IEM's AI Modeling: Short-term COVID-19 Projections
Date: 10/16/20

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 10/16/20 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
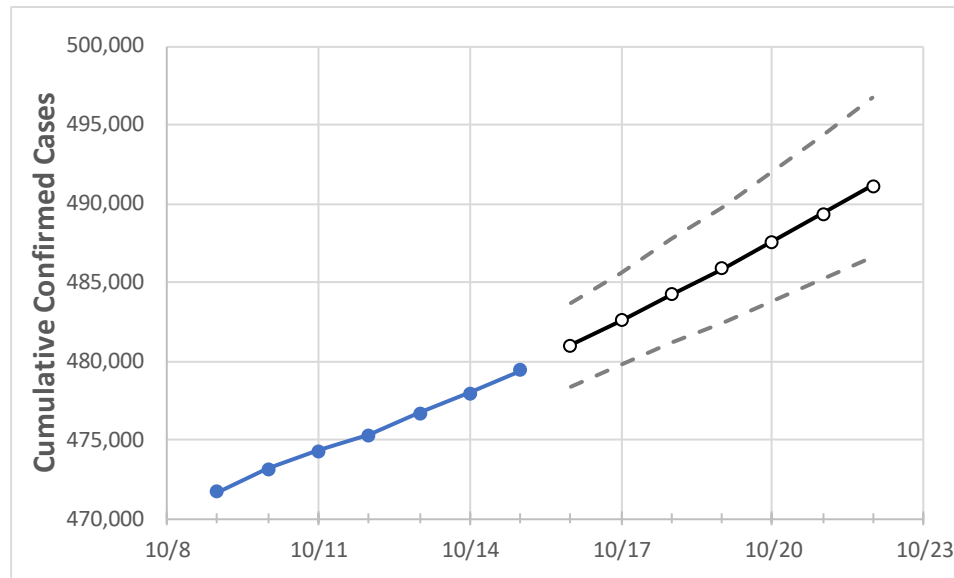
	Actual Confirmed Cases On:				Projected Cases For:						
	10/12	10/13	10/14	10/15	10/16	10/17	10/18	10/19	10/20	10/21	10/22
New York	475,315	476,708	477,940	479,400	480,976	482,583	484,223	485,895	487,601	489,342	491,117

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:						
	10/12	10/13	10/14	10/15	10/16	10/17	10/18	10/19	10/20	10/21	10/22
Albany	3,304	3,324	3,343	3,369	3,388	3,407	3,427	3,447	3,467	3,488	3,510
Bronx	53,894	53,960	54,006	54,077	54,146	54,216	54,286	54,357	54,428	54,500	54,572
Dutchess	5,259	5,271	5,281	5,289	5,299	5,310	5,321	5,332	5,343	5,354	5,366
Erie	12,154	12,182	12,216	12,269	12,314	12,359	12,403	12,448	12,492	12,536	12,579
Kings	71,756	71,941	72,159	72,369	72,617	72,867	73,119	73,374	73,632	73,891	74,154
Monroe	6,453	6,490	6,516	6,572	6,608	6,646	6,685	6,725	6,766	6,809	6,853
Nassau	47,998	48,099	48,184	48,272	48,375	48,481	48,588	48,697	48,807	48,920	49,034
New York	34,408	34,501	34,569	34,637	34,718	34,800	34,883	34,969	35,056	35,145	35,235
Niagara	1,902	1,907	1,911	1,928	1,937	1,946	1,955	1,964	1,974	1,984	1,994
Onondaga	4,807	4,843	4,880	4,908	4,944	4,982	5,021	5,060	5,102	5,144	5,187
Orange	12,869	12,930	12,983	13,033	13,100	13,169	13,241	13,315	13,391	13,470	13,552
Putnam	1,689	1,698	1,705	1,710	1,716	1,722	1,729	1,736	1,742	1,749	1,757
Queens	74,265	74,404	74,510	74,632	74,781	74,933	75,085	75,240	75,397	75,556	75,716
Rensselaer	985	994	1,002	1,007	1,014	1,021	1,028	1,036	1,044	1,052	1,062
Richmond	16,434	16,496	16,522	16,559	16,606	16,655	16,705	16,757	16,811	16,866	16,922
Rockland	16,760	16,829	16,891	16,972	17,061	17,153	17,246	17,342	17,439	17,539	17,641
Saratoga	1,158	1,168	1,174	1,182	1,189	1,196	1,204	1,211	1,219	1,227	1,234
Schenectady	1,459	1,461	1,464	1,477	1,480	1,483	1,486	1,489	1,493	1,496	1,499
Suffolk	47,493	47,561	47,630	47,711	47,802	47,895	47,991	48,089	48,189	48,291	48,396
Sullivan	1,650	1,655	1,659	1,663	1,667	1,671	1,674	1,679	1,683	1,687	1,692
Tompkins	481	490	507	515	522	530	538	547	556	566	576
Ulster	2,366	2,377	2,386	2,392	2,401	2,411	2,422	2,432	2,444	2,456	2,468
Westchester	39,001	39,064	39,118	39,200	39,274	39,350	39,428	39,508	39,590	39,674	39,761

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:		
	10/12	10/13	10/14	10/15	10/17	10/19	10/21
Albany	3,304	3,324	3,343	3,369	3,407 (681) [164] {82}	3,447 (689) [165] {83}	3,488 (698) [167] {84}
Bronx	53,894	53,960	54,006	54,077	54,216 (10,843) [2,602] {1,301}	54,357 (10,871) [2,609] {1,305}	54,500 (10,900) [2,616] {1,308}
Dutchess	5,259	5,271	5,281	5,289	5,310 (1,062) [255] {127}	5,332 (1,066) [256] {128}	5,354 (1,071) [257] {128}
Erie	12,154	12,182	12,216	12,269	12,359 (2,472) [593] {297}	12,448 (2,490) [597] {299}	12,536 (2,507) [602] {301}
Kings	71,756	71,941	72,159	72,369	72,867 (14,573) [3,498] {1,749}	73,374 (14,675) [3,522] {1,761}	73,891 (14,778) [3,547] {1,773}
Monroe	6,453	6,490	6,516	6,572	6,646 (1,329) [319] {160}	6,725 (1,345) [323] {161}	6,809 (1,362) [327] {163}
Nassau	47,998	48,099	48,184	48,272	48,481 (9,696) [2,327] {1,164}	48,697 (9,739) [2,337] {1,169}	48,920 (9,784) [2,348] {1,174}
New York	34,408	34,501	34,569	34,637	34,800 (6,960) [1,670] {835}	34,969 (6,994) [1,679] {839}	35,145 (7,029) [1,687] {843}
Niagara	1,902	1,907	1,911	1,928	1,946 (389) [93] {47}	1,964 (393) [94] {47}	1,984 (397) [95] {48}
Onondaga	4,807	4,843	4,880	4,908	4,982 (996) [239] {120}	5,060 (1,012) [243] {121}	5,144 (1,029) [247] {123}
Orange	12,869	12,930	12,983	13,033	13,169 (2,634) [632] {316}	13,315 (2,663) [639] {320}	13,470 (2,694) [647] {323}
Putnam	1,689	1,698	1,705	1,710	1,722 (344) [83] {41}	1,736 (347) [83] {42}	1,749 (350) [84] {42}
Queens	74,265	74,404	74,510	74,632	74,933 (14,987) [3,597] {1,798}	75,240 (15,048) [3,612] {1,806}	75,556 (15,111) [3,627] {1,813}
Rensselaer	985	994	1,002	1,007	1,021 (204) [49] {24}	1,036 (207) [50] {25}	1,052 (210) [51] {25}
Richmond	16,434	16,496	16,522	16,559	16,655 (3,331) [799] {400}	16,757 (3,351) [804] {402}	16,866 (3,373) [810] {405}
Rockland	16,760	16,829	16,891	16,972	17,153 (3,431) [823] {412}	17,342 (3,468) [832] {416}	17,539 (3,508) [842] {421}
Saratoga	1,158	1,168	1,174	1,182	1,196 (239) [57] {29}	1,211 (242) [58] {29}	1,227 (245) [59] {29}
Schenectady	1,459	1,461	1,464	1,477	1,483 (297) [71] {36}	1,489 (298) [71] {36}	1,496 (299) [72] {36}
Suffolk	47,493	47,561	47,630	47,711	47,895 (9,579) [2,299] {1,149}	48,089 (9,618) [2,308] {1,154}	48,291 (9,658) [2,318] {1,159}
Sullivan	1,650	1,655	1,659	1,663	1,671 (334) [80] {40}	1,679 (336) [81] {40}	1,687 (337) [81] {40}
Tompkins	481	490	507	515	530 (106) [25] {13}	547 (109) [26] {13}	566 (113) [27] {14}
Ulster	2,366	2,377	2,386	2,392	2,411 (482) [116] {58}	2,432 (486) [117] {58}	2,456 (491) [118] {59}
Westchester	39,001	39,064	39,118	39,200	39,350 (7,870) [1,889] {944}	39,508 (7,902) [1,896] {948}	39,674 (7,935) [1,904] {952}

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.