IEM's AI Modeling: Short-term COVID-19 Projections
Date: 9/3/20

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 9/3/20 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
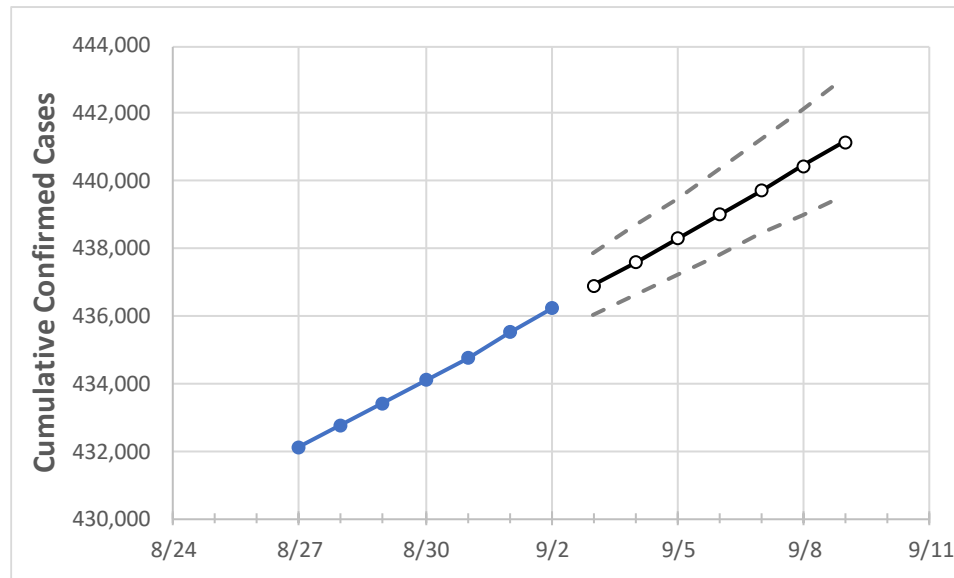
	Actual Confirmed Cases On:				Projected Cases For:						
	8/30	8/31	9/1	9/2	9/3	9/4	9/5	9/6	9/7	9/8	9/9
New York	434,100	434,756	435,510	436,218	436,903	437,595	438,294	439,000	439,714	440,435	441,164

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:						
	8/30	8/31	9/1	9/2	9/3	9/4	9/5	9/6	9/7	9/8	9/9
Albany	2,764	2,770	2,786	2,791	2,797	2,804	2,810	2,817	2,824	2,830	2,837
Bronx	51,533	51,610	51,663	51,711	51,766	51,822	51,877	51,932	51,986	52,041	52,096
Dutchess	4,852	4,865	4,868	4,878	4,888	4,898	4,908	4,918	4,928	4,938	4,949
Erie	9,807	9,872	9,947	10,017	10,081	10,147	10,216	10,287	10,360	10,436	10,515
Kings	64,930	64,998	65,118	65,201	65,285	65,370	65,456	65,542	65,630	65,718	65,807
Monroe	5,443	5,452	5,462	5,468	5,478	5,487	5,496	5,504	5,512	5,520	5,527
Nassau	44,610	44,677	44,761	44,845	44,916	44,990	45,067	45,147	45,229	45,315	45,404
New York	32,075	32,119	32,165	32,218	32,262	32,305	32,349	32,392	32,434	32,476	32,518
Niagara	1,612	1,618	1,626	1,632	1,639	1,645	1,652	1,659	1,667	1,674	1,682
Onondaga	3,883	3,892	3,912	3,922	3,936	3,950	3,964	3,978	3,993	4,007	4,022
Orange	11,418	11,433	11,445	11,460	11,473	11,487	11,501	11,515	11,529	11,544	11,559
Putnam	1,500	1,501	1,505	1,510	1,513	1,517	1,521	1,525	1,529	1,533	1,538
Queens	70,162	70,222	70,288	70,344	70,406	70,468	70,530	70,590	70,650	70,710	70,769
Rensselaer	833	838	841	844	846	849	851	854	856	859	861
Richmond	15,269	15,288	15,308	15,332	15,349	15,367	15,385	15,403	15,422	15,440	15,459
Rockland	14,233	14,255	14,271	14,305	14,326	14,348	14,371	14,395	14,420	14,446	14,473
Saratoga	842	844	846	852	855	858	861	865	868	871	875
Schenectady	1,260	1,263	1,271	1,278	1,285	1,293	1,300	1,308	1,315	1,323	1,330
Suffolk	44,763	44,820	44,885	44,940	44,988	45,036	45,085	45,134	45,184	45,235	45,286
Sullivan	1,521	1,529	1,530	1,534	1,537	1,540	1,544	1,548	1,552	1,557	1,562
Tompkins	264	265	270	280	282	284	286	289	291	294	297
Ulster	2,168	2,175	2,176	2,178	2,181	2,185	2,188	2,192	2,195	2,199	2,202
Westchester	36,949	36,984	37,021	37,057	37,095	37,133	37,172	37,212	37,252	37,292	37,334

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:		
	8/30	8/31	9/1	9/2	9/4	9/6	9/8
Albany	2,764	2,770	2,786	2,791	2,804 (561) [135] {67}	2,817 (563) [135] {68}	2,830 (566) [136] {68}
Bronx	51,533	51,610	51,663	51,711	51,822 (10,364) [2,487] {1,244}	51,932 (10,386) [2,493] {1,246}	52,041 (10,408) [2,498] {1,249}
Dutchess	4,852	4,865	4,868	4,878	4,898 (980) [235] {118}	4,918 (984) [236] {118}	4,938 (988) [237] {119}
Erie	9,807	9,872	9,947	10,017	10,147 (2,029) [487] {244}	10,287 (2,057) [494] {247}	10,436 (2,087) [501] {250}
Kings	64,930	64,998	65,118	65,201	65,370 (13,074) [3,138] {1,569}	65,542 (13,108) [3,146] {1,573}	65,718 (13,144) [3,154] {1,577}
Monroe	5,443	5,452	5,462	5,468	5,487 (1,097) [263] {132}	5,504 (1,101) [264] {132}	5,520 (1,104) [265] {132}
Nassau	44,610	44,677	44,761	44,845	44,990 (8,998) [2,160] {1,080}	45,147 (9,029) [2,167] {1,084}	45,315 (9,063) [2,175] {1,088}
New York	32,075	32,119	32,165	32,218	32,305 (6,461) [1,551] {775}	32,392 (6,478) [1,555] {777}	32,476 (6,495) [1,559] {779}
Niagara	1,612	1,618	1,626	1,632	1,645 (329) [79] {39}	1,659 (332) [80] {40}	1,674 (335) [80] {40}
Onondaga	3,883	3,892	3,912	3,922	3,950 (790) [190] {95}	3,978 (796) [191] {95}	4,007 (801) [192] {96}
Orange	11,418	11,433	11,445	11,460	11,487 (2,297) [551] {276}	11,515 (2,303) [553] {276}	11,544 (2,309) [554] {277}
Putnam	1,500	1,501	1,505	1,510	1,517 (303) [73] {36}	1,525 (305) [73] {37}	1,533 (307) [74] {37}
Queens	70,162	70,222	70,288	70,344	70,468 (14,094) [3,382] {1,691}	70,590 (14,118) [3,388] {1,694}	70,710 (14,142) [3,394] {1,697}
Rensselaer	833	838	841	844	849 (170) [41] {20}	854 (171) [41] {20}	859 (172) [41] {21}
Richmond	15,269	15,288	15,308	15,332	15,367 (3,073) [738] {369}	15,403 (3,081) [739] {370}	15,440 (3,088) [741] {371}
Rockland	14,233	14,255	14,271	14,305	14,348 (2,870) [689] {344}	14,395 (2,879) [691] {345}	14,446 (2,889) [693] {347}
Saratoga	842	844	846	852	858 (172) [41] {21}	865 (173) [42] {21}	871 (174) [42] {21}
Schenectady	1,260	1,263	1,271	1,278	1,293 (259) [62] {31}	1,308 (262) [63] {31}	1,323 (265) [63] {32}
Suffolk	44,763	44,820	44,885	44,940	45,036 (9,007) [2,162] {1,081}	45,134 (9,027) [2,166] {1,083}	45,235 (9,047) [2,171] {1,086}
Sullivan	1,521	1,529	1,530	1,534	1,540 (308) [74] {37}	1,548 (310) [74] {37}	1,557 (311) [75] {37}
Tompkins	264	265	270	280	284 (57) [14] {7}	289 (58) [14] {7}	294 (59) [14] {7}
Ulster	2,168	2,175	2,176	2,178	2,185 (437) [105] {52}	2,192 (438) [105] {53}	2,199 (440) [106] {53}
Westchester	36,949	36,984	37,021	37,057	37,133 (7,427) [1,782] {891}	37,212 (7,442) [1,786] {893}	37,292 (7,458) [1,790] {895}

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.