IEM's AI Modeling: Short-term COVID-19 Projections
Date: 6/26/20

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 6/26/20 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
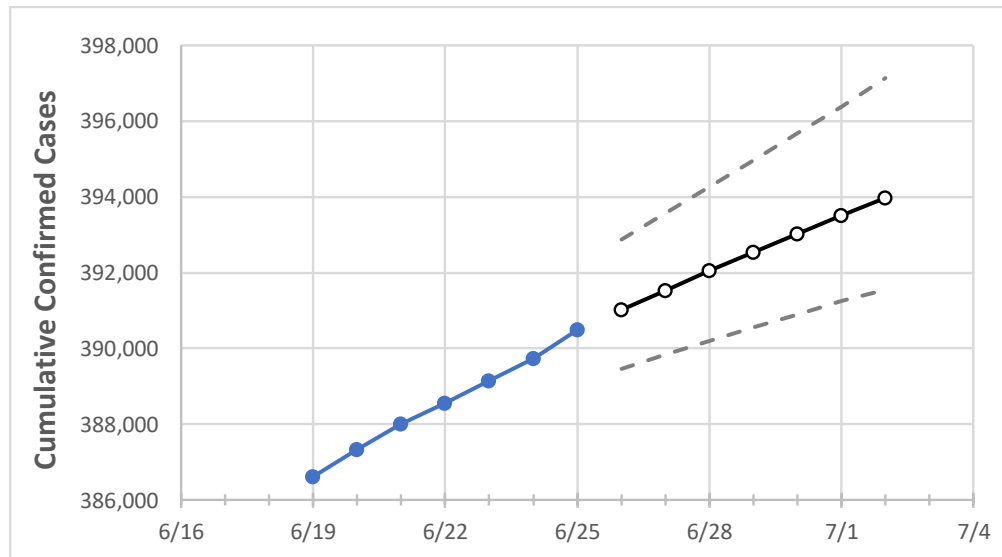
	Actual Confirmed Cases On:				Projected Cases For:						
	6/22	6/23	6/24	6/25	6/26	6/27	6/28	6/29	6/30	7/1	7/2
New York	388,557	389,154	389,735	390,484	391,016	391,536	392,046	392,544	393,033	393,510	393,978

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.

IEM. 35 YEARS

New York Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	6/22	6/23	6/24	6/25	6/26	6/27	6/28	6/29	6/30	7/1	7/2
Albany	2,060	2,062	2,065	2,076	2,079	2,082	2,085	2,087	2,090	2,092	2,095
Bronx	47,092	47,154	47,230	47,294	47,347	47,399	47,449	47,498	47,546	47,593	47,639
Dutchess	4,145	4,150	4,158	4,176	4,184	4,192	4,200	4,208	4,215	4,223	4,231
Erie	7,035	7,073	7,108	7,138	7,164	7,189	7,214	7,238	7,261	7,284	7,306
Kings	58,949	59,047	59,111	59,206	59,288	59,367	59,445	59,520	59,592	59,663	59,732
Monroe	3,512	3,540	3,567	3,602	3,619	3,636	3,653	3,670	3,687	3,703	3,719
Nassau	41,513	41,544	41,585	41,646	41,677	41,707	41,737	41,766	41,794	41,822	41,850
New York	28,017	28,075	28,132	28,192	28,239	28,287	28,333	28,380	28,426	28,471	28,516
Niagara	1,193	1,195	1,199	1,203	1,205	1,208	1,210	1,212	1,214	1,216	1,217
Onondaga	2,675	2,702	2,734	2,751	2,766	2,780	2,795	2,809	2,823	2,837	2,851
Orange	10,654	10,666	10,669	10,679	10,685	10,691	10,697	10,702	10,708	10,713	10,718
Putnam	1,305	1,306	1,306	1,311	1,312	1,313	1,314	1,315	1,316	1,318	1,318
Queens	64,712	64,797	64,881	64,987	65,076	65,163	65,249	65,333	65,416	65,498	65,578
Rensselaer	528	533	534	541	543	545	547	549	551	553	555
Richmond	13,971	13,983	13,994	14,020	14,031	14,041	14,051	14,061	14,071	14,080	14,089
Rockland	13,514	13,529	13,534	13,549	13,557	13,565	13,572	13,579	13,586	13,593	13,599
Saratoga	535	538	539	540	541	543	544	545	547	548	549
Schenectady	761	770	772	778	782	785	789	793	797	801	805
Suffolk	41,010	41,056	41,101	41,151	41,186	41,219	41,253	41,285	41,317	41,348	41,379
Sullivan	1,438	1,440	1,447	1,448	1,449	1,450	1,450	1,451	1,452	1,452	1,453
Tompkins	175	175	175	175	175	175	175	176	176	176	176
Ulster	1,756	1,757	1,760	1,765	1,766	1,768	1,769	1,770	1,771	1,773	1,774
Westchester	34,557	34,581	34,597	34,642	34,666	34,690	34,713	34,735	34,757	34,777	34,797

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:		
	6/22	6/23	6/24	6/25	6/27	6/29	7/1
Albany	2,060	2,062	2,065	2,076	2,082 (416) [100] {50}	2,087 (417) [100] {50}	2,092 (418) [100] {50}
Bronx	47,092	47,154	47,230	47,294	47,399 (9,480) [2,275] {1,138}	47,498 (9,500) [2,280] {1,140}	47,593 (9,519) [2,284] {1,
Dutchess	4,145	4,150	4,158	4,176	4,192 (838) [201] {101}	4,208 (842) [202] {101}	4,223 (845) [203] {101
Erie	7,035	7,073	7,108	7,138	7,189 (1,438) [345] {173}	7,238 (1,448) [347] {174}	7,284 (1,457) [350] {175
Kings	58,949	59,047	59,111	59,206	59,367 (11,873) [2,850] {1,425}	59,520 (11,904) [2,857] {1,428}	59,663 (11,933) [2,864] {1,
Monroe	3,512	3,540	3,567	3,602	3,636 (727) [175] {87}	3,670 (734) [176] {88}	3,703 (741) [178] {89}
Nassau	41,513	41,544	41,585	41,646	41,707 (8,341) [2,002] {1,001}	41,766 (8,353) [2,005] {1,002}	41,822 (8,364) [2,007] {1,0
New York	28,017	28,075	28,132	28,192	28,287 (5,657) [1,358] {679}	28,380 (5,676) [1,362] {681}	28,471 (5,694) [1,367] {68
Niagara	1,193	1,195	1,199	1,203	1,208 (242) [58] {29}	1,212 (242) [58] {29}	1,216 (243) [58] {29}
Onondaga	2,675	2,702	2,734	2,751	2,780 (556) [133] {67}	2,809 (562) [135] {67}	2,837 (567) [136] {68}
Orange	10,654	10,666	10,669	10,679	10,691 (2,138) [513] {257}	10,702 (2,140) [514] {257}	10,713 (2,143) [514] {25
Putnam	1,305	1,306	1,306	1,311	1,313 (263) [63] {32}	1,315 (263) [63] {32}	1,318 (264) [63] {32}
Queens	64,712	64,797	64,881	64,987	65,163 (13,033) [3,128] {1,564}	65,333 (13,067) [3,136] {1,568}	65,498 (13,100) [3,144] {1,
Rensselaer	528	533	534	541	545 (109) [26] {13}	549 (110) [26] {13}	553 (111) [27] {13}
Richmond	13,971	13,983	13,994	14,020	14,041 (2,808) [674] {337}	14,061 (2,812) [675] {337}	14,080 (2,816) [676] {33
Rockland	13,514	13,529	13,534	13,549	13,565 (2,713) [651] {326}	13,579 (2,716) [652] {326}	13,593 (2,719) [652] {32
Saratoga	535	538	539	540	543 (109) [26] {13}	545 (109) [26] {13}	548 (110) [26] {13}
Schenectady	761	770	772	778	785 (157) [38] {19}	793 (159) [38] {19}	801 (160) [38] {19}
Suffolk	41,010	41,056	41,101	41,151	41,219 (8,244) [1,979] {989}	41,285 (8,257) [1,982] {991}	41,348 (8,270) [1,985] {99
Sullivan	1,438	1,440	1,447	1,448	1,450 (290) [70] {35}	1,451 (290) [70] {35}	1,452 (290) [70] {35}
Tompkins	175	175	175	175	175 (35) [8] {4}	176 (35) [8] {4}	176 (35) [8] {4}
Ulster	1,756	1,757	1,760	1,765	1,768 (354) [85] {42}	1,770 (354) [85] {42}	1,773 (355) [85] {43}
Westchester	34,557	34,581	34,597	34,642	34,690 (6,938) [1,665] {833}	34,735 (6,947) [1,667] {834}	34,777 (6,955) [1,669] {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.