

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

Date: 8/21/20

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 8/21/20 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.

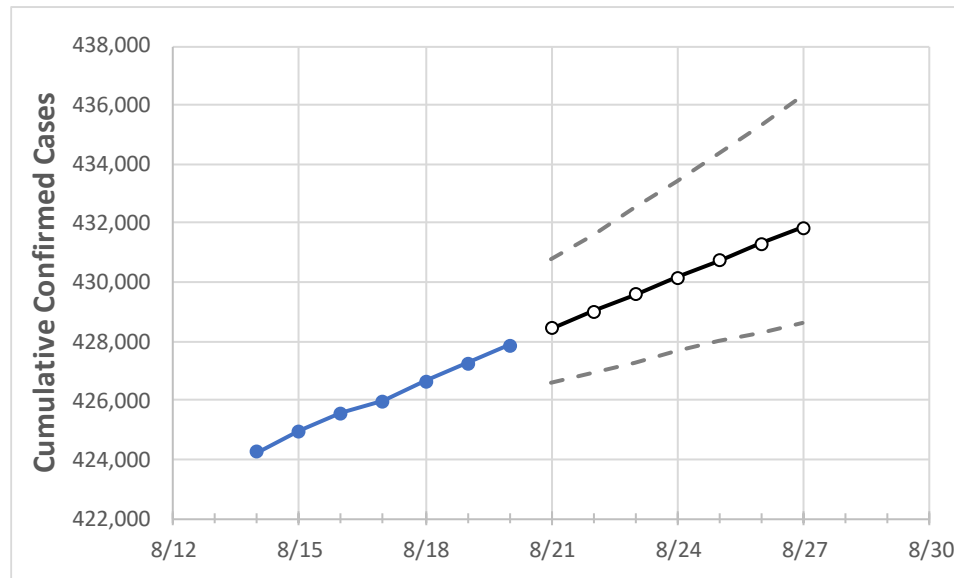
IEM's Modeling Lead

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:						
	8/17	8/18	8/19	8/20	8/21	8/22	8/23	8/24	8/25	8/26	8/27
New York	425,985	426,640	427,271	427,872	428,448	429,022	429,594	430,163	430,731	431,296	431,859

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:						
	8/17	8/18	8/19	8/20	8/21	8/22	8/23	8/24	8/25	8/26	8/27
Albany	2,657	2,661	2,675	2,684	2,689	2,695	2,700	2,705	2,710	2,715	2,720
Bronx	50,786	50,840	50,907	50,954	51,014	51,075	51,135	51,196	51,257	51,317	51,379
Dutchess	4,700	4,704	4,710	4,721	4,729	4,737	4,745	4,753	4,760	4,768	4,776
Erie	9,157	9,187	9,241	9,283	9,308	9,333	9,357	9,381	9,404	9,427	9,450
Kings	63,913	64,002	64,082	64,162	64,241	64,321	64,400	64,480	64,559	64,638	64,718
Monroe	5,183	5,213	5,241	5,256	5,278	5,300	5,321	5,343	5,364	5,386	5,407
Nassau	43,955	44,001	44,063	44,112	44,150	44,188	44,226	44,265	44,303	44,341	44,379
New York	31,441	31,505	31,541	31,603	31,651	31,700	31,747	31,795	31,842	31,889	31,936
Niagara	1,534	1,535	1,544	1,547	1,550	1,552	1,555	1,558	1,560	1,563	1,565
Onondaga	3,680	3,696	3,712	3,719	3,729	3,739	3,749	3,758	3,768	3,778	3,788
Orange	11,256	11,269	11,282	11,292	11,301	11,310	11,319	11,328	11,337	11,347	11,356
Putnam	1,463	1,465	1,466	1,468	1,469	1,470	1,471	1,473	1,474	1,475	1,476
Queens	69,245	69,308	69,384	69,451	69,521	69,590	69,660	69,730	69,801	69,871	69,942
Rensselaer	798	801	804	809	812	815	818	821	824	827	830
Richmond	15,073	15,087	15,101	15,118	15,132	15,146	15,160	15,173	15,187	15,200	15,213
Rockland	14,011	14,053	14,067	14,089	14,102	14,116	14,131	14,147	14,163	14,180	14,198
Saratoga	795	800	801	802	804	806	808	810	812	814	815
Schenectady	1,121	1,130	1,133	1,143	1,148	1,153	1,159	1,164	1,170	1,176	1,182
Suffolk	44,185	44,235	44,305	44,353	44,394	44,434	44,474	44,513	44,551	44,589	44,626
Sullivan	1,494	1,494	1,494	1,495	1,495	1,496	1,496	1,496	1,497	1,497	1,497
Tompkins	239	239	240	240	240	241	241	241	242	242	242
Ulster	2,098	2,100	2,106	2,113	2,116	2,120	2,123	2,126	2,129	2,133	2,136
Westchester	36,486	36,540	36,563	36,586	36,616	36,646	36,676	36,706	36,736	36,766	36,796

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:											
	8/17	8/18	8/19	8/20	8/22				8/24				8/26			
Albany	2,657	2,661	2,675	2,684	2,695	(539)	[129]	{65}	2,705	(541)	[130]	{65}	2,715	(543)	[130]	{65}
Bronx	50,786	50,840	50,907	50,954	51,075	(10,215)	[2,452]	{1,226}	51,196	(10,239)	[2,457]	{1,229}	51,317	(10,263)	[2,463]	{1,232}
Dutchess	4,700	4,704	4,710	4,721	4,737	(947)	[227]	{114}	4,753	(951)	[228]	{114}	4,768	(954)	[229]	{114}
Erie	9,157	9,187	9,241	9,283	9,333	(1,867)	[448]	{224}	9,381	(1,876)	[450]	{225}	9,427	(1,885)	[453]	{226}
Kings	63,913	64,002	64,082	64,162	64,321	(12,864)	[3,087]	{1,544}	64,480	(12,896)	[3,095]	{1,548}	64,638	(12,928)	[3,103]	{1,551}
Monroe	5,183	5,213	5,241	5,256	5,300	(1,060)	[254]	{127}	5,343	(1,069)	[256]	{128}	5,386	(1,077)	[259]	{129}
Nassau	43,955	44,001	44,063	44,112	44,188	(8,838)	[2,121]	{1,061}	44,265	(8,853)	[2,125]	{1,062}	44,341	(8,868)	[2,128]	{1,064}
New York	31,441	31,505	31,541	31,603	31,700	(6,340)	[1,522]	{761}	31,795	(6,359)	[1,526]	{763}	31,889	(6,378)	[1,531]	{765}
Niagara	1,534	1,535	1,544	1,547	1,552	(310)	[75]	{37}	1,558	(312)	[75]	{37}	1,563	(313)	[75]	{38}
Onondaga	3,680	3,696	3,712	3,719	3,739	(748)	[179]	{90}	3,758	(752)	[180]	{90}	3,778	(756)	[181]	{91}
Orange	11,256	11,269	11,282	11,292	11,310	(2,262)	[543]	{271}	11,328	(2,266)	[544]	{272}	11,347	(2,269)	[545]	{272}
Putnam	1,463	1,465	1,466	1,468	1,470	(294)	[71]	{35}	1,473	(295)	[71]	{35}	1,475	(295)	[71]	{35}
Queens	69,245	69,308	69,384	69,451	69,590	(13,918)	[3,340]	{1,670}	69,730	(13,946)	[3,347]	{1,674}	69,871	(13,974)	[3,354]	{1,677}
Rensselaer	798	801	804	809	815	(163)	[39]	{20}	821	(164)	[39]	{20}	827	(165)	[40]	{20}
Richmond	15,073	15,087	15,101	15,118	15,146	(3,029)	[727]	{364}	15,173	(3,035)	[728]	{364}	15,200	(3,040)	[730]	{365}
Rockland	14,011	14,053	14,067	14,089	14,116	(2,823)	[678]	{339}	14,147	(2,829)	[679]	{340}	14,180	(2,836)	[681]	{340}
Saratoga	795	800	801	802	806	(161)	[39]	{19}	810	(162)	[39]	{19}	814	(163)	[39]	{20}
Schenectady	1,121	1,130	1,133	1,143	1,153	(231)	[55]	{28}	1,164	(233)	[56]	{28}	1,176	(235)	[56]	{28}
Suffolk	44,185	44,235	44,305	44,353	44,434	(8,887)	[2,133]	{1,066}	44,513	(8,903)	[2,137]	{1,068}	44,589	(8,918)	[2,140]	{1,070}
Sullivan	1,494	1,494	1,494	1,495	1,496	(299)	[72]	{36}	1,496	(299)	[72]	{36}	1,497	(299)	[72]	{36}
Tompkins	239	239	240	240	241	(48)	[12]	{6}	241	(48)	[12]	{6}	242	(48)	[12]	{6}
Ulster	2,098	2,100	2,106	2,113	2,120	(424)	[102]	{51}	2,126	(425)	[102]	{51}	2,133	(427)	[102]	{51}
Westchester	36,486	36,540	36,563	36,586	36,646	(7,329)	[1,759]	{880}	36,706	(7,341)	[1,762]	{881}	36,766	(7,353)	[1,765]	{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.