IEM's AI Modeling: Short-term COVID-19 Projections
Date: 10/15/20

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

The projections shown in this document are based on data pulled in as of 10/15/20 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
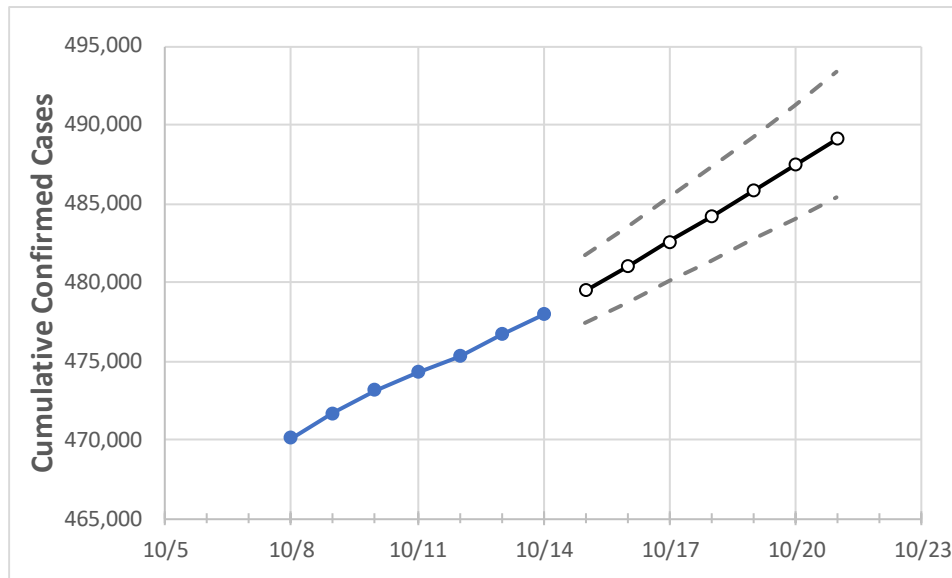
	Actual Confirmed Cases On:				Projected Cases For:						
	10/11	10/12	10/13	10/14	10/15	10/16	10/17	10/18	10/19	10/20	10/21
New York	474,286	475,315	476,708	477,940	479,462	481,008	482,579	484,175	485,798	487,447	489,123

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:						
	10/11	10/12	10/13	10/14	10/15	10/16	10/17	10/18	10/19	10/20	10/21
Albany	3,293	3,304	3,324	3,343	3,360	3,377	3,395	3,413	3,431	3,450	3,469
Bronx	53,836	53,894	53,960	54,006	54,075	54,144	54,213	54,283	54,354	54,425	54,497
Dutchess	5,252	5,259	5,271	5,281	5,291	5,302	5,313	5,324	5,336	5,347	5,359
Erie	12,107	12,154	12,182	12,216	12,261	12,305	12,349	12,392	12,435	12,478	12,520
Kings	71,635	71,756	71,941	72,159	72,434	72,713	72,998	73,288	73,584	73,885	74,192
Monroe	6,421	6,453	6,490	6,516	6,549	6,583	6,619	6,655	6,692	6,730	6,769
Nassau	47,933	47,998	48,099	48,184	48,286	48,391	48,497	48,604	48,714	48,825	48,938
New York	34,342	34,408	34,501	34,569	34,650	34,732	34,816	34,902	34,989	35,079	35,170
Niagara	1,895	1,902	1,907	1,911	1,919	1,927	1,935	1,943	1,951	1,960	1,968
Onondaga	4,779	4,807	4,843	4,880	4,917	4,954	4,994	5,034	5,075	5,118	5,162
Orange	12,842	12,869	12,930	12,983	13,051	13,122	13,194	13,269	13,347	13,427	13,510
Putnam	1,683	1,689	1,698	1,705	1,711	1,718	1,724	1,731	1,738	1,745	1,753
Queens	74,150	74,265	74,404	74,510	74,675	74,844	75,017	75,194	75,375	75,560	75,750
Rensselaer	980	985	994	1,002	1,008	1,015	1,022	1,030	1,038	1,046	1,055
Richmond	16,401	16,434	16,496	16,522	16,569	16,617	16,667	16,719	16,772	16,826	16,883
Rockland	16,717	16,760	16,829	16,891	16,982	17,074	17,169	17,265	17,364	17,465	17,567
Saratoga	1,149	1,158	1,168	1,174	1,181	1,188	1,195	1,202	1,210	1,217	1,224
Schenectady	1,454	1,459	1,461	1,464	1,467	1,469	1,472	1,474	1,477	1,479	1,482
Suffolk	47,431	47,493	47,561	47,630	47,719	47,811	47,905	48,001	48,100	48,202	48,306
Sullivan	1,649	1,650	1,655	1,659	1,662	1,666	1,670	1,674	1,678	1,682	1,686
Tompkins	479	481	490	507	514	521	529	537	546	554	564
Ulster	2,358	2,366	2,377	2,386	2,396	2,406	2,417	2,428	2,440	2,453	2,466
Westchester	38,894	39,001	39,064	39,118	39,189	39,262	39,337	39,414	39,493	39,574	39,656

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:		
	10/11	10/12	10/13	10/14	10/16	10/18	10/20
Albany	3,293	3,304	3,324	3,343	3,377 (675) [162] {81}	3,413 (683) [164] {82}	3,450 (690) [166] {83}
Bronx	53,836	53,894	53,960	54,006	54,144 (10,829) [2,599] {1,299}	54,283 (10,857) [2,606] {1,303}	54,425 (10,885) [2,612] {1,306}
Dutchess	5,252	5,259	5,271	5,281	5,302 (1,060) [255] {127}	5,324 (1,065) [256] {128}	5,347 (1,069) [257] {128}
Erie	12,107	12,154	12,182	12,216	12,305 (2,461) [591] {295}	12,392 (2,478) [595] {297}	12,478 (2,496) [599] {299}
Kings	71,635	71,756	71,941	72,159	72,713 (14,543) [3,490] {1,745}	73,288 (14,658) [3,518] {1,759}	73,885 (14,777) [3,546] {1,773}
Monroe	6,421	6,453	6,490	6,516	6,583 (1,317) [316] {158}	6,655 (1,331) [319] {160}	6,730 (1,346) [323] {162}
Nassau	47,933	47,998	48,099	48,184	48,391 (9,678) [2,323] {1,161}	48,604 (9,721) [2,333] {1,166}	48,825 (9,765) [2,344] {1,172}
New York	34,342	34,408	34,501	34,569	34,732 (6,946) [1,667] {834}	34,902 (6,980) [1,675] {838}	35,079 (7,016) [1,684] {842}
Niagara	1,895	1,902	1,907	1,911	1,927 (385) [92] {46}	1,943 (389) [93] {47}	1,960 (392) [94] {47}
Onondaga	4,779	4,807	4,843	4,880	4,954 (991) [238] {119}	5,034 (1,007) [242] {121}	5,118 (1,024) [246] {123}
Orange	12,842	12,869	12,930	12,983	13,122 (2,624) [630] {315}	13,269 (2,654) [637] {318}	13,427 (2,685) [645] {322}
Putnam	1,683	1,689	1,698	1,705	1,718 (344) [82] {41}	1,731 (346) [83] {42}	1,745 (349) [84] {42}
Queens	74,150	74,265	74,404	74,510	74,844 (14,969) [3,593] {1,796}	75,194 (15,039) [3,609] {1,805}	75,560 (15,112) [3,627] {1,813}
Rensselaer	980	985	994	1,002	1,015 (203) [49] {24}	1,030 (206) [49] {25}	1,046 (209) [50] {25}
Richmond	16,401	16,434	16,496	16,522	16,617 (3,323) [798] {399}	16,719 (3,344) [802] {401}	16,826 (3,365) [808] {404}
Rockland	16,717	16,760	16,829	16,891	17,074 (3,415) [820] {410}	17,265 (3,453) [829] {414}	17,465 (3,493) [838] {419}
Saratoga	1,149	1,158	1,168	1,174	1,188 (238) [57] {29}	1,202 (240) [58] {29}	1,217 (243) [58] {29}
Schenectady	1,454	1,459	1,461	1,464	1,469 (294) [71] {35}	1,474 (295) [71] {35}	1,479 (296) [71] {35}
Suffolk	47,431	47,493	47,561	47,630	47,811 (9,562) [2,295] {1,147}	48,001 (9,600) [2,304] {1,152}	48,202 (9,640) [2,314] {1,157}
Sullivan	1,649	1,650	1,655	1,659	1,666 (333) [80] {40}	1,674 (335) [80] {40}	1,682 (336) [81] {40}
Tompkins	479	481	490	507	521 (104) [25] {13}	537 (107) [26] {13}	554 (111) [27] {13}
Ulster	2,358	2,366	2,377	2,386	2,406 (481) [115] {58}	2,428 (486) [117] {58}	2,453 (491) [118] {59}
Westchester	38,894	39,001	39,064	39,118	39,262 (7,852) [1,885] {942}	39,414 (7,883) [1,892] {946}	39,574 (7,915) [1,900] {950}

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.