

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

Date: 6/2/21

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 6/2/21 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.

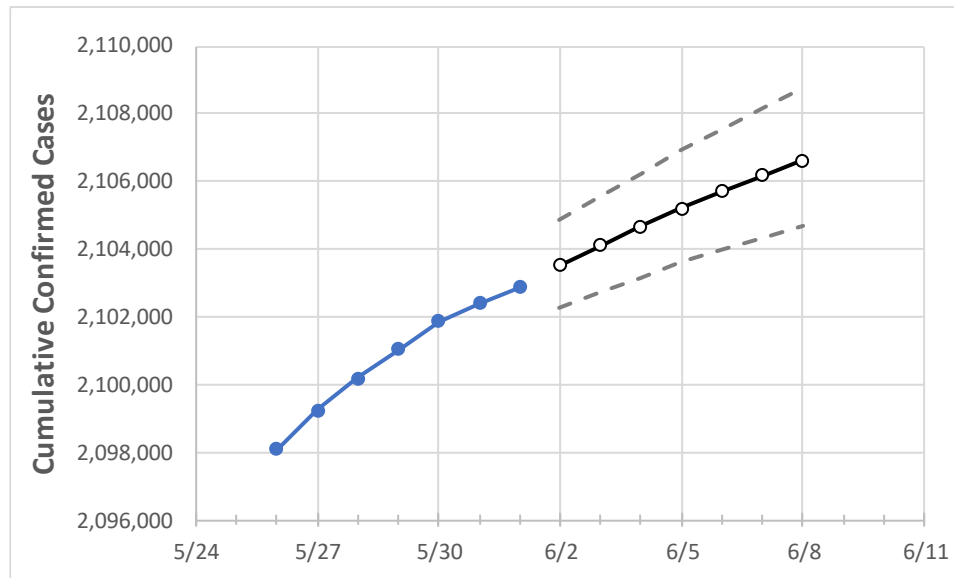
IEM's Modeling Lead

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:							
	5/29	5/30	5/31	6/1	6/2	6/3	6/4	6/5	6/6	6/7	6/8	
New York	2,101,055	2,101,875	2,102,404	2,102,869	2,103,509	2,104,115	2,104,675	2,105,203	2,105,714	2,106,181	2,106,614	

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:						
	5/29	5/30	5/31	6/1	6/2	6/3	6/4	6/5	6/6	6/7	6/8
Albany	24,621	24,628	24,633	24,634	24,642	24,650	24,657	24,663	24,670	24,676	24,682
Bronx	182,479	182,548	182,591	182,635	182,683	182,729	182,774	182,816	182,858	182,899	182,936
Dutchess	29,380	29,385	29,392	29,394	29,400	29,406	29,412	29,417	29,422	29,426	29,430
Erie	89,219	89,270	89,289	89,314	89,346	89,378	89,405	89,432	89,457	89,480	89,502
Kings	279,526	279,611	279,682	279,755	279,845	279,929	280,009	280,084	280,156	280,225	280,290
Monroe	68,310	68,386	68,440	68,480	68,544	68,604	68,660	68,715	68,763	68,810	68,857
Nassau	183,145	183,169	183,195	183,212	183,245	183,275	183,304	183,330	183,355	183,378	183,400
New York	137,676	137,710	137,742	137,766	137,800	137,834	137,867	137,898	137,928	137,956	137,981
Niagara	19,956	19,968	19,970	19,980	19,990	20,000	20,009	20,017	20,025	20,033	20,040
Onondaga	38,643	38,691	38,703	38,715	38,745	38,775	38,805	38,833	38,860	38,885	38,911
Orange	48,132	48,145	48,154	48,162	48,173	48,183	48,193	48,203	48,212	48,220	48,228
Putnam	10,573	10,574	10,575	10,577	10,578	10,580	10,581	10,582	10,583	10,584	10,585
Queens	276,253	276,330	276,401	276,485	276,564	276,642	276,718	276,789	276,856	276,920	276,981
Rensselaer	11,186	11,188	11,189	11,192	11,194	11,196	11,198	11,200	11,201	11,203	11,204
Richmond	74,614	74,644	74,665	74,689	74,714	74,739	74,762	74,784	74,805	74,825	74,844
Rockland	46,835	46,844	46,849	46,857	46,864	46,871	46,878	46,884	46,890	46,895	46,901
Saratoga	15,291	15,295	15,302	15,306	15,314	15,321	15,328	15,335	15,341	15,347	15,353
Schenectady	13,143	13,152	13,154	13,156	13,163	13,169	13,176	13,182	13,188	13,194	13,199
Suffolk	200,393	200,501	200,520	200,548	200,590	200,631	200,671	200,708	200,743	200,779	200,810
Sullivan	6,634	6,636	6,637	6,637	6,641	6,645	6,649	6,653	6,656	6,659	6,663
Tompkins	4,310	4,318	4,322	4,323	4,326	4,329	4,332	4,334	4,337	4,339	4,341
Ulster	13,864	13,867	13,872	13,873	13,876	13,879	13,882	13,885	13,887	13,889	13,891
Westchester	129,342	129,369	129,387	129,399	129,421	129,442	129,462	129,481	129,499	129,517	129,534

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:											
	5/29	5/30	5/31	6/1	6/3			6/5			6/7					
Albany	24,621	24,628	24,633	24,634	24,650	(4,930)	[1,183]	{592}	24,663	(4,933)	[1,184]	{592}	24,676	(4,935)	[1,184]	{592}
Bronx	182,479	182,548	182,591	182,635	182,729	(36,546)	[8,771]	{4,386}	182,816	(36,563)	[8,775]	{4,388}	182,899	(36,580)	[8,779]	{4,390}
Dutchess	29,380	29,385	29,392	29,394	29,406	(5,881)	[1,412]	{706}	29,417	(5,883)	[1,412]	{706}	29,426	(5,885)	[1,412]	{706}
Erie	89,219	89,270	89,289	89,314	89,378	(17,876)	[4,290]	{2,145}	89,432	(17,886)	[4,293]	{2,146}	89,480	(17,896)	[4,295]	{2,148}
Kings	279,526	279,611	279,682	279,755	279,929	(55,986)	[13,437]	{6,718}	280,084	(56,017)	[13,444]	{6,722}	280,225	(56,045)	[13,451]	{6,725}
Monroe	68,310	68,386	68,440	68,480	68,604	(13,721)	[3,293]	{1,646}	68,715	(13,743)	[3,298]	{1,649}	68,810	(13,762)	[3,303]	{1,651}
Nassau	183,145	183,169	183,195	183,212	183,275	(36,655)	[8,797]	{4,399}	183,330	(36,666)	[8,800]	{4,400}	183,378	(36,676)	[8,802]	{4,401}
New York	137,676	137,710	137,742	137,766	137,834	(27,567)	[6,616]	{3,308}	137,898	(27,580)	[6,619]	{3,310}	137,956	(27,591)	[6,622]	{3,311}
Niagara	19,956	19,968	19,970	19,980	20,000	(4,000)	[960]	{480}	20,017	(4,003)	[961]	{480}	20,033	(4,007)	[962]	{481}
Onondaga	38,643	38,691	38,703	38,715	38,775	(7,755)	[1,861]	{931}	38,833	(7,767)	[1,864]	{932}	38,885	(7,777)	[1,866]	{933}
Orange	48,132	48,145	48,154	48,162	48,183	(9,637)	[2,313]	{1,156}	48,203	(9,641)	[2,314]	{1,157}	48,220	(9,644)	[2,315]	{1,157}
Putnam	10,573	10,574	10,575	10,577	10,580	(2,116)	[508]	{254}	10,582	(2,116)	[508]	{254}	10,584	(2,117)	[508]	{254}
Queens	276,253	276,330	276,401	276,485	276,642	(55,328)	[13,279]	{6,639}	276,789	(55,358)	[13,286]	{6,643}	276,920	(55,384)	[13,292]	{6,646}
Rensselaer	11,186	11,188	11,189	11,192	11,196	(2,239)	[537]	{269}	11,200	(2,240)	[538]	{269}	11,203	(2,241)	[538]	{269}
Richmond	74,614	74,644	74,665	74,689	74,739	(14,948)	[3,587]	{1,794}	74,784	(14,957)	[3,590]	{1,795}	74,825	(14,965)	[3,592]	{1,796}
Rockland	46,835	46,844	46,849	46,857	46,871	(9,374)	[2,250]	{1,125}	46,884	(9,377)	[2,250]	{1,125}	46,895	(9,379)	[2,251]	{1,125}
Saratoga	15,291	15,295	15,302	15,306	15,321	(3,064)	[735]	{368}	15,335	(3,067)	[736]	{368}	15,347	(3,069)	[737]	{368}
Schenectady	13,143	13,152	13,154	13,156	13,169	(2,634)	[632]	{316}	13,182	(2,636)	[633]	{316}	13,194	(2,639)	[633]	{317}
Suffolk	200,393	200,501	200,520	200,548	200,631	(40,126)	[9,630]	{4,815}	200,708	(40,142)	[9,634]	{4,817}	200,779	(40,156)	[9,637]	{4,819}
Sullivan	6,634	6,636	6,637	6,637	6,645	(1,329)	[319]	{159}	6,653	(1,331)	[319]	{160}	6,659	(1,332)	[320]	{160}
Tompkins	4,310	4,318	4,322	4,323	4,329	(866)	[208]	{104}	4,334	(867)	[208]	{104}	4,339	(868)	[208]	{104}
Ulster	13,864	13,867	13,872	13,873	13,879	(2,776)	[666]	{333}	13,885	(2,777)	[666]	{333}	13,889	(2,778)	[667]	{333}
Westchester	129,342	129,369	129,387	129,399	129,442	(25,888)	[6,213]	{3,107}	129,481	(25,896)	[6,215]	{3,108}	129,517	(25,903)	[6,217]	{3,108}

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.