

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

Date: 8/24/20

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 8/24/20 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.

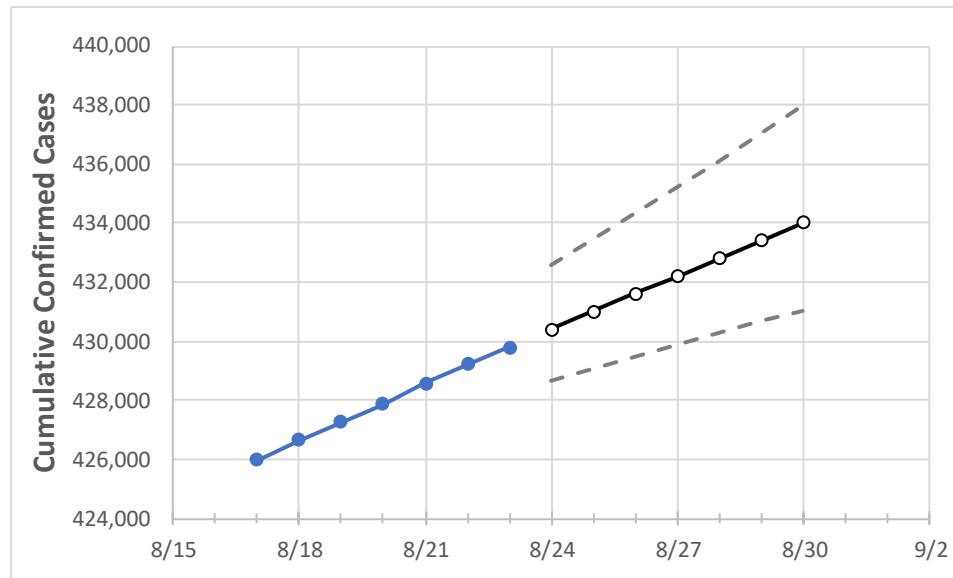
IEM's Modeling Lead

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:						
	8/20	8/21	8/22	8/23	8/24	8/25	8/26	8/27	8/28	8/29	8/30	
New York	427,872	428,581	429,234	429,806	430,406	431,006	431,607	432,208	432,809	433,410	434,011	

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:						
	8/20	8/21	8/22	8/23	8/24	8/25	8/26	8/27	8/28	8/29	8/30
Albany	2,684	2,691	2,693	2,699	2,703	2,708	2,712	2,716	2,720	2,724	2,728
Bronx	50,954	51,010	51,067	51,137	51,197	51,258	51,319	51,380	51,442	51,504	51,566
Dutchess	4,721	4,734	4,753	4,767	4,778	4,788	4,799	4,810	4,822	4,833	4,845
Erie	9,283	9,364	9,413	9,465	9,499	9,534	9,569	9,604	9,640	9,676	9,713
Kings	64,162	64,236	64,301	64,375	64,449	64,523	64,597	64,670	64,743	64,816	64,889
Monroe	5,256	5,273	5,297	5,317	5,337	5,356	5,375	5,394	5,413	5,432	5,450
Nassau	44,112	44,162	44,205	44,245	44,285	44,326	44,367	44,408	44,449	44,490	44,532
New York	31,603	31,661	31,708	31,752	31,800	31,847	31,894	31,941	31,988	32,034	32,080
Niagara	1,547	1,556	1,566	1,575	1,579	1,584	1,588	1,592	1,597	1,601	1,606
Onondaga	3,719	3,743	3,756	3,758	3,766	3,775	3,783	3,791	3,799	3,806	3,814
Orange	11,292	11,316	11,328	11,334	11,344	11,354	11,365	11,375	11,386	11,397	11,408
Putnam	1,468	1,470	1,473	1,473	1,474	1,476	1,477	1,479	1,480	1,482	1,483
Queens	69,451	69,538	69,623	69,694	69,765	69,837	69,909	69,981	70,053	70,126	70,199
Rensselaer	809	810	813	817	820	822	825	827	830	833	835
Richmond	15,118	15,129	15,142	15,162	15,175	15,188	15,201	15,213	15,226	15,238	15,251
Rockland	14,089	14,106	14,118	14,129	14,143	14,158	14,174	14,190	14,207	14,225	14,244
Saratoga	802	808	813	815	817	820	822	824	826	828	830
Schenectady	1,143	1,159	1,172	1,179	1,186	1,193	1,201	1,208	1,216	1,225	1,233
Suffolk	44,353	44,400	44,456	44,498	44,540	44,582	44,623	44,664	44,705	44,745	44,785
Sullivan	1,495	1,495	1,495	1,495	1,495	1,496	1,496	1,497	1,497	1,497	1,498
Tompkins	240	244	244	244	245	245	246	246	247	247	248
Ulster	2,113	2,115	2,126	2,127	2,130	2,133	2,136	2,138	2,141	2,144	2,146
Westchester	36,586	36,621	36,651	36,689	36,720	36,751	36,782	36,813	36,845	36,876	36,908

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:											
	8/20	8/21	8/22	8/23	8/25				8/27				8/29			
Albany	2,684	2,691	2,693	2,699	2,708	(542)	[130]	{65}	2,716	(543)	[130]	{65}	2,724	(545)	[131]	{65}
Bronx	50,954	51,010	51,067	51,137	51,258	(10,252)	[2,460]	{1,230}	51,380	(10,276)	[2,466]	{1,233}	51,504	(10,301)	[2,472]	{1,236}
Dutchess	4,721	4,734	4,753	4,767	4,788	(958)	[230]	{115}	4,810	(962)	[231]	{115}	4,833	(967)	[232]	{116}
Erie	9,283	9,364	9,413	9,465	9,534	(1,907)	[458]	{229}	9,604	(1,921)	[461]	{231}	9,676	(1,935)	[464]	{232}
Kings	64,162	64,236	64,301	64,375	64,523	(12,905)	[3,097]	{1,549}	64,670	(12,934)	[3,104]	{1,552}	64,816	(12,963)	[3,111]	{1,556}
Monroe	5,256	5,273	5,297	5,317	5,356	(1,071)	[257]	{129}	5,394	(1,079)	[259]	{129}	5,432	(1,086)	[261]	{130}
Nassau	44,112	44,162	44,205	44,245	44,326	(8,865)	[2,128]	{1,064}	44,408	(8,882)	[2,132]	{1,066}	44,490	(8,898)	[2,136]	{1,068}
New York	31,603	31,661	31,708	31,752	31,847	(6,369)	[1,529]	{764}	31,941	(6,388)	[1,533]	{767}	32,034	(6,407)	[1,538]	{769}
Niagara	1,547	1,556	1,566	1,575	1,584	(317)	[76]	{38}	1,592	(318)	[76]	{38}	1,601	(320)	[77]	{38}
Onondaga	3,719	3,743	3,756	3,758	3,775	(755)	[181]	{91}	3,791	(758)	[182]	{91}	3,806	(761)	[183]	{91}
Orange	11,292	11,316	11,328	11,334	11,354	(2,271)	[545]	{273}	11,375	(2,275)	[546]	{273}	11,397	(2,279)	[547]	{274}
Putnam	1,468	1,470	1,473	1,473	1,476	(295)	[71]	{35}	1,479	(296)	[71]	{35}	1,482	(296)	[71]	{36}
Queens	69,451	69,538	69,623	69,694	69,837	(13,967)	[3,352]	{1,676}	69,981	(13,996)	[3,359]	{1,680}	70,126	(14,025)	[3,366]	{1,683}
Rensselaer	809	810	813	817	822	(164)	[39]	{20}	827	(165)	[40]	{20}	833	(167)	[40]	{20}
Richmond	15,118	15,129	15,142	15,162	15,188	(3,038)	[729]	{365}	15,213	(3,043)	[730]	{365}	15,238	(3,048)	[731]	{366}
Rockland	14,089	14,106	14,118	14,129	14,158	(2,832)	[680]	{340}	14,190	(2,838)	[681]	{341}	14,225	(2,845)	[683]	{341}
Saratoga	802	808	813	815	820	(164)	[39]	{20}	824	(165)	[40]	{20}	828	(166)	[40]	{20}
Schenectady	1,143	1,159	1,172	1,179	1,193	(239)	[57]	{29}	1,208	(242)	[58]	{29}	1,225	(245)	[59]	{29}
Suffolk	44,353	44,400	44,456	44,498	44,582	(8,916)	[2,140]	{1,070}	44,664	(8,933)	[2,144]	{1,072}	44,745	(8,949)	[2,148]	{1,074}
Sullivan	1,495	1,495	1,495	1,495	1,496	(299)	[72]	{36}	1,497	(299)	[72]	{36}	1,497	(299)	[72]	{36}
Tompkins	240	244	244	244	245	(49)	[12]	{6}	246	(49)	[12]	{6}	247	(49)	[12]	{6}
Ulster	2,113	2,115	2,126	2,127	2,133	(427)	[102]	{51}	2,138	(428)	[103]	{51}	2,144	(429)	[103]	{51}
Westchester	36,586	36,621	36,651	36,689	36,751	(7,350)	[1,764]	{882}	36,813	(7,363)	[1,767]	{884}	36,876	(7,375)	[1,770]	{885}

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.