

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

Date: 6/8/21

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 6/8/21 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.

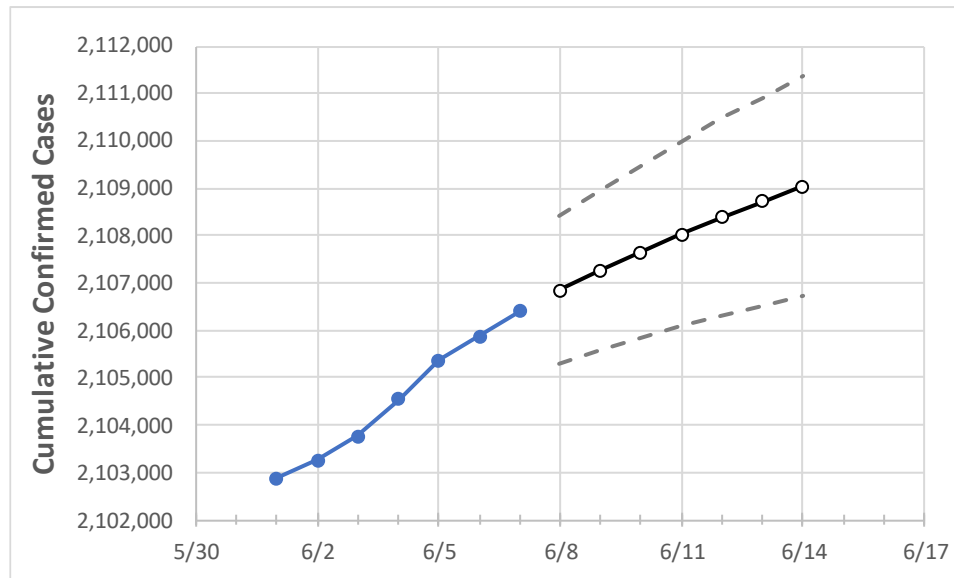
IEM's Modeling Lead

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:							
	6/4	6/5	6/6	6/7	6/8	6/9	6/10	6/11	6/12	6/13	6/14	
New York	2,104,539	2,105,375	2,105,882	2,106,399	2,106,841	2,107,266	2,107,650	2,108,024	2,108,386	2,108,714	2,109,035	

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:						
	6/4	6/5	6/6	6/7	6/8	6/9	6/10	6/11	6/12	6/13	6/14
Albany	24,652	24,661	24,668	24,675	24,679	24,683	24,687	24,690	24,693	24,696	24,699
Bronx	182,803	182,901	182,938	183,009	183,060	183,111	183,160	183,206	183,253	183,298	183,342
Dutchess	29,422	29,434	29,443	29,448	29,453	29,458	29,462	29,467	29,471	29,474	29,478
Erie	89,386	89,422	89,446	89,472	89,492	89,511	89,529	89,546	89,561	89,576	89,590
Kings	279,902	279,991	280,050	280,110	280,155	280,199	280,239	280,279	280,313	280,346	280,378
Monroe	68,625	68,679	68,723	68,768	68,804	68,839	68,872	68,902	68,931	68,959	68,985
Nassau	183,309	183,360	183,392	183,422	183,445	183,467	183,487	183,507	183,526	183,543	183,560
New York	137,886	137,929	137,963	137,990	138,018	138,045	138,072	138,099	138,123	138,147	138,169
Niagara	19,995	20,003	20,006	20,011	20,015	20,018	20,021	20,023	20,026	20,028	20,030
Onondaga	38,758	38,798	38,816	38,839	38,856	38,874	38,890	38,906	38,920	38,935	38,949
Orange	48,201	48,216	48,228	48,237	48,247	48,257	48,266	48,275	48,283	48,291	48,300
Putnam	10,589	10,592	10,595	10,599	10,601	10,604	10,606	10,608	10,611	10,613	10,615
Queens	276,665	276,759	276,805	276,849	276,902	276,950	276,997	277,041	277,082	277,122	277,159
Rensselaer	11,204	11,205	11,208	11,215	11,217	11,219	11,220	11,222	11,223	11,225	11,226
Richmond	74,757	74,783	74,801	74,822	74,841	74,859	74,877	74,894	74,909	74,925	74,940
Rockland	46,882	46,894	46,904	46,905	46,911	46,917	46,923	46,928	46,933	46,938	46,943
Saratoga	15,324	15,330	15,337	15,342	15,346	15,351	15,355	15,358	15,361	15,364	15,368
Schenectady	13,170	13,175	13,178	13,180	13,183	13,186	13,189	13,192	13,195	13,197	13,199
Suffolk	200,656	200,704	200,727	200,766	200,798	200,828	200,858	200,887	200,914	200,939	200,962
Sullivan	6,648	6,654	6,657	6,661	6,664	6,667	6,670	6,673	6,675	6,678	6,681
Tompkins	4,334	4,336	4,338	4,341	4,343	4,345	4,347	4,349	4,351	4,353	4,355
Ulster	13,881	13,885	13,886	13,889	13,891	13,892	13,893	13,895	13,896	13,897	13,898
Westchester	129,449	129,471	129,488	129,507	129,522	129,536	129,550	129,563	129,575	129,587	129,597

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:											
	6/4	6/5	6/6	6/7	6/9			6/11			6/13					
Albany	24,652	24,661	24,668	24,675	24,683	(4,937)	[1,185]	{592}	24,690	(4,938)	[1,185]	{593}	24,696	(4,939)	[1,185]	{593}
Bronx	182,803	182,901	182,938	183,009	183,111	(36,622)	[8,789]	{4,395}	183,206	(36,641)	[8,794]	{4,397}	183,298	(36,660)	[8,798]	{4,399}
Dutchess	29,422	29,434	29,443	29,448	29,458	(5,892)	[1,414]	{707}	29,467	(5,893)	[1,414]	{707}	29,474	(5,895)	[1,415]	{707}
Erie	89,386	89,422	89,446	89,472	89,511	(17,902)	[4,297]	{2,148}	89,546	(17,909)	[4,298]	{2,149}	89,576	(17,915)	[4,300]	{2,150}
Kings	279,902	279,991	280,050	280,110	280,199	(56,040)	[13,450]	{6,725}	280,279	(56,056)	[13,453]	{6,727}	280,346	(56,069)	[13,457]	{6,728}
Monroe	68,625	68,679	68,723	68,768	68,839	(13,768)	[3,304]	{1,652}	68,902	(13,780)	[3,307]	{1,654}	68,959	(13,792)	[3,310]	{1,655}
Nassau	183,309	183,360	183,392	183,422	183,467	(36,693)	[8,806]	{4,403}	183,507	(36,701)	[8,808]	{4,404}	183,543	(36,709)	[8,810]	{4,405}
New York	137,886	137,929	137,963	137,990	138,045	(27,609)	[6,626]	{3,313}	138,099	(27,620)	[6,629]	{3,314}	138,147	(27,629)	[6,631]	{3,316}
Niagara	19,995	20,003	20,006	20,011	20,018	(4,004)	[961]	{480}	20,023	(4,005)	[961]	{481}	20,028	(4,006)	[961]	{481}
Onondaga	38,758	38,798	38,816	38,839	38,874	(7,775)	[1,866]	{933}	38,906	(7,781)	[1,867]	{934}	38,935	(7,787)	[1,869]	{934}
Orange	48,201	48,216	48,228	48,237	48,257	(9,651)	[2,316]	{1,158}	48,275	(9,655)	[2,317]	{1,159}	48,291	(9,658)	[2,318]	{1,159}
Putnam	10,589	10,592	10,595	10,599	10,604	(2,121)	[509]	{254}	10,608	(2,122)	[509]	{255}	10,613	(2,123)	[509]	{255}
Queens	276,665	276,759	276,805	276,849	276,950	(55,390)	[13,294]	{6,647}	277,041	(55,408)	[13,298]	{6,649}	277,122	(55,424)	[13,302]	{6,651}
Rensselaer	11,204	11,205	11,208	11,215	11,219	(2,244)	[538]	{269}	11,222	(2,244)	[539]	{269}	11,225	(2,245)	[539]	{269}
Richmond	74,757	74,783	74,801	74,822	74,859	(14,972)	[3,593]	{1,797}	74,894	(14,979)	[3,595]	{1,797}	74,925	(14,985)	[3,596]	{1,798}
Rockland	46,882	46,894	46,904	46,905	46,917	(9,383)	[2,252]	{1,126}	46,928	(9,386)	[2,253]	{1,126}	46,938	(9,388)	[2,253]	{1,127}
Saratoga	15,324	15,330	15,337	15,342	15,351	(3,070)	[737]	{368}	15,358	(3,072)	[737]	{369}	15,364	(3,073)	[737]	{369}
Schenectady	13,170	13,175	13,178	13,180	13,186	(2,637)	[633]	{316}	13,192	(2,638)	[633]	{317}	13,197	(2,639)	[633]	{317}
Suffolk	200,656	200,704	200,727	200,766	200,828	(40,166)	[9,640]	{4,820}	200,887	(40,177)	[9,643]	{4,821}	200,939	(40,188)	[9,645]	{4,823}
Sullivan	6,648	6,654	6,657	6,661	6,667	(1,333)	[320]	{160}	6,673	(1,335)	[320]	{160}	6,678	(1,336)	[321]	{160}
Tompkins	4,334	4,336	4,338	4,341	4,345	(869)	[209]	{104}	4,349	(870)	[209]	{104}	4,353	(871)	[209]	{104}
Ulster	13,881	13,885	13,886	13,889	13,892	(2,778)	[667]	{333}	13,895	(2,779)	[667]	{333}	13,897	(2,779)	[667]	{334}
Westchester	129,449	129,471	129,488	129,507	129,536	(25,907)	[6,218]	{3,109}	129,563	(25,913)	[6,219]	{3,110}	129,587	(25,917)	[6,220]	{3,110}

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.