IEM's AI Modeling: Short-term COVID-19 Projections
Date: 10/9/20

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 10/9/20 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
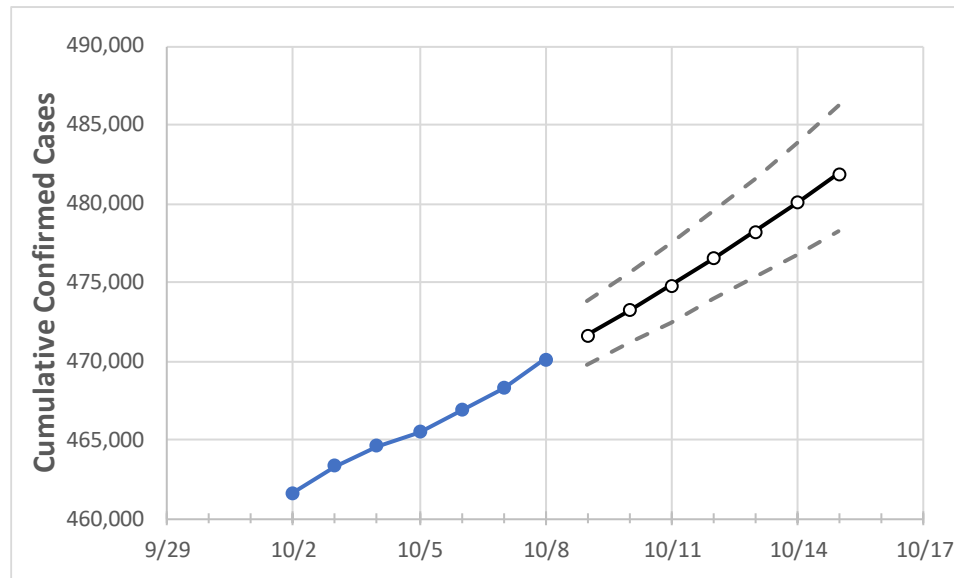
	Actual Confirmed Cases On:				Projected Cases For:						
	10/5	10/6	10/7	10/8	10/9	10/10	10/11	10/12	10/13	10/14	10/15
New York	465,515	466,908	468,268	470,104	471,616	473,182	474,804	476,484	478,224	480,026	481,892

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:						
	10/5	10/6	10/7	10/8	10/9	10/10	10/11	10/12	10/13	10/14	10/15
Albany	3,201	3,218	3,233	3,251	3,266	3,281	3,297	3,313	3,329	3,346	3,363
Bronx	53,417	53,501	53,556	53,617	53,684	53,752	53,821	53,891	53,963	54,035	54,109
Dutchess	5,187	5,205	5,214	5,222	5,230	5,238	5,246	5,254	5,262	5,270	5,279
Erie	11,798	11,864	11,898	11,953	12,004	12,055	12,106	12,157	12,209	12,261	12,314
Kings	70,131	70,354	70,616	70,899	71,197	71,507	71,829	72,164	72,513	72,875	73,252
Monroe	6,220	6,248	6,266	6,316	6,340	6,364	6,389	6,414	6,440	6,465	6,491
Nassau	47,302	47,392	47,516	47,656	47,755	47,856	47,960	48,066	48,176	48,287	48,402
New York	33,935	34,005	34,051	34,144	34,216	34,290	34,365	34,442	34,521	34,602	34,684
Niagara	1,834	1,840	1,842	1,855	1,861	1,868	1,875	1,881	1,888	1,895	1,903
Onondaga	4,556	4,593	4,636	4,669	4,698	4,728	4,759	4,790	4,823	4,856	4,891
Orange	12,438	12,493	12,563	12,664	12,735	12,811	12,891	12,975	13,065	13,159	13,259
Putnam	1,652	1,656	1,661	1,669	1,675	1,681	1,688	1,694	1,701	1,709	1,716
Queens	73,245	73,383	73,537	73,742	73,901	74,067	74,239	74,419	74,605	74,799	75,001
Rensselaer	945	952	957	958	962	966	970	974	978	983	987
Richmond	16,157	16,209	16,240	16,294	16,334	16,375	16,418	16,462	16,508	16,556	16,605
Rockland	16,071	16,190	16,256	16,454	16,584	16,722	16,869	17,025	17,192	17,369	17,558
Saratoga	1,100	1,103	1,111	1,122	1,129	1,136	1,144	1,151	1,159	1,167	1,174
Schenectady	1,430	1,430	1,432	1,438	1,440	1,442	1,443	1,445	1,447	1,448	1,450
Suffolk	46,891	46,980	47,089	47,196	47,265	47,336	47,409	47,482	47,558	47,635	47,714
Sullivan	1,616	1,623	1,629	1,633	1,637	1,640	1,644	1,648	1,652	1,656	1,661
Tompkins	451	455	458	465	470	474	479	484	490	495	501
Ulster	2,324	2,329	2,335	2,343	2,350	2,358	2,366	2,374	2,383	2,393	2,403
Westchester	38,515	38,567	38,628	38,694	38,752	38,811	38,872	38,934	38,997	39,061	39,126

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:		
	10/5	10/6	10/7	10/8	10/10	10/12	10/14
Albany	3,201	3,218	3,233	3,251	3,281 (656) [158] {79}	3,313 (663) [159] {80}	3,346 (669) [161] {80}
Bronx	53,417	53,501	53,556	53,617	53,752 (10,750) [2,580] {1,290}	53,891 (10,778) [2,587] {1,293}	54,035 (10,807) [2,594] {1,297}
Dutchess	5,187	5,205	5,214	5,222	5,238 (1,048) [251] {126}	5,254 (1,051) [252] {126}	5,270 (1,054) [253] {126}
Erie	11,798	11,864	11,898	11,953	12,055 (2,411) [579] {289}	12,157 (2,431) [584] {292}	12,261 (2,452) [589] {294}
Kings	70,131	70,354	70,616	70,899	71,507 (14,301) [3,432] {1,716}	72,164 (14,433) [3,464] {1,732}	72,875 (14,575) [3,498] {1,749}
Monroe	6,220	6,248	6,266	6,316	6,364 (1,273) [305] {153}	6,414 (1,283) [308] {154}	6,465 (1,293) [310] {155}
Nassau	47,302	47,392	47,516	47,656	47,856 (9,571) [2,297] {1,149}	48,066 (9,613) [2,307] {1,154}	48,287 (9,657) [2,318] {1,159}
New York	33,935	34,005	34,051	34,144	34,290 (6,858) [1,646] {823}	34,442 (6,888) [1,653] {827}	34,602 (6,920) [1,661] {830}
Niagara	1,834	1,840	1,842	1,855	1,868 (374) [90] {45}	1,881 (376) [90] {45}	1,895 (379) [91] {45}
Onondaga	4,556	4,593	4,636	4,669	4,728 (946) [227] {113}	4,790 (958) [230] {115}	4,856 (971) [233] {117}
Orange	12,438	12,493	12,563	12,664	12,811 (2,562) [615] {307}	12,975 (2,595) [623] {311}	13,159 (2,632) [632] {316}
Putnam	1,652	1,656	1,661	1,669	1,681 (336) [81] {40}	1,694 (339) [81] {41}	1,709 (342) [82] {41}
Queens	73,245	73,383	73,537	73,742	74,067 (14,813) [3,555] {1,778}	74,419 (14,884) [3,572] {1,786}	74,799 (14,960) [3,590] {1,795}
Rensselaer	945	952	957	958	966 (193) [46] {23}	974 (195) [47] {23}	983 (197) [47] {24}
Richmond	16,157	16,209	16,240	16,294	16,375 (3,275) [786] {393}	16,462 (3,292) [790] {395}	16,556 (3,311) [795] {397}
Rockland	16,071	16,190	16,256	16,454	16,722 (3,344) [803] {401}	17,025 (3,405) [817] {409}	17,369 (3,474) [834] {417}
Saratoga	1,100	1,103	1,111	1,122	1,136 (227) [55] {27}	1,151 (230) [55] {28}	1,167 (233) [56] {28}
Schenectady	1,430	1,430	1,432	1,438	1,442 (288) [69] {35}	1,445 (289) [69] {35}	1,448 (290) [70] {35}
Suffolk	46,891	46,980	47,089	47,196	47,336 (9,467) [2,272] {1,136}	47,482 (9,496) [2,279] {1,140}	47,635 (9,527) [2,286] {1,143}
Sullivan	1,616	1,623	1,629	1,633	1,640 (328) [79] {39}	1,648 (330) [79] {40}	1,656 (331) [80] {40}
Tompkins	451	455	458	465	474 (95) [23] {11}	484 (97) [23] {12}	495 (99) [24] {12}
Ulster	2,324	2,329	2,335	2,343	2,358 (472) [113] {57}	2,374 (475) [114] {57}	2,393 (479) [115] {57}
Westchester	38,515	38,567	38,628	38,694	38,811 (7,762) [1,863] {931}	38,934 (7,787) [1,869] {934}	39,061 (7,812) [1,875] {937}

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.