

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

Date: 6/1/21

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 6/1/21 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.

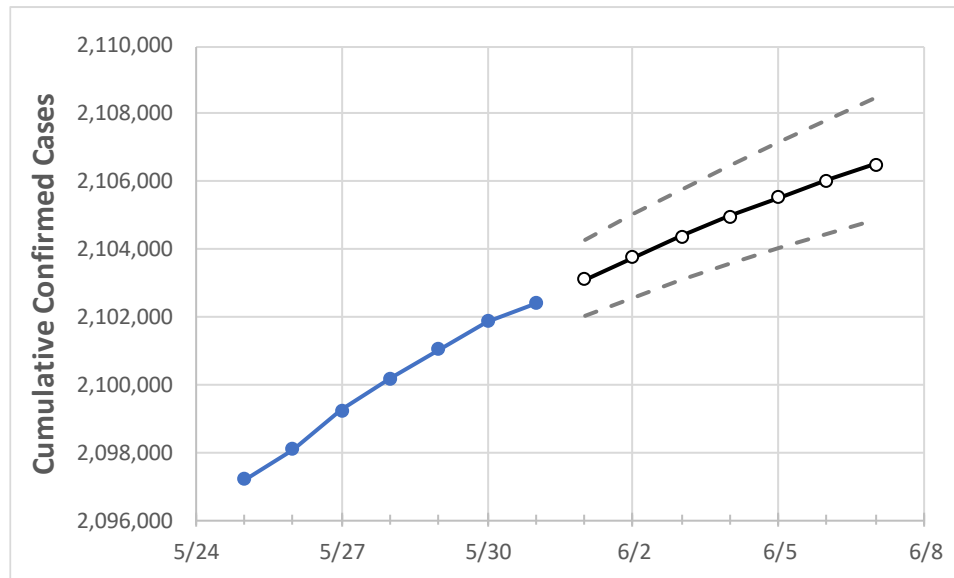
IEM's Modeling Lead

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:							
	5/28	5/29	5/30	5/31	6/1	6/2	6/3	6/4	6/5	6/6	6/7	
New York	2,100,183	2,101,055	2,101,875	2,102,404	2,103,113	2,103,764	2,104,390	2,104,977	2,105,526	2,106,038	2,106,516	

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:						
	5/28	5/29	5/30	5/31	6/1	6/2	6/3	6/4	6/5	6/6	6/7
Albany	24,614	24,621	24,628	24,633	24,642	24,651	24,660	24,668	24,676	24,684	24,691
Bronx	182,422	182,479	182,548	182,591	182,643	182,694	182,743	182,787	182,831	182,874	182,915
Dutchess	29,371	29,380	29,385	29,392	29,399	29,406	29,413	29,419	29,424	29,430	29,435
Erie	89,180	89,219	89,270	89,289	89,323	89,356	89,386	89,415	89,441	89,466	89,489
Kings	279,421	279,526	279,611	279,682	279,779	279,871	279,959	280,041	280,117	280,195	280,268
Monroe	68,233	68,310	68,386	68,440	68,510	68,576	68,638	68,698	68,754	68,808	68,858
Nassau	183,108	183,145	183,169	183,195	183,232	183,265	183,297	183,327	183,356	183,382	183,408
New York	137,618	137,676	137,710	137,742	137,780	137,817	137,850	137,883	137,914	137,945	137,972
Niagara	19,947	19,956	19,968	19,970	19,981	19,991	20,001	20,010	20,019	20,027	20,035
Onondaga	38,596	38,643	38,691	38,703	38,736	38,769	38,800	38,832	38,861	38,890	38,918
Orange	48,113	48,132	48,145	48,154	48,165	48,176	48,186	48,195	48,205	48,214	48,222
Putnam	10,570	10,573	10,574	10,575	10,576	10,578	10,579	10,580	10,581	10,582	10,583
Queens	276,149	276,253	276,330	276,401	276,486	276,563	276,635	276,705	276,773	276,833	276,891
Rensselaer	11,185	11,186	11,188	11,189	11,191	11,194	11,196	11,197	11,199	11,201	11,202
Richmond	74,590	74,614	74,644	74,665	74,693	74,720	74,745	74,768	74,791	74,813	74,835
Rockland	46,829	46,835	46,844	46,849	46,856	46,863	46,870	46,876	46,882	46,888	46,894
Saratoga	15,280	15,291	15,295	15,302	15,310	15,318	15,326	15,333	15,339	15,346	15,352
Schenectady	13,133	13,143	13,152	13,154	13,161	13,169	13,176	13,182	13,189	13,195	13,201
Suffolk	200,333	200,393	200,501	200,520	200,567	200,611	200,653	200,693	200,732	200,770	200,805
Sullivan	6,627	6,634	6,636	6,637	6,641	6,645	6,649	6,652	6,656	6,659	6,663
Tompkins	4,307	4,310	4,318	4,322	4,325	4,329	4,332	4,335	4,338	4,341	4,344
Ulster	13,861	13,864	13,867	13,872	13,876	13,879	13,882	13,884	13,887	13,890	13,892
Westchester	129,313	129,342	129,369	129,387	129,410	129,433	129,455	129,476	129,495	129,513	129,532

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:											
	5/28	5/29	5/30	5/31	6/2				6/4				6/6			
Albany	24,614	24,621	24,628	24,633	24,651	(4,930)	[1,183]	{592}	24,668	(4,934)	[1,184]	{592}	24,684	(4,937)	[1,185]	{592}
Bronx	182,422	182,479	182,548	182,591	182,694	(36,539)	[8,769]	{4,385}	182,787	(36,557)	[8,774]	{4,387}	182,874	(36,575)	[8,778]	{4,389}
Dutchess	29,371	29,380	29,385	29,392	29,406	(5,881)	[1,412]	{706}	29,419	(5,884)	[1,412]	{706}	29,430	(5,886)	[1,413]	{706}
Erie	89,180	89,219	89,270	89,289	89,356	(17,871)	[4,289]	{2,145}	89,415	(17,883)	[4,292]	{2,146}	89,466	(17,893)	[4,294]	{2,147}
Kings	279,421	279,526	279,611	279,682	279,871	(55,974)	[13,434]	{6,717}	280,041	(56,008)	[13,442]	{6,721}	280,195	(56,039)	[13,449]	{6,725}
Monroe	68,233	68,310	68,386	68,440	68,576	(13,715)	[3,292]	{1,646}	68,698	(13,740)	[3,297]	{1,649}	68,808	(13,762)	[3,303]	{1,651}
Nassau	183,108	183,145	183,169	183,195	183,265	(36,653)	[8,797]	{4,398}	183,327	(36,665)	[8,800]	{4,400}	183,382	(36,676)	[8,802]	{4,401}
New York	137,618	137,676	137,710	137,742	137,817	(27,563)	[6,615]	{3,308}	137,883	(27,577)	[6,618]	{3,309}	137,945	(27,589)	[6,621]	{3,311}
Niagara	19,947	19,956	19,968	19,970	19,991	(3,998)	[960]	{480}	20,010	(4,002)	[960]	{480}	20,027	(4,005)	[961]	{481}
Onondaga	38,596	38,643	38,691	38,703	38,769	(7,754)	[1,861]	{930}	38,832	(7,766)	[1,864]	{932}	38,890	(7,778)	[1,867]	{933}
Orange	48,113	48,132	48,145	48,154	48,176	(9,635)	[2,312]	{1,156}	48,195	(9,639)	[2,313]	{1,157}	48,214	(9,643)	[2,314]	{1,157}
Putnam	10,570	10,573	10,574	10,575	10,578	(2,116)	[508]	{254}	10,580	(2,116)	[508]	{254}	10,582	(2,116)	[508]	{254}
Queens	276,149	276,253	276,330	276,401	276,563	(55,313)	[13,275]	{6,638}	276,705	(55,341)	[13,282]	{6,641}	276,833	(55,367)	[13,288]	{6,644}
Rensselaer	11,185	11,186	11,188	11,189	11,194	(2,239)	[537]	{269}	11,197	(2,239)	[537]	{269}	11,201	(2,240)	[538]	{269}
Richmond	74,590	74,614	74,644	74,665	74,720	(14,944)	[3,587]	{1,793}	74,768	(14,954)	[3,589]	{1,794}	74,813	(14,963)	[3,591]	{1,796}
Rockland	46,829	46,835	46,844	46,849	46,863	(9,373)	[2,249]	{1,125}	46,876	(9,375)	[2,250]	{1,125}	46,888	(9,378)	[2,251]	{1,125}
Saratoga	15,280	15,291	15,295	15,302	15,318	(3,064)	[735]	{368}	15,333	(3,067)	[736]	{368}	15,346	(3,069)	[737]	{368}
Schenectady	13,133	13,143	13,152	13,154	13,169	(2,634)	[632]	{316}	13,182	(2,636)	[633]	{316}	13,195	(2,639)	[633]	{317}
Suffolk	200,333	200,393	200,501	200,520	200,611	(40,122)	[9,629]	{4,815}	200,693	(40,139)	[9,633]	{4,817}	200,770	(40,154)	[9,637]	{4,818}
Sullivan	6,627	6,634	6,636	6,637	6,645	(1,329)	[319]	{159}	6,652	(1,330)	[319]	{160}	6,659	(1,332)	[320]	{160}
Tompkins	4,307	4,310	4,318	4,322	4,329	(866)	[208]	{104}	4,335	(867)	[208]	{104}	4,341	(868)	[208]	{104}
Ulster	13,861	13,864	13,867	13,872	13,879	(2,776)	[666]	{333}	13,884	(2,777)	[666]	{333}	13,890	(2,778)	[667]	{333}
Westchester	129,313	129,342	129,369	129,387	129,433	(25,887)	[6,213]	{3,106}	129,476	(25,895)	[6,215]	{3,107}	129,513	(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.