

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

Date: 8/11/20

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 8/11/20 12 p.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.

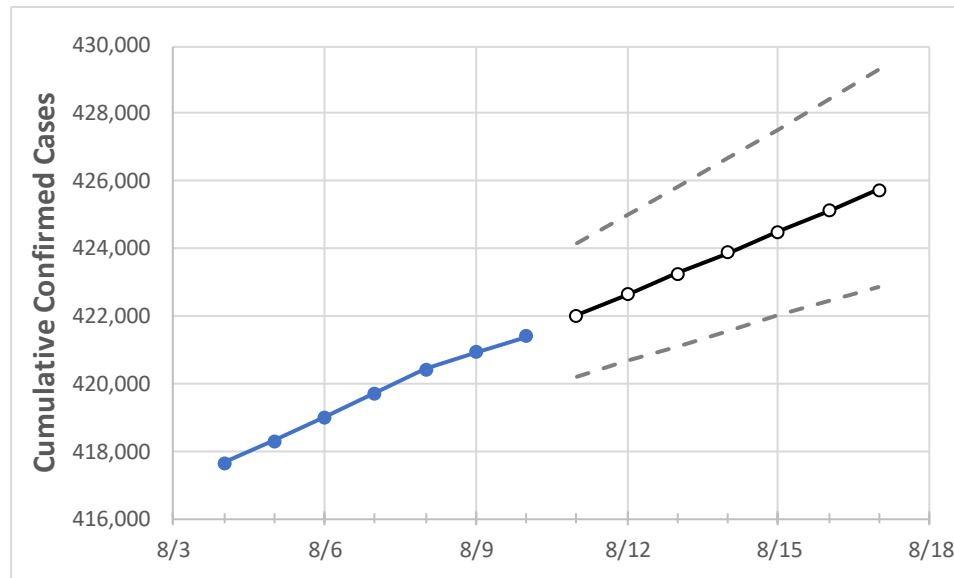
IEM's Modeling Lead

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:				
	8/7	8/8	8/9	8/10	8/11	8/12	8/13	8/14	8/15	8/16	8/17
New York	419,711	420,414	420,929	421,405	422,024	422,643	423,262	423,881	424,500	425,119	425,738

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:						
	8/7	8/8	8/9	8/10	8/11	8/12	8/13	8/14	8/15	8/16	8/17
Albany	2,573	2,581	2,595	2,600	2,608	2,617	2,626	2,634	2,643	2,651	2,660
Bronx	50,057	50,120	50,188	50,226	50,281	50,336	50,392	50,448	50,503	50,559	50,616
Dutchess	4,589	4,600	4,607	4,613	4,625	4,638	4,651	4,664	4,678	4,692	4,706
Erie	8,791	8,850	8,904	8,918	8,956	8,994	9,033	9,072	9,112	9,152	9,192
Kings	62,999	63,086	63,155	63,223	63,300	63,376	63,454	63,531	63,609	63,687	63,766
Monroe	4,901	4,922	4,956	4,976	4,999	5,022	5,045	5,068	5,091	5,114	5,137
Nassau	43,580	43,628	43,655	43,690	43,732	43,773	43,815	43,857	43,898	43,940	43,982
New York	30,859	30,921	30,964	31,016	31,066	31,116	31,166	31,216	31,266	31,316	31,365
Niagara	1,491	1,494	1,498	1,500	1,504	1,508	1,512	1,516	1,520	1,523	1,527
Onondaga	3,556	3,565	3,576	3,585	3,594	3,602	3,610	3,618	3,626	3,634	3,642
Orange	11,129	11,156	11,159	11,168	11,175	11,182	11,188	11,195	11,202	11,209	11,215
Putnam	1,446	1,447	1,449	1,449	1,452	1,455	1,457	1,460	1,463	1,466	1,470
Queens	68,452	68,548	68,604	68,670	68,734	68,798	68,862	68,926	68,989	69,053	69,116
Rensselaer	759	761	765	766	769	772	775	778	781	784	787
Richmond	14,891	14,909	14,921	14,934	14,949	14,965	14,980	14,995	15,010	15,025	15,040
Rockland	13,925	13,936	13,942	13,949	13,955	13,961	13,968	13,974	13,980	13,986	13,993
Saratoga	752	755	757	760	764	768	772	776	779	783	787
Schenectady	1,055	1,058	1,059	1,060	1,063	1,065	1,068	1,070	1,072	1,075	1,077
Suffolk	43,681	43,749	43,786	43,844	43,903	43,963	44,024	44,085	44,146	44,208	44,271
Sullivan	1,488	1,489	1,489	1,489	1,490	1,490	1,491	1,492	1,492	1,493	1,493
Tompkins	233	234	234	234	235	235	236	236	237	237	238
Ulster	2,049	2,057	2,062	2,072	2,079	2,086	2,093	2,100	2,108	2,116	2,124
Westchester	36,136	36,180	36,205	36,233	36,261	36,289	36,317	36,345	36,373	36,401	36,429

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:											
	8/7	8/8	8/9	8/10	8/12				8/14				8/16			
Albany	2,573	2,581	2,595	2,600	2,617	(523)	[126]	{63}	2,634	(527)	[126]	{63}	2,651	(530)	[127]	{64}
Bronx	50,057	50,120	50,188	50,226	50,336	(10,067)	[2,416]	{1,208}	50,448	(10,090)	[2,421]	{1,211}	50,559	(10,112)	[2,427]	{1,213}
Dutchess	4,589	4,600	4,607	4,613	4,638	(928)	[223]	{111}	4,664	(933)	[224]	{112}	4,692	(938)	[225]	{113}
Erie	8,791	8,850	8,904	8,918	8,994	(1,799)	[432]	{216}	9,072	(1,814)	[435]	{218}	9,152	(1,830)	[439]	{220}
Kings	62,999	63,086	63,155	63,223	63,376	(12,675)	[3,042]	{1,521}	63,531	(12,706)	[3,049]	{1,525}	63,687	(12,737)	[3,057]	{1,528}
Monroe	4,901	4,922	4,956	4,976	5,022	(1,004)	[241]	{121}	5,068	(1,014)	[243]	{122}	5,114	(1,023)	[245]	{123}
Nassau	43,580	43,628	43,655	43,690	43,773	(8,755)	[2,101]	{1,051}	43,857	(8,771)	[2,105]	{1,053}	43,940	(8,788)	[2,109]	{1,055}
New York	30,859	30,921	30,964	31,016	31,116	(6,223)	[1,494]	{747}	31,216	(6,243)	[1,498]	{749}	31,316	(6,263)	[1,503]	{752}
Niagara	1,491	1,494	1,498	1,500	1,508	(302)	[72]	{36}	1,516	(303)	[73]	{36}	1,523	(305)	[73]	{37}
Onondaga	3,556	3,565	3,576	3,585	3,602	(720)	[173]	{86}	3,618	(724)	[174]	{87}	3,634	(727)	[174]	{87}
Orange	11,129	11,156	11,159	11,168	11,182	(2,236)	[537]	{268}	11,195	(2,239)	[537]	{269}	11,209	(2,242)	[538]	{269}
Putnam	1,446	1,447	1,449	1,449	1,455	(291)	[70]	{35}	1,460	(292)	[70]	{35}	1,466	(293)	[70]	{35}
Queens	68,452	68,548	68,604	68,670	68,798	(13,760)	[3,302]	{1,651}	68,926	(13,785)	[3,308]	{1,654}	69,053	(13,811)	[3,315]	{1,657}
Rensselaer	759	761	765	766	772	(154)	[37]	{19}	778	(156)	[37]	{19}	784	(157)	[38]	{19}
Richmond	14,891	14,909	14,921	14,934	14,965	(2,993)	[718]	{359}	14,995	(2,999)	[720]	{360}	15,025	(3,005)	[721]	{361}
Rockland	13,925	13,936	13,942	13,949	13,961	(2,792)	[670]	{335}	13,974	(2,795)	[671]	{335}	13,986	(2,797)	[671]	{336}
Saratoga	752	755	757	760	768	(154)	[37]	{18}	776	(155)	[37]	{19}	783	(157)	[38]	{19}
Schenectady	1,055	1,058	1,059	1,060	1,065	(213)	[51]	{26}	1,070	(214)	[51]	{26}	1,075	(215)	[52]	{26}
Suffolk	43,681	43,749	43,786	43,844	43,963	(8,793)	[2,110]	{1,055}	44,085	(8,817)	[2,116]	{1,058}	44,208	(8,842)	[2,122]	{1,061}
Sullivan	1,488	1,489	1,489	1,489	1,490	(298)	[72]	{36}	1,492	(298)	[72]	{36}	1,493	(299)	[72]	{36}
Tompkins	233	234	234	234	235	(47)	[11]	{6}	236	(47)	[11]	{6}	237	(47)	[11]	{6}
Ulster	2,049	2,057	2,062	2,072	2,086	(417)	[100]	{50}	2,100	(420)	[101]	{50}	2,116	(423)	[102]	{51}
Westchester	36,136	36,180	36,205	36,233	36,289	(7,258)	[1,742]	{871}	36,345	(7,269)	[1,745]	{872}	36,401	(7,280)	[1,747]	{874}

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.