

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 7/27/20**

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 20%, and are often within 10%, of actual confirmed cases.

The projections shown in this document are based on data pulled in as of 7/27/20 11 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.

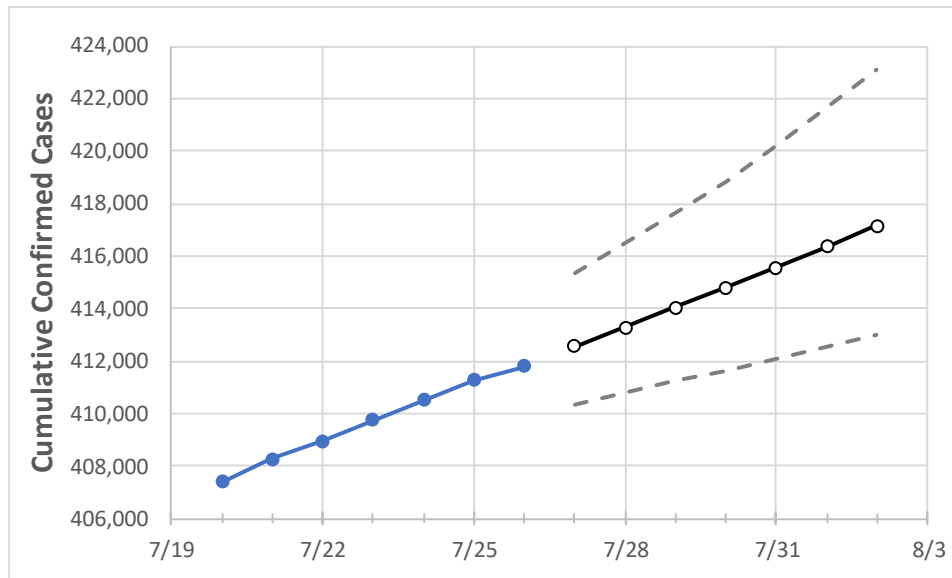
IEM's Modeling Lead

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:				
	7/23	7/24	7/25	7/26	7/27	7/28	7/29	7/30	7/31	8/1	8/2
New York	409,759	410,509	411,269	411,805	412,540	413,285	414,038	414,800	415,571	416,351	417,140

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 20%, and are often within 10%, of actual confirmed cases.

New York Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	7/23	7/24	7/25	7/26	7/27	7/28	7/29	7/30	7/31	8/1	8/2
Albany	2,401	2,426	2,438	2,451	2,466	2,482	2,498	2,515	2,533	2,552	2,571
Bronx	49,086	49,200	49,280	49,336	49,416	49,498	49,583	49,669	49,757	49,847	49,940
Dutchess	4,400	4,408	4,412	4,425	4,432	4,438	4,445	4,452	4,459	4,465	4,472
Erie	8,187	8,234	8,282	8,301	8,330	8,360	8,389	8,418	8,446	8,475	8,503
Kings	61,752	61,824	61,926	61,988	62,063	62,137	62,210	62,283	62,355	62,426	62,497
Monroe	4,511	4,537	4,569	4,591	4,615	4,639	4,663	4,686	4,710	4,733	4,756
Nassau	42,816	42,860	42,915	42,960	43,005	43,051	43,098	43,144	43,191	43,239	43,287
New York	30,033	30,097	30,161	30,193	30,255	30,317	30,379	30,441	30,504	30,567	30,630
Niagara	1,405	1,408	1,420	1,422	1,426	1,431	1,435	1,439	1,443	1,447	1,451
Onondaga	3,344	3,360	3,378	3,389	3,403	3,416	3,429	3,442	3,455	3,468	3,480
Orange	10,968	10,976	10,994	10,998	11,007	11,016	11,025	11,034	11,043	11,053	11,062
Putnam	1,397	1,399	1,403	1,404	1,406	1,407	1,409	1,410	1,412	1,413	1,415
Queens	67,374	67,458	67,532	67,595	67,674	67,753	67,832	67,911	67,990	68,070	68,149
Rensselaer	669	676	681	684	688	692	696	700	704	709	713
Richmond	14,587	14,613	14,633	14,649	14,673	14,698	14,724	14,750	14,777	14,804	14,832
Rockland	13,820	13,830	13,837	13,839	13,845	13,851	13,856	13,862	13,867	13,873	13,878
Saratoga	655	667	679	685	691	697	704	711	718	726	734
Schenectady	946	955	975	987	998	1,010	1,023	1,036	1,051	1,066	1,082
Suffolk	42,715	42,773	42,822	42,883	42,933	42,982	43,031	43,081	43,130	43,179	43,228
Sullivan	1,475	1,476	1,476	1,476	1,476	1,477	1,477	1,478	1,478	1,479	1,479
Tompkins	213	221	223	224	226	228	231	233	236	239	242
Ulster	1,911	1,912	1,916	1,925	1,928	1,930	1,933	1,935	1,938	1,940	1,942
Westchester	35,667	35,700	35,738	35,777	35,811	35,846	35,881	35,917	35,952	35,989	36,025

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:							
	7/23	7/24	7/25	7/26	7/28		7/30		8/1			
Albany	2,401	2,426	2,438	2,451	2,482	(496) [119] {60}	2,515	(503) [121] {60}	2,552	(510) [122] {61}		
Bronx	49,086	49,200	49,280	49,336	49,498	(9,900) [2,376] {1,188}	49,669	(9,934) [2,384] {1,192}	49,847	(9,969) [2,393] {1,196}		
Dutchess	4,400	4,408	4,412	4,425	4,438	(888) [213] {107}	4,452	(890) [214] {107}	4,465	(893) [214] {107}		
Erie	8,187	8,234	8,282	8,301	8,360	(1,672) [401] {201}	8,418	(1,684) [404] {202}	8,475	(1,695) [407] {203}		
Kings	61,752	61,824	61,926	61,988	62,137	(12,427) [2,983] {1,491}	62,283	(12,457) [2,990] {1,495}	62,426	(12,485) [2,996] {1,498}		
Monroe	4,511	4,537	4,569	4,591	4,639	(928) [223] {111}	4,686	(937) [225] {112}	4,733	(947) [227] {114}		
Nassau	42,816	42,860	42,915	42,960	43,051	(8,610) [2,066] {1,033}	43,144	(8,629) [2,071] {1,035}	43,239	(8,648) [2,075] {1,038}		
New York	30,033	30,097	30,161	30,193	30,317	(6,063) [1,455] {728}	30,441	(6,088) [1,461] {731}	30,567	(6,113) [1,467] {734}		
Niagara	1,405	1,408	1,420	1,422	1,431	(286) [69] {34}	1,439	(288) [69] {35}	1,447	(289) [69] {35}		
Onondaga	3,344	3,360	3,378	3,389	3,416	(683) [164] {82}	3,442	(688) [165] {83}	3,468	(694) [166] {83}		
Orange	10,968	10,976	10,994	10,998	11,016	(2,203) [529] {264}	11,034	(2,207) [530] {265}	11,053	(2,211) [531] {265}		
Putnam	1,397	1,399	1,403	1,404	1,407	(281) [68] {34}	1,410	(282) [68] {34}	1,413	(283) [68] {34}		
Queens	67,374	67,458	67,532	67,595	67,753	(13,551) [3,252] {1,626}	67,911	(13,582) [3,260] {1,630}	68,070	(13,614) [3,267] {1,634}		
Rensselaer	669	676	681	684	692	(138) [33] {17}	700	(140) [34] {17}	709	(142) [34] {17}		
Richmond	14,587	14,613	14,633	14,649	14,698	(2,940) [706] {353}	14,750	(2,950) [708] {354}	14,804	(2,961) [711] {355}		
Rockland	13,820	13,830	13,837	13,839	13,851	(2,770) [665] {332}	13,862	(2,772) [665] {333}	13,873	(2,775) [666] {333}		
Saratoga	655	667	679	685	697	(139) [33] {17}	711	(142) [34] {17}	726	(145) [35] {17}		
Schenectady	946	955	975	987	1,010	(202) [48] {24}	1,036	(207) [50] {25}	1,066	(213) [51] {26}		
Suffolk	42,715	42,773	42,822	42,883	42,982	(8,596) [2,063] {1,032}	43,081	(8,616) [2,068] {1,034}	43,179	(8,636) [2,073] {1,036}		
Sullivan	1,475	1,476	1,476	1,476	1,477	(295) [71] {35}	1,478	(296) [71] {35}	1,479	(296) [71] {35}		
Tompkins	213	221	223	224	228	(46) [11] {5}	233	(47) [11] {6}	239	(48) [11] {6}		
Ulster	1,911	1,912	1,916	1,925	1,930	(386) [93] {46}	1,935	(387) [93] {46}	1,940	(388) [93] {47}		
Westchester	35,667	35,700	35,738	35,777	35,846	(7,169) [1,721] {860}	35,917	(7,183) [1,724] {862}	35,989	(7,198) [1,727] {864}		

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.