

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

Date: 8/19/20

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 8/19/20 1 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.

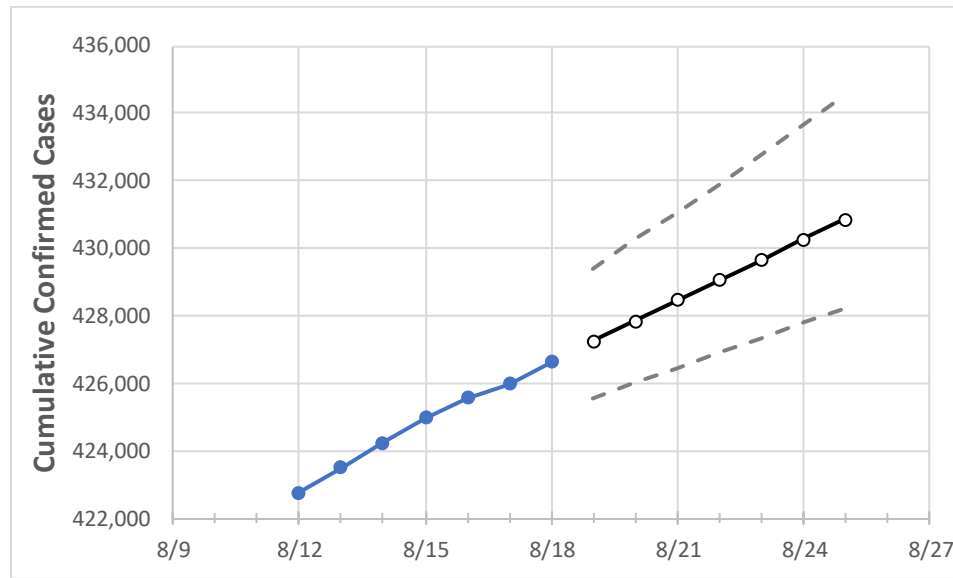
IEM's Modeling Lead

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:						
	8/15	8/16	8/17	8/18	8/19	8/20	8/21	8/22	8/23	8/24	8/25
New York	424,970	425,577	425,985	426,640	427,243	427,845	428,448	429,052	429,655	430,258	430,862

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:						
	8/15	8/16	8/17	8/18	8/19	8/20	8/21	8/22	8/23	8/24	8/25
Albany	2,643	2,654	2,657	2,661	2,667	2,672	2,678	2,683	2,689	2,694	2,699
Bronx	50,651	50,724	50,786	50,840	50,911	50,983	51,055	51,129	51,204	51,280	51,358
Dutchess	4,668	4,686	4,700	4,704	4,714	4,724	4,734	4,744	4,754	4,765	4,775
Erie	9,114	9,147	9,157	9,187	9,215	9,243	9,271	9,299	9,327	9,355	9,383
Kings	63,779	63,861	63,913	64,002	64,093	64,184	64,277	64,370	64,465	64,560	64,657
Monroe	5,143	5,165	5,183	5,213	5,239	5,265	5,291	5,317	5,344	5,371	5,398
Nassau	43,891	43,929	43,955	44,001	44,036	44,070	44,104	44,138	44,172	44,206	44,239
New York	31,342	31,398	31,441	31,505	31,561	31,618	31,675	31,732	31,790	31,847	31,905
Niagara	1,529	1,532	1,534	1,535	1,538	1,541	1,545	1,548	1,551	1,554	1,557
Onondaga	3,663	3,674	3,680	3,696	3,706	3,717	3,727	3,738	3,748	3,759	3,769
Orange	11,229	11,254	11,256	11,269	11,277	11,286	11,295	11,303	11,312	11,321	11,330
Putnam	1,459	1,461	1,463	1,463	1,464	1,465	1,467	1,468	1,469	1,470	1,471
Queens	69,098	69,174	69,245	69,308	69,379	69,451	69,524	69,596	69,670	69,743	69,817
Rensselaer	789	795	798	801	804	806	809	812	815	817	820
Richmond	15,046	15,066	15,073	15,087	15,102	15,116	15,130	15,145	15,159	15,173	15,187
Rockland	13,997	14,007	14,011	14,053	14,063	14,074	14,085	14,096	14,108	14,120	14,132
Saratoga	783	792	795	800	803	806	810	813	816	819	822
Schenectady	1,101	1,119	1,121	1,130	1,134	1,139	1,143	1,147	1,152	1,156	1,161
Suffolk	44,109	44,159	44,185	44,235	44,280	44,324	44,368	44,411	44,455	44,498	44,540
Sullivan	1,493	1,493	1,493	1,493	1,494	1,495	1,495	1,496	1,497	1,498	1,499
Tompkins	238	238	238	238	238	239	239	240	240	240	241
Ulster	2,089	2,095	2,098	2,100	2,103	2,107	2,110	2,113	2,116	2,119	2,123
Westchester	36,435	36,453	36,486	36,540	36,574	36,608	36,642	36,677	36,713	36,748	36,784

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:											
	8/15	8/16	8/17	8/18	8/20				8/22				8/24			
Albany	2,643	2,654	2,657	2,661	2,672	(534)	[128]	{64}	2,683	(537)	[129]	{64}	2,694	(539)	[129]	{65}
Bronx	50,651	50,724	50,786	50,840	50,983	(10,197)	[2,447]	{1,224}	51,129	(10,226)	[2,454]	{1,227}	51,280	(10,256)	[2,461]	{1,231}
Dutchess	4,668	4,686	4,700	4,704	4,724	(945)	[227]	{113}	4,744	(949)	[228]	{114}	4,765	(953)	[229]	{114}
Erie	9,114	9,147	9,157	9,187	9,243	(1,849)	[444]	{222}	9,299	(1,860)	[446]	{223}	9,355	(1,871)	[449]	{225}
Kings	63,779	63,861	63,913	64,002	64,184	(12,837)	[3,081]	{1,540}	64,370	(12,874)	[3,090]	{1,545}	64,560	(12,912)	[3,099]	{1,549}
Monroe	5,143	5,165	5,183	5,213	5,265	(1,053)	[253]	{126}	5,317	(1,063)	[255]	{128}	5,371	(1,074)	[258]	{129}
Nassau	43,891	43,929	43,955	44,001	44,070	(8,814)	[2,115]	{1,058}	44,138	(8,828)	[2,119]	{1,059}	44,206	(8,841)	[2,122]	{1,061}
New York	31,342	31,398	31,441	31,505	31,618	(6,324)	[1,518]	{759}	31,732	(6,346)	[1,523]	{762}	31,847	(6,369)	[1,529]	{764}
Niagara	1,529	1,532	1,534	1,535	1,541	(308)	[74]	{37}	1,548	(310)	[74]	{37}	1,554	(311)	[75]	{37}
Onondaga	3,663	3,674	3,680	3,696	3,717	(743)	[178]	{89}	3,738	(748)	[179]	{90}	3,759	(752)	[180]	{90}
Orange	11,229	11,254	11,256	11,269	11,286	(2,257)	[542]	{271}	11,303	(2,261)	[543]	{271}	11,321	(2,264)	[543]	{272}
Putnam	1,459	1,461	1,463	1,463	1,465	(293)	[70]	{35}	1,468	(294)	[70]	{35}	1,470	(294)	[71]	{35}
Queens	69,098	69,174	69,245	69,308	69,451	(13,890)	[3,334]	{1,667}	69,596	(13,919)	[3,341]	{1,670}	69,743	(13,949)	[3,348]	{1,674}
Rensselaer	789	795	798	801	806	(161)	[39]	{19}	812	(162)	[39]	{19}	817	(163)	[39]	{20}
Richmond	15,046	15,066	15,073	15,087	15,116	(3,023)	[726]	{363}	15,145	(3,029)	[727]	{363}	15,173	(3,035)	[728]	{364}
Rockland	13,997	14,007	14,011	14,053	14,074	(2,815)	[676]	{338}	14,096	(2,819)	[677]	{338}	14,120	(2,824)	[678]	{339}
Saratoga	783	792	795	800	806	(161)	[39]	{19}	813	(163)	[39]	{20}	819	(164)	[39]	{20}
Schenectady	1,101	1,119	1,121	1,130	1,139	(228)	[55]	{27}	1,147	(229)	[55]	{28}	1,156	(231)	[55]	{28}
Suffolk	44,109	44,159	44,185	44,235	44,324	(8,865)	[2,128]	{1,064}	44,411	(8,882)	[2,132]	{1,066}	44,498	(8,900)	[2,136]	{1,068}
Sullivan	1,493	1,493	1,493	1,493	1,495	(299)	[72]	{36}	1,496	(299)	[72]	{36}	1,498	(300)	[72]	{36}
Tompkins	238	238	238	238	239	(48)	[11]	{6}	240	(48)	[12]	{6}	240	(48)	[12]	{6}
Ulster	2,089	2,095	2,098	2,100	2,107	(421)	[101]	{51}	2,113	(423)	[101]	{51}	2,119	(424)	[102]	{51}
Westchester	36,435	36,453	36,486	36,540	36,608	(7,322)	[1,757]	{879}	36,677	(7,335)	[1,761]	{880}	36,748	(7,350)	[1,764]	{882}

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.