IEM's AI Modeling: Short-term COVID-19 Projections
Date: 6/30/20

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 6/30/20 10 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
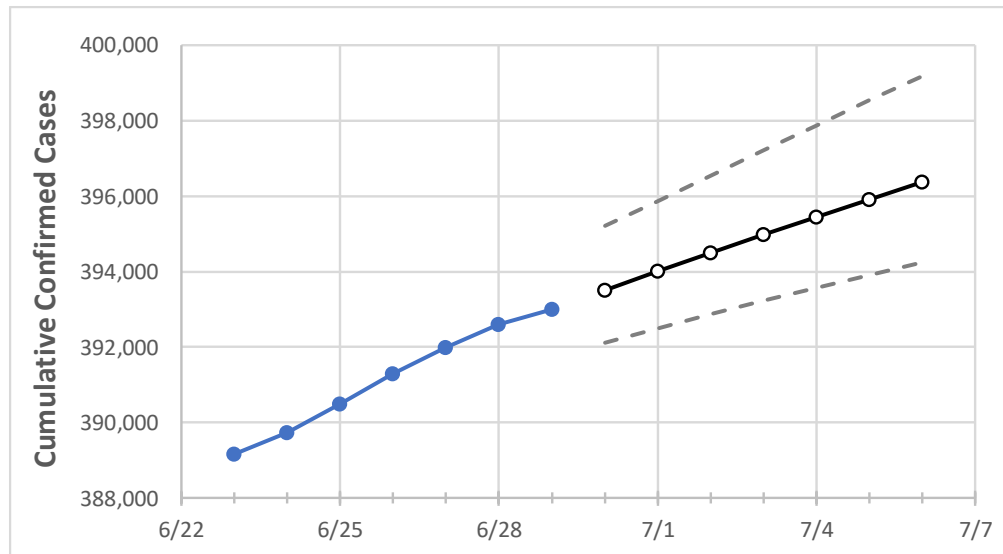
	Actual Confirmed Cases On:				**Projected Cases For:**						
	6/26	6/27	6/28	6/29	6/30	7/1	7/2	7/3	7/4	7/5	7/6
New York	391,289	391,992	392,608	392,989	393,501	394,002	394,495	394,978	395,451	395,916	396,372

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:						
	6/26	6/27	6/28	6/29	6/30	7/1	7/2	7/3	7/4	7/5	7/6
Albany	2,084	2,091	2,097	2,099	2,102	2,105	2,108	2,111	2,114	2,117	2,120
Bronx	47,383	47,456	47,514	47,555	47,607	47,658	47,708	47,757	47,805	47,853	47,899
Dutchess	4,179	4,191	4,198	4,201	4,208	4,214	4,221	4,227	4,234	4,240	4,246
Erie	7,181	7,206	7,228	7,249	7,273	7,297	7,320	7,343	7,365	7,387	7,408
Kings	59,311	59,420	59,507	59,576	59,655	59,732	59,807	59,880	59,951	60,021	60,089
Monroe	3,641	3,676	3,690	3,709	3,728	3,747	3,765	3,784	3,802	3,820	3,839
Nassau	41,684	41,725	41,754	41,780	41,809	41,837	41,865	41,892	41,918	41,944	41,970
New York	28,250	28,331	28,380	28,401	28,447	28,494	28,539	28,584	28,629	28,674	28,717
Niagara	1,213	1,223	1,226	1,228	1,231	1,233	1,236	1,239	1,241	1,244	1,246
Onondaga	2,782	2,791	2,816	2,822	2,836	2,851	2,865	2,879	2,893	2,907	2,920
Orange	10,698	10,710	10,713	10,716	10,722	10,727	10,733	10,738	10,743	10,748	10,753
Putnam	1,317	1,319	1,323	1,325	1,327	1,328	1,330	1,331	1,333	1,334	1,336
Queens	65,089	65,175	65,276	65,325	65,405	65,484	65,562	65,638	65,713	65,786	65,859
Rensselaer	549	550	551	553	555	557	559	562	564	567	569
Richmond	14,037	14,052	14,073	14,082	14,093	14,105	14,116	14,127	14,138	14,148	14,159
Rockland	13,557	13,566	13,576	13,580	13,587	13,593	13,599	13,605	13,610	13,616	13,621
Saratoga	543	546	548	549	551	552	554	555	557	558	560
Schenectady	781	786	792	799	804	808	813	819	824	830	835
Suffolk	41,208	41,253	41,306	41,339	41,378	41,416	41,454	41,491	41,529	41,566	41,602
Sullivan	1,449	1,451	1,451	1,451	1,452	1,453	1,453	1,454	1,455	1,456	1,456
Tompkins	176	176	176	177	177	177	177	178	178	178	178
Ulster	1,768	1,773	1,778	1,778	1,780	1,782	1,784	1,787	1,789	1,791	1,793
Westchester	34,700	34,748	34,780	34,789	34,813	34,836	34,859	34,881	34,903	34,924	34,945

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:		
	6/26	6/27	6/28	6/29	7/1	7/3	7/5
Albany	2,084	2,091	2,097	2,099	2,105 (421) [101] {51}	2,111 (422) [101] {51}	2,117 (423) [102] {51}
Bronx	47,383	47,456	47,514	47,555	47,658 (9,532) [2,288] {1,144}	47,757 (9,551) [2,292] {1,146}	47,853 (9,571) [2,297] {1,1
Dutchess	4,179	4,191	4,198	4,201	4,214 (843) [202] {101}	4,227 (845) [203] {101}	4,240 (848) [204] {102}
Erie	7,181	7,206	7,228	7,249	7,297 (1,459) [350] {175}	7,343 (1,469) [352] {176}	7,387 (1,477) [355] {177
Kings	59,311	59,420	59,507	59,576	59,732 (11,946) [2,867] {1,434}	59,880 (11,976) [2,874] {1,437}	60,021 (12,004) [2,881] {1,
Monroe	3,641	3,676	3,690	3,709	3,747 (749) [180] {90}	3,784 (757) [182] {91}	3,820 (764) [183] {92}
Nassau	41,684	41,725	41,754	41,780	41,837 (8,367) [2,008] {1,004}	41,892 (8,378) [2,011] {1,005}	41,944 (8,389) [2,013] {1,0
New York	28,250	28,331	28,380	28,401	28,494 (5,699) [1,368] {684}	28,584 (5,717) [1,372] {686}	28,674 (5,735) [1,376] {68
Niagara	1,213	1,223	1,226	1,228	1,233 (247) [59] {30}	1,239 (248) [59] {30}	1,244 (249) [60] {30}
Onondaga	2,782	2,791	2,816	2,822	2,851 (570) [137] {68}	2,879 (576) [138] {69}	2,907 (581) [140] {70}
Orange	10,698	10,710	10,713	10,716	10,727 (2,145) [515] {257}	10,738 (2,148) [515] {258}	10,748 (2,150) [516] {25
Putnam	1,317	1,319	1,323	1,325	1,328 (266) [64] {32}	1,331 (266) [64] {32}	1,334 (267) [64] {32}
Queens	65,089	65,175	65,276	65,325	65,484 (13,097) [3,143] {1,572}	65,638 (13,128) [3,151] {1,575}	65,786 (13,157) [3,158] {1,
Rensselaer	549	550	551	553	557 (111) [27] {13}	562 (112) [27] {13}	567 (113) [27] {14}
Richmond	14,037	14,052	14,073	14,082	14,105 (2,821) [677] {339}	14,127 (2,825) [678] {339}	14,148 (2,830) [679] {34
Rockland	13,557	13,566	13,576	13,580	13,593 (2,719) [652] {326}	13,605 (2,721) [653] {327}	13,616 (2,723) [654] {32
Saratoga	543	546	548	549	552 (110) [27] {13}	555 (111) [27] {13}	558 (112) [27] {13}
Schenectady	781	786	792	799	808 (162) [39] {19}	819 (164) [39] {20}	830 (166) [40] {20}
Suffolk	41,208	41,253	41,306	41,339	41,416 (8,283) [1,988] {994}	41,491 (8,298) [1,992] {996}	41,566 (8,313) [1,995] {99
Sullivan	1,449	1,451	1,451	1,451	1,453 (291) [70] {35}	1,454 (291) [70] {35}	1,456 (291) [70] {35}
Tompkins	176	176	176	177	177 (35) [9] {4}	178 (36) [9] {4}	178 (36) [9] {4}
Ulster	1,768	1,773	1,778	1,778	1,782 (356) [86] {43}	1,787 (357) [86] {43}	1,791 (358) [86] {43}
Westchester	34,700	34,748	34,780	34,789	34,836 (6,967) [1,672] {836}	34,881 (6,976) [1,674] {837}	34,924 (6,985) [1,676] {8

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.