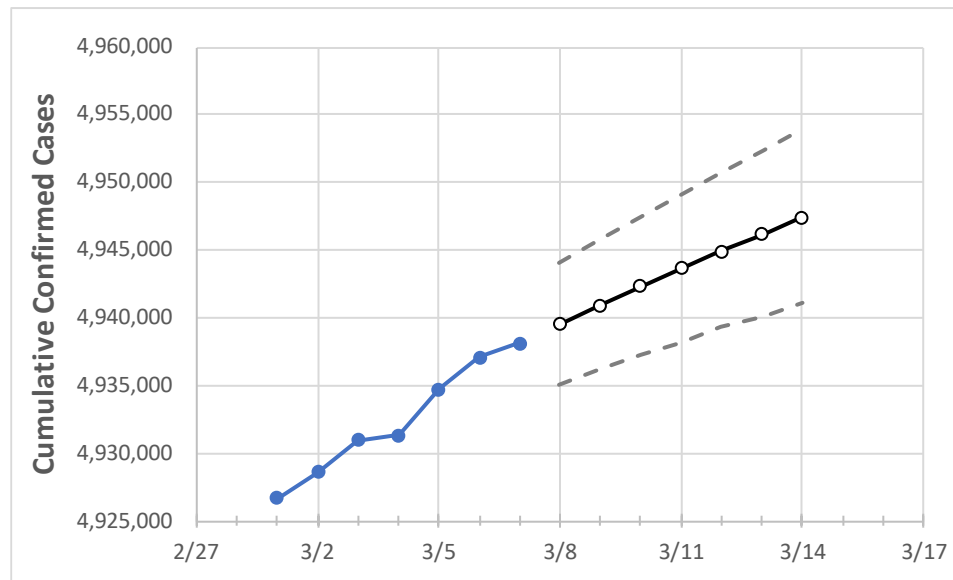
IEM's Modeling Lead

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:							
	3/4	3/5	3/6	3/7	3/8	3/9	3/10	3/11	3/12	3/13	3/14	
New York	4,931,337	4,934,709	4,937,052	4,938,085	4,939,553	4,940,925	4,942,364	4,943,662	4,944,900	4,946,171	4,947,406	

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:						
	3/4	3/5	3/6	3/7	3/8	3/9	3/10	3/11	3/12	3/13	3/14
Albany	58,060	58,101	58,130	58,143	58,167	58,189	58,210	58,232	58,252	58,272	58,292
Bronx	404,565	404,714	404,862	404,903	404,969	405,033	405,087	405,154	405,207	405,264	405,315
Dutchess	63,277	63,297	63,317	63,329	63,347	63,364	63,381	63,397	63,412	63,428	63,442
Erie	206,040	206,126	206,187	206,235	206,295	206,355	206,411	206,467	206,520	206,571	206,621
Kings	686,511	686,820	687,128	687,264	687,430	687,593	687,749	687,893	688,044	688,180	688,322
Monroe	149,470	149,523	149,560	149,583	149,623	149,658	149,693	149,728	149,761	149,792	149,822
Nassau	398,776	398,883	398,962	399,040	399,123	399,206	399,283	399,359	399,434	399,503	399,571
New York	403,339	403,629	403,808	403,935	404,126	404,311	404,489	404,672	404,841	405,019	405,186
Niagara	47,280	47,299	47,313	47,326	47,342	47,358	47,374	47,389	47,404	47,418	47,431
Onondaga	107,530	107,652	107,706	107,756	107,835	107,913	107,990	108,064	108,137	108,213	108,282
Orange	108,762	108,762	108,762	108,762	108,785	108,806	108,828	108,848	108,867	108,885	108,903
Putnam	23,328	23,336	23,343	23,348	23,354	23,359	23,364	23,369	23,374	23,379	23,383
Queens	635,061	635,248	635,355	635,446	635,560	635,671	635,778	635,882	635,983	636,082	636,171
Rensselaer	30,890	30,904	30,946	30,960	30,978	30,997	31,013	31,030	31,046	31,063	31,078
Richmond	164,229	164,279	164,328	164,357	164,391	164,422	164,451	164,480	164,508	164,535	164,561
Rockland	91,256	91,290	91,307	91,321	91,337	91,352	91,366	91,380	91,394	91,407	91,419
Saratoga	45,213	45,250	45,276	45,298	45,324	45,348	45,372	45,395	45,418	45,440	45,461
Schenectady	32,397	32,419	32,427	32,435	32,448	32,460	32,473	32,484	32,495	32,507	32,516
Suffolk	422,992	423,073	423,166	423,224	423,301	423,375	423,445	423,514	423,577	423,642	423,706
Sullivan	18,202	18,210	18,213	18,216	18,221	18,227	18,231	18,236	18,241	18,245	18,249
Tompkins	17,518	17,564	17,580	17,584	17,606	17,627	17,646	17,668	17,688	17,708	17,727
Ulster	30,892	30,909	30,935	30,949	30,967	30,984	31,001	31,017	31,033	31,049	31,064
Westchester	246,928	247,036	247,250	247,298	247,374	247,447	247,521	247,593	247,663	247,734	247,803

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:											
	3/4	3/5	3/6	3/7	3/9			3/11			3/13					
Albany	58,060	58,101	58,130	58,143	58,189	(11,638)	[2,793]	{1,397}	58,232	(11,646)	[2,795]	{1,398}	58,272	(11,654)	[2,797]	{1,399}
Bronx	404,565	404,714	404,862	404,903	405,033	(81,007)	[19,442]	{9,721}	405,154	(81,031)	[19,447]	{9,724}	405,264	(81,053)	[19,453]	{9,726}
Dutchess	63,277	63,297	63,317	63,329	63,364	(12,673)	[3,041]	{1,521}	63,397	(12,679)	[3,043]	{1,522}	63,428	(12,686)	[3,045]	{1,522}
Erie	206,040	206,126	206,187	206,235	206,355	(41,271)	[9,905]	{4,953}	206,467	(41,293)	[9,910]	{4,955}	206,571	(41,314)	[9,915]	{4,958}
Kings	686,511	686,820	687,128	687,264	687,593	(137,519)	[33,004]	{16,502}	687,893	(137,579)	[33,019]	{16,509}	688,180	(137,636)	[33,033]	{16,516}
Monroe	149,470	149,523	149,560	149,583	149,658	(29,932)	[7,184]	{3,592}	149,728	(29,946)	[7,187]	{3,593}	149,792	(29,958)	[7,190]	{3,595}
Nassau	398,776	398,883	398,962	399,040	399,206	(79,841)	[19,162]	{9,581}	399,359	(79,872)	[19,169]	{9,585}	399,503	(79,901)	[19,176]	{9,588}
New York	403,339	403,629	403,808	403,935	404,311	(80,862)	[19,407]	{9,703}	404,672	(80,934)	[19,424]	{9,712}	405,019	(81,004)	[19,441]	{9,720}
Niagara	47,280	47,299	47,313	47,326	47,358	(9,472)	[2,273]	{1,137}	47,389	(9,478)	[2,275]	{1,137}	47,418	(9,484)	[2,276]	{1,138}
Onondaga	107,530	107,652	107,706	107,756	107,913	(21,583)	[5,180]	{2,590}	108,064	(21,613)	[5,187]	{2,594}	108,213	(21,643)	[5,194]	{2,597}
Orange	108,762	108,762	108,762	108,762	108,806	(21,761)	[5,223]	{2,611}	108,848	(21,770)	[5,225]	{2,612}	108,885	(21,777)	[5,226]	{2,613}
Putnam	23,328	23,336	23,343	23,348	23,359	(4,672)	[1,121]	{561}	23,369	(4,674)	[1,122]	{561}	23,379	(4,676)	[1,122]	{561}
Queens	635,061	635,248	635,355	635,446	635,671	(127,134)	[30,512]	{15,256}	635,882	(127,176)	[30,522]	{15,261}	636,082	(127,216)	[30,532]	{15,266}
Rensselaer	30,890	30,904	30,946	30,960	30,997	(6,199)	[1,488]	{744}	31,030	(6,206)	[1,489]	{745}	31,063	(6,213)	[1,491]	{746}
Richmond	164,229	164,279	164,328	164,357	164,422	(32,884)	[7,892]	{3,946}	164,480	(32,896)	[7,895]	{3,948}	164,535	(32,907)	[7,898]	{3,949}
Rockland	91,256	91,290	91,307	91,321	91,352	(18,270)	[4,385]	{2,192}	91,380	(18,276)	[4,386]	{2,193}	91,407	(18,281)	[4,388]	{2,194}
Saratoga	45,213	45,250	45,276	45,298	45,348	(9,070)	[2,177]	{1,088}	45,395	(9,079)	[2,179]	{1,089}	45,440	(9,088)	[2,181]	{1,091}
Schenectady	32,397	32,419	32,427	32,435	32,460	(6,492)	[1,558]	{779}	32,484	(6,497)	[1,559]	{780}	32,507	(6,501)	[1,560]	{780}
Suffolk	422,992	423,073	423,166	423,224	423,375	(84,675)	[20,322]	{10,161}	423,514	(84,703)	[20,329]	{10,164}	423,642	(84,728)	[20,335]	{10,167}
Sullivan	18,202	18,210	18,213	18,216	18,227	(3,645)	[875]	{437}	18,236	(3,647)	[875]	{438}	18,245	(3,649)	[876]	{438}
Tompkins	17,518	17,564	17,580	17,584	17,627	(3,525)	[846]	{423}	17,668	(3,534)	[848]	{424}	17,708	(3,542)	[850]	{425}
Ulster	30,892	30,909	30,935	30,949	30,984	(6,197)	[1,487]	{744}	31,017	(6,203)	[1,489]	{744}	31,049	(6,210)	[1,490]	{745}
Westchester	246,928	247,036	247,250	247,298	247,447	(49,489)	[11,877]	{5,939}	247,593	(49,519)	[11,884]	{5,942}	247,734	(49,547)	[11,891]	{5,946}

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.