

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

Date: 6/14/21

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 6/14/21 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.

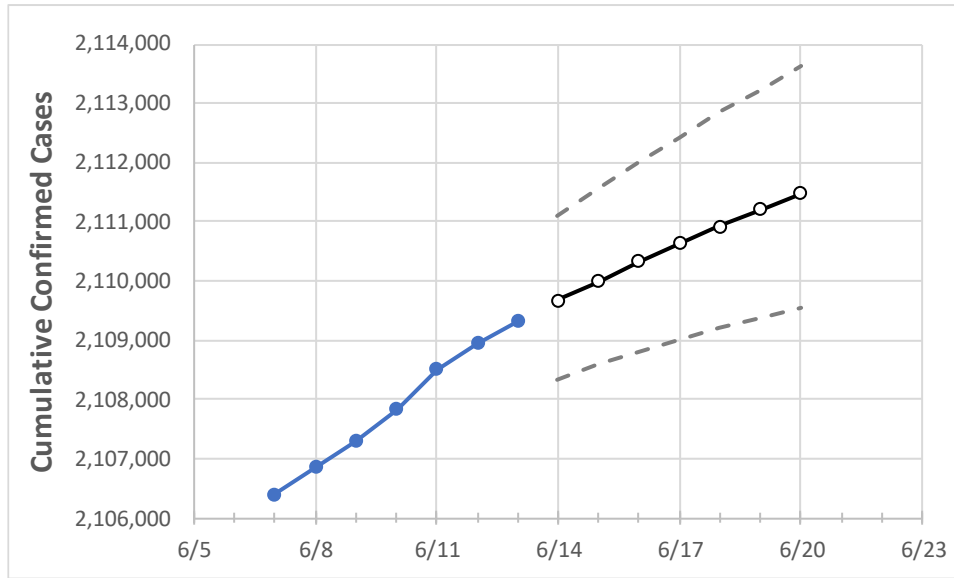
IEM's Modeling Lead

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:						
	6/10	6/11	6/12	6/13	6/14	6/15	6/16	6/17	6/18	6/19	6/20

New York 2,107,831 2,108,510 2,108,950 2,109,313 2,109,667 2,110,002 2,110,330 2,110,631 2,110,926 2,111,212 2,111,480

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:							
	6/10	6/11	6/12	6/13	6/14	6/15	6/16	6/17	6/18	6/19	6/20	
Albany	24,685	24,687	24,689	24,694	24,697	24,699	24,702	24,704	24,706	24,708	24,710	
Bronx	183,220	183,323	183,378	183,412	183,464	183,514	183,563	183,613	183,660	183,707	183,754	
Dutchess	29,460	29,464	29,467	29,468	29,472	29,475	29,478	29,481	29,484	29,487	29,490	
Erie	89,520	89,541	89,557	89,564	89,577	89,589	89,600	89,611	89,621	89,630	89,638	
Kings	280,306	280,439	280,468	280,513	280,557	280,598	280,638	280,675	280,709	280,741	280,774	
Monroe	68,853	68,879	68,901	68,929	68,952	68,974	68,994	69,013	69,030	69,046	69,062	
Nassau	183,511	183,545	183,578	183,601	183,623	183,644	183,664	183,684	183,703	183,721	183,739	
New York	138,092	138,127	138,177	138,212	138,243	138,273	138,303	138,332	138,361	138,390	138,417	
Niagara	20,019	20,027	20,030	20,032	20,034	20,036	20,038	20,040	20,041	20,043	20,044	
Onondaga	38,875	38,888	38,903	38,913	38,924	38,935	38,946	38,955	38,964	38,973	38,982	
Orange	48,268	48,281	48,294	48,303	48,312	48,322	48,331	48,339	48,348	48,356	48,364	
Putnam	10,602	10,604	10,605	10,605	10,607	10,608	10,610	10,612	10,613	10,615	10,616	
Queens	277,026	277,130	277,151	277,187	277,230	277,270	277,309	277,345	277,381	277,413	277,444	
Rensselaer	11,220	11,222	11,223	11,225	11,227	11,228	11,230	11,231	11,232	11,234	11,235	
Richmond	74,877	74,918	74,931	74,944	74,960	74,975	74,990	75,005	75,020	75,033	75,046	
Rockland	46,920	46,924	46,930	46,935	46,940	46,944	46,948	46,953	46,957	46,961	46,964	
Saratoga	15,350	15,352	15,357	15,359	15,362	15,364	15,367	15,369	15,371	15,373	15,375	
Schenectady	13,186	13,190	13,192	13,197	13,199	13,201	13,203	13,204	13,206	13,208	13,209	
Suffolk	200,858	200,895	200,959	200,989	201,014	201,040	201,063	201,086	201,107	201,127	201,147	
Sullivan	6,668	6,670	6,671	6,672	6,674	6,676	6,678	6,679	6,681	6,683	6,684	
Tompkins	4,345	4,345	4,346	4,346	4,347	4,349	4,350	4,352	4,353	4,354	4,356	
Ulster	13,894	13,897	13,903	13,905	13,907	13,908	13,909	13,911	13,912	13,913	13,914	
Westchester	129,579	129,600	129,624	129,645	129,660	129,676	129,691	129,706	129,721	129,735	129,750	

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:											
	6/10	6/11	6/12	6/13	6/15				6/17				6/19			
Albany	24,685	24,687	24,689	24,694	24,699	(4,940)	[1,186]	{593}	24,704	(4,941)	[1,186]	{593}	24,708	(4,942)	[1,186]	{593}
Bronx	183,220	183,323	183,378	183,412	183,514	(36,703)	[8,809]	{4,404}	183,613	(36,723)	[8,813]	{4,407}	183,707	(36,741)	[8,818]	{4,409}
Dutchess	29,460	29,464	29,467	29,468	29,475	(5,895)	[1,415]	{707}	29,481	(5,896)	[1,415]	{708}	29,487	(5,897)	[1,415]	{708}
Erie	89,520	89,541	89,557	89,564	89,589	(17,918)	[4,300]	{2,150}	89,611	(17,922)	[4,301]	{2,151}	89,630	(17,926)	[4,302]	{2,151}
Kings	280,306	280,439	280,468	280,513	280,598	(56,120)	[13,469]	{6,734}	280,675	(56,135)	[13,472]	{6,736}	280,741	(56,148)	[13,476]	{6,738}
Monroe	68,853	68,879	68,901	68,929	68,974	(13,795)	[3,311]	{1,655}	69,013	(13,803)	[3,313]	{1,656}	69,046	(13,809)	[3,314]	{1,657}
Nassau	183,511	183,545	183,578	183,601	183,644	(36,729)	[8,815]	{4,407}	183,684	(36,737)	[8,817]	{4,408}	183,721	(36,744)	[8,819]	{4,409}
New York	138,092	138,127	138,177	138,212	138,273	(27,655)	[6,637]	{3,319}	138,332	(27,666)	[6,640]	{3,320}	138,390	(27,678)	[6,643]	{3,321}
Niagara	20,019	20,027	20,030	20,032	20,036	(4,007)	[962]	{481}	20,040	(4,008)	[962]	{481}	20,043	(4,009)	[962]	{481}
Onondaga	38,875	38,888	38,903	38,913	38,935	(7,787)	[1,869]	{934}	38,955	(7,791)	[1,870]	{935}	38,973	(7,795)	[1,871]	{935}
Orange	48,268	48,281	48,294	48,303	48,322	(9,664)	[2,319]	{1,160}	48,339	(9,668)	[2,320]	{1,160}	48,356	(9,671)	[2,321]	{1,161}
Putnam	10,602	10,604	10,605	10,605	10,608	(2,122)	[509]	{255}	10,612	(2,122)	[509]	{255}	10,615	(2,123)	[510]	{255}
Queens	277,026	277,130	277,151	277,187	277,270	(55,454)	[13,309]	{6,654}	277,345	(55,469)	[13,313]	{6,656}	277,413	(55,483)	[13,316]	{6,658}
Rensselaer	11,220	11,222	11,223	11,225	11,228	(2,246)	[539]	{269}	11,231	(2,246)	[539]	{270}	11,234	(2,247)	[539]	{270}
Richmond	74,877	74,918	74,931	74,944	74,975	(14,995)	[3,599]	{1,799}	75,005	(15,001)	[3,600]	{1,800}	75,033	(15,007)	[3,602]	{1,801}
Rockland	46,920	46,924	46,930	46,935	46,944	(9,389)	[2,253]	{1,127}	46,953	(9,391)	[2,254]	{1,127}	46,961	(9,392)	[2,254]	{1,127}
Saratoga	15,350	15,352	15,357	15,359	15,364	(3,073)	[737]	{369}	15,369	(3,074)	[738]	{369}	15,373	(3,075)	[738]	{369}
Schenectady	13,186	13,190	13,192	13,197	13,201	(2,640)	[634]	{317}	13,204	(2,641)	[634]	{317}	13,208	(2,642)	[634]	{317}
Suffolk	200,858	200,895	200,959	200,989	201,040	(40,208)	[9,650]	{4,825}	201,086	(40,217)	[9,652]	{4,826}	201,127	(40,225)	[9,654]	{4,827}
Sullivan	6,668	6,670	6,671	6,672	6,676	(1,335)	[320]	{160}	6,679	(1,336)	[321]	{160}	6,683	(1,337)	[321]	{160}
Tompkins	4,345	4,345	4,346	4,346	4,349	(870)	[209]	{104}	4,352	(870)	[209]	{104}	4,354	(871)	[209]	{105}
Ulster	13,894	13,897	13,903	13,905	13,908	(2,782)	[668]	{334}	13,911	(2,782)	[668]	{334}	13,913	(2,783)	[668]	{334}
Westchester	129,579	129,600	129,624	129,645	129,676	(25,935)	[6,224]	{3,112}	129,706	(25,941)	[6,226]	{3,113}	129,735	(25,947)	[6,227]	{3,114}

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.