

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

Date: 8/7/20

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 8/7/20 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.

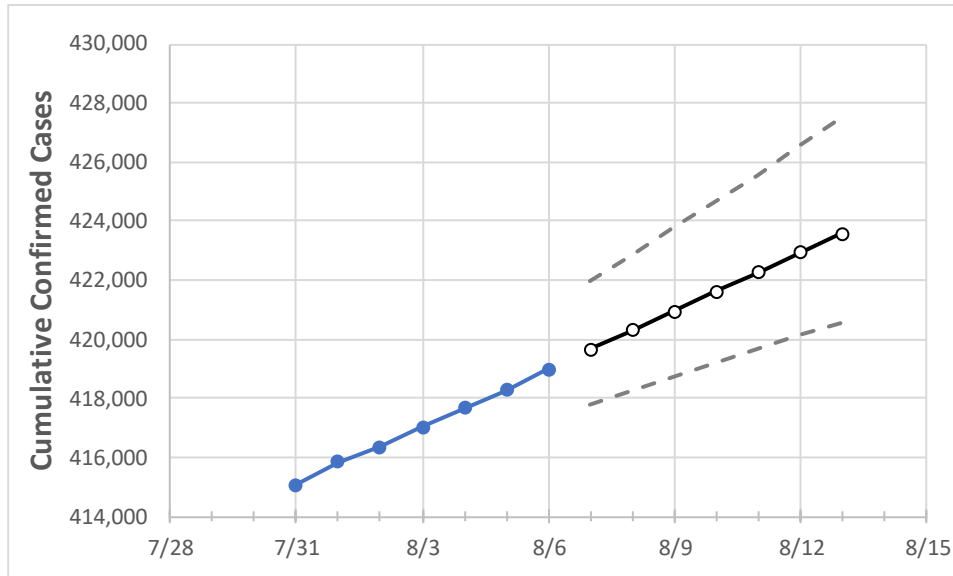
IEM's Modeling Lead

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:							
	8/3	8/4	8/5	8/6	8/7	8/8	8/9	8/10	8/11	8/12	8/13	
New York	417,041	417,658	418,292	418,997	419,645	420,295	420,948	421,604	422,263	422,924	423,588	

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:						
	8/3	8/4	8/5	8/6	8/7	8/8	8/9	8/10	8/11	8/12	8/13
Albany	2,531	2,543	2,556	2,565	2,574	2,584	2,593	2,602	2,612	2,622	2,631
Bronx	49,714	49,823	49,906	49,980	50,037	50,094	50,151	50,209	50,267	50,325	50,383
Dutchess	4,543	4,557	4,568	4,582	4,596	4,611	4,627	4,644	4,661	4,679	4,698
Erie	8,626	8,667	8,702	8,737	8,771	8,806	8,840	8,875	8,910	8,946	8,981
Kings	62,641	62,715	62,790	62,890	62,962	63,034	63,106	63,178	63,250	63,321	63,393
Monroe	4,790	4,821	4,841	4,868	4,889	4,910	4,931	4,952	4,973	4,994	5,015
Nassau	43,436	43,459	43,482	43,534	43,581	43,629	43,677	43,725	43,773	43,822	43,871
New York	30,621	30,677	30,734	30,799	30,847	30,895	30,943	30,991	31,039	31,086	31,134
Niagara	1,449	1,458	1,466	1,470	1,473	1,477	1,480	1,483	1,486	1,489	1,492
Onondaga	3,490	3,515	3,525	3,535	3,544	3,553	3,561	3,570	3,578	3,586	3,594
Orange	11,096	11,105	11,113	11,127	11,135	11,144	11,152	11,160	11,169	11,177	11,186
Putnam	1,433	1,437	1,439	1,444	1,447	1,451	1,454	1,458	1,461	1,465	1,469
Queens	68,166	68,225	68,297	68,368	68,429	68,490	68,550	68,610	68,669	68,728	68,786
Rensselaer	740	748	755	758	763	768	774	779	785	790	796
Richmond	14,822	14,840	14,854	14,877	14,896	14,914	14,933	14,952	14,971	14,990	15,009
Rockland	13,885	13,893	13,903	13,918	13,923	13,928	13,933	13,937	13,942	13,947	13,951
Saratoga	733	739	744	747	752	757	762	768	773	779	784
Schenectady	1,037	1,041	1,045	1,050	1,055	1,059	1,064	1,069	1,073	1,078	1,082
Suffolk	43,468	43,511	43,553	43,630	43,694	43,758	43,823	43,890	43,957	44,024	44,093
Sullivan	1,484	1,484	1,485	1,485	1,486	1,486	1,487	1,487	1,488	1,488	1,489
Tompkins	231	231	231	232	233	233	234	234	235	235	236
Ulster	2,031	2,039	2,042	2,045	2,051	2,057	2,063	2,070	2,077	2,084	2,091
Westchester	36,014	36,049	36,075	36,107	36,133	36,159	36,185	36,211	36,237	36,263	36,288

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:											
	8/3	8/4	8/5	8/6	8/8		8/10		8/12							
Albany	2,531	2,543	2,556	2,565	2,584	(517)	[124]	{62}	2,602	(520)	[125]	{62}	2,622	(524)	[126]	{63}
Bronx	49,714	49,823	49,906	49,980	50,094	(10,019)	[2,405]	{1,202}	50,209	(10,042)	[2,410]	{1,205}	50,325	(10,065)	[2,416]	{1,208}
Dutchess	4,543	4,557	4,568	4,582	4,611	(922)	[221]	{111}	4,644	(929)	[223]	{111}	4,679	(936)	[225]	{112}
Erie	8,626	8,667	8,702	8,737	8,806	(1,761)	[423]	{211}	8,875	(1,775)	[426]	{213}	8,946	(1,789)	[429]	{215}
Kings	62,641	62,715	62,790	62,890	63,034	(12,607)	[3,026]	{1,513}	63,178	(12,636)	[3,033]	{1,516}	63,321	(12,664)	[3,039]	{1,520}
Monroe	4,790	4,821	4,841	4,868	4,910	(982)	[236]	{118}	4,952	(990)	[238]	{119}	4,994	(999)	[240]	{120}
Nassau	43,436	43,459	43,482	43,534	43,629	(8,726)	[2,094]	{1,047}	43,725	(8,745)	[2,099]	{1,049}	43,822	(8,764)	[2,103]	{1,052}
New York	30,621	30,677	30,734	30,799	30,895	(6,179)	[1,483]	{741}	30,991	(6,198)	[1,488]	{744}	31,086	(6,217)	[1,492]	{746}
Niagara	1,449	1,458	1,466	1,470	1,477	(295)	[71]	{35}	1,483	(297)	[71]	{36}	1,489	(298)	[71]	{36}
Onondaga	3,490	3,515	3,525	3,535	3,553	(711)	[171]	{85}	3,570	(714)	[171]	{86}	3,586	(717)	[172]	{86}
Orange	11,096	11,105	11,113	11,127	11,144	(2,229)	[535]	{267}	11,160	(2,232)	[536]	{268}	11,177	(2,235)	[536]	{268}
Putnam	1,433	1,437	1,439	1,444	1,451	(290)	[70]	{35}	1,458	(292)	[70]	{35}	1,465	(293)	[70]	{35}
Queens	68,166	68,225	68,297	68,368	68,490	(13,698)	[3,288]	{1,644}	68,610	(13,722)	[3,293]	{1,647}	68,728	(13,746)	[3,299]	{1,649}
Rensselaer	740	748	755	758	768	(154)	[37]	{18}	779	(156)	[37]	{19}	790	(158)	[38]	{19}
Richmond	14,822	14,840	14,854	14,877	14,914	(2,983)	[716]	{358}	14,952	(2,990)	[718]	{359}	14,990	(2,998)	[720]	{360}
Rockland	13,885	13,893	13,903	13,918	13,928	(2,786)	[669]	{334}	13,937	(2,787)	[669]	{334}	13,947	(2,789)	[669]	{335}
Saratoga	733	739	744	747	757	(151)	[36]	{18}	768	(154)	[37]	{18}	779	(156)	[37]	{19}
Schenectady	1,037	1,041	1,045	1,050	1,059	(212)	[51]	{25}	1,069	(214)	[51]	{26}	1,078	(216)	[52]	{26}
Suffolk	43,468	43,511	43,553	43,630	43,758	(8,752)	[2,100]	{1,050}	43,890	(8,778)	[2,107]	{1,053}	44,024	(8,805)	[2,113]	{1,057}
Sullivan	1,484	1,484	1,485	1,485	1,486	(297)	[71]	{36}	1,487	(297)	[71]	{36}	1,488	(298)	[71]	{36}
Tompkins	231	231	231	232	233	(47)	[11]	{6}	234	(47)	[11]	{6}	235	(47)	[11]	{6}
Ulster	2,031	2,039	2,042	2,045	2,057	(411)	[99]	{49}	2,070	(414)	[99]	{50}	2,084	(417)	[100]	{50}
Westchester	36,014	36,049	36,075	36,107	36,159	(7,232)	[1,736]	{868}	36,211	(7,242)	[1,738]	{869}	36,263	(7,253)	[1,741]	{870}

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.