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

Date: 3/1/21

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 10%, and are often within 5%, of actual confirmed cases.

The projections shown in this document are based on data pulled in as of 3/1/21 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.

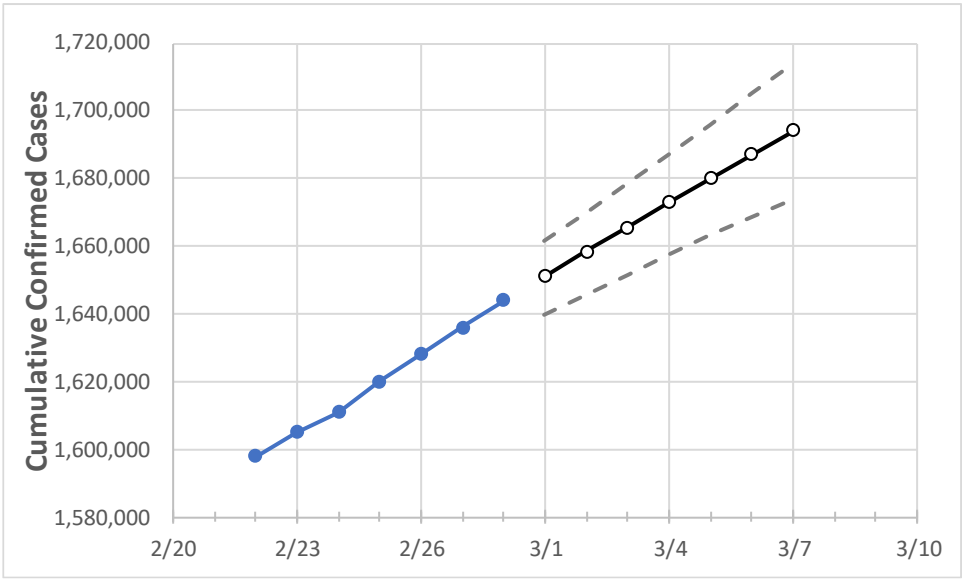
IEM's Modeling Lead

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:						
	2/25	2/26	2/27	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7
New York	1,619,924	1,627,998	1,636,040	1,643,867	1,651,176	1,658,414	1,665,628	1,672,843	1,680,047	1,687,153	1,694,211

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 10%, and are often within 5%, of actual confirmed cases.

New York Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	2/25	2/26	2/27	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7
Albany	20,620	20,683	20,758	20,848	20,900	20,950	20,998	21,047	21,095	21,141	21,188
Bronx	141,174	142,069	142,935	143,814	144,574	145,324	146,058	146,776	147,512	148,224	148,908
Dutchess	21,968	22,088	22,190	22,297	22,400	22,502	22,604	22,706	22,809	22,913	23,015
Erie	64,414	64,689	64,963	65,215	65,434	65,648	65,859	66,071	66,282	66,480	66,673
Kings	206,029	207,366	208,629	209,868	211,103	212,327	213,558	214,779	215,986	217,224	218,459
Monroe	52,122	52,245	52,371	52,543	52,672	52,800	52,925	53,047	53,170	53,286	53,407
Nassau	145,985	146,727	147,472	148,110	148,715	149,327	149,937	150,552	151,154	151,756	152,356
New York	101,250	101,934	102,643	103,289	103,914	104,546	105,171	105,806	106,420	107,042	107,677
Niagara	15,156	15,194	15,240	15,295	15,331	15,365	15,399	15,433	15,466	15,497	15,530
Onondaga	32,151	32,224	32,312	32,410	32,471	32,531	32,588	32,647	32,704	32,759	32,813
Orange	36,334	36,556	36,747	36,952	37,121	37,291	37,461	37,632	37,805	37,979	38,153
Putnam	8,244	8,271	8,307	8,340	8,369	8,398	8,427	8,455	8,483	8,511	8,538
Queens	207,309	208,445	209,641	210,793	211,918	213,050	214,164	215,263	216,364	217,468	218,557
Rensselaer	8,902	8,935	8,965	9,013	9,041	9,069	9,097	9,124	9,151	9,178	9,202
Richmond	56,174	56,406	56,649	56,938	57,181	57,426	57,670	57,907	58,150	58,389	58,627
Rockland	38,138	38,265	38,416	38,538	38,665	38,792	38,921	39,046	39,170	39,292	39,411
Saratoga	11,796	11,844	11,889	11,939	11,983	12,026	12,070	12,113	12,156	12,199	12,243
Schenectady	10,740	10,765	10,790	10,827	10,847	10,867	10,886	10,905	10,923	10,940	10,957
Suffolk	160,292	160,967	161,632	162,243	162,782	163,311	163,839	164,362	164,873	165,373	165,879
Sullivan	4,689	4,715	4,730	4,741	4,760	4,778	4,797	4,816	4,836	4,854	4,873
Tompkins	3,427	3,435	3,441	3,452	3,458	3,465	3,471	3,477	3,482	3,488	3,493
Ulster	9,898	9,940	9,981	10,037	10,077	10,118	10,157	10,197	10,236	10,274	10,312
Westchester	106,129	106,611	107,075	107,487	107,920	108,361	108,791	109,220	109,649	110,078	110,511

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:		
	2/25	2/26	2/27	2/28	3/2	3/4	3/6
Albany	20,620	20,683	20,758	20,848	20,950 (4,190) [1,006] {503}	21,047 (4,209) [1,010] {505}	21,141 (4,228) [1,015] {507}
Bronx	141,174	142,069	142,935	143,814	145,324 (29,065) [6,976] {3,488}	146,776 (29,355) [7,045] {3,523}	148,224 (29,645) [7,115] {3,557}
Dutchess	21,968	22,088	22,190	22,297	22,502 (4,500) [1,080] {540}	22,706 (4,541) [1,090] {545}	22,913 (4,583) [1,100] {550}
Erie	64,414	64,689	64,963	65,215	65,648 (13,130) [3,151] {1,576}	66,071 (13,214) [3,171] {1,586}	66,480 (13,296) [3,191] {1,596}
Kings	206,029	207,366	208,629	209,868	212,327 (42,465) [10,192] {5,096}	214,779 (42,956) [10,309] {5,155}	217,224 (43,445) [10,427] {5,213}
Monroe	52,122	52,245	52,371	52,543	52,800 (10,560) [2,534] {1,267}	53,047 (10,609) [2,546] {1,273}	53,286 (10,657) [2,558] {1,279}
Nassau	145,985	146,727	147,472	148,110	149,327 (29,865) [7,168] {3,584}	150,552 (30,110) [7,227] {3,613}	151,756 (30,351) [7,284] {3,642}
New York	101,250	101,934	102,643	103,289	104,546 (20,909) [5,018] {2,509}	105,806 (21,161) [5,079] {2,539}	107,042 (21,408) [5,138] {2,569}
Niagara	15,156	15,194	15,240	15,295	15,365 (3,073) [738] {369}	15,433 (3,087) [741] {370}	15,497 (3,099) [744] {372}
Onondaga	32,151	32,224	32,312	32,410	32,531 (6,506) [1,561] {781}	32,647 (6,529) [1,567] {784}	32,759 (6,552) [1,572] {786}
Orange	36,334	36,556	36,747	36,952	37,291 (7,458) [1,790] {895}	37,632 (7,526) [1,806] {903}	37,979 (7,596) [1,823] {911}
Putnam	8,244	8,271	8,307	8,340	8,398 (1,680) [403] {202}	8,455 (1,691) [406] {203}	8,511 (1,702) [409] {204}
Queens	207,309	208,445	209,641	210,793	213,050 (42,610) [10,226] {5,113}	215,263 (43,053) [10,333] {5,166}	217,468 (43,494) [10,438] {5,219}
Rensselaer	8,902	8,935	8,965	9,013	9,069 (1,814) [435] {218}	9,124 (1,825) [438] {219}	9,178 (1,836) [441] {220}
Richmond	56,174	56,406	56,649	56,938	57,426 (11,485) [2,756] {1,378}	57,907 (11,581) [2,780] {1,390}	58,389 (11,678) [2,803] {1,401}
Rockland	38,138	38,265	38,416	38,538	38,792 (7,758) [1,862] {931}	39,046 (7,809) [1,874] {937}	39,292 (7,858) [1,886] {943}
Saratoga	11,796	11,844	11,889	11,939	12,026 (2,405) [577] {289}	12,113 (2,423) [581] {291}	12,199 (2,440) [586] {293}
Schenectady	10,740	10,765	10,790	10,827	10,867 (2,173) [522] {261}	10,905 (2,181) [523] {262}	10,940 (2,188) [525] {263}
Suffolk	160,292	160,967	161,632	162,243	163,311 (32,662) [7,839] {3,919}	164,362 (32,872) [7,889] {3,945}	165,373 (33,075) [7,938] {3,969}
Sullivan	4,689	4,715	4,730	4,741	4,778 (956) [229] {115}	4,816 (963) [231] {116}	4,854 (971) [233] {116}
Tompkins	3,427	3,435	3,441	3,452	3,465 (693) [166] {83}	3,477 (695) [167] {83}	3,488 (698) [167] {84}
Ulster	9,898	9,940	9,981	10,037	10,118 (2,024) [486] {243}	10,197 (2,039) [489] {245}	10,274 (2,055) [493] {247}
Westchester	106,129	106,611	107,075	107,487	108,361 (21,672) [5,201] {2,601}	109,220 (21,844) [5,243] {2,621}	110,078 (22,016) [5,284] {2,642}

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.