IEM's AI Modeling: Short-term COVID-19 Projections
Date: 8/3/20

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 <u>not</u> 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 8/3/20 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
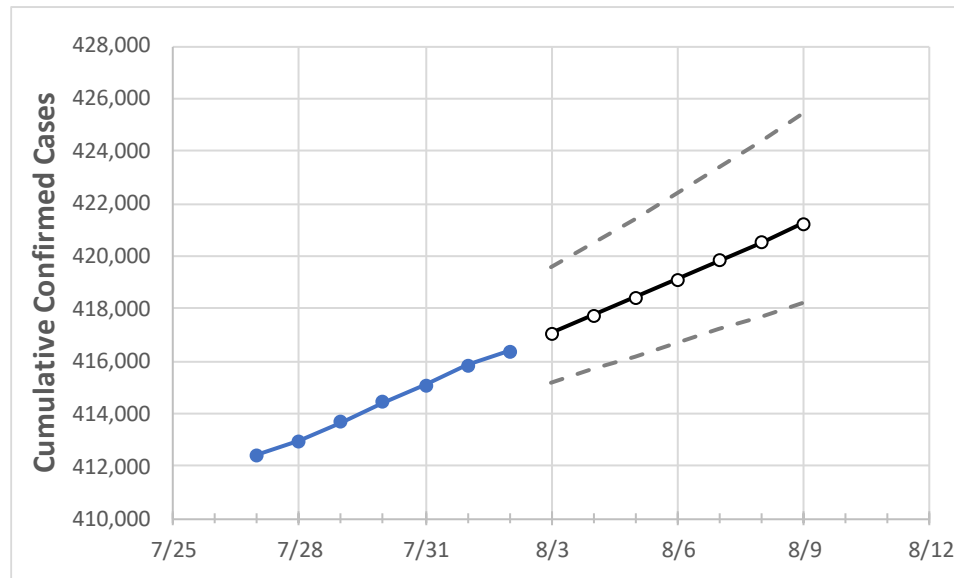
	Actual Confirmed Cases On:				Projected Cases For:						
	7/30	7/31	8/1	8/2	8/3	8/4	8/5	8/6	8/7	8/8	8/9
New York	414,439	415,083	415,836	416,367	417,048	417,734	418,424	419,118	419,816	420,519	421,226

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:						
	7/30	7/31	8/1	8/2	8/3	8/4	8/5	8/6	8/7	8/8	8/9
Albany	2,493	2,503	2,515	2,521	2,532	2,544	2,556	2,568	2,580	2,593	2,605
Bronx	49,527	49,573	49,626	49,676	49,732	49,789	49,845	49,902	49,959	50,015	50,072
Dutchess	4,468	4,490	4,504	4,520	4,530	4,541	4,552	4,564	4,576	4,588	4,600
Erie	8,434	8,492	8,548	8,572	8,606	8,641	8,675	8,710	8,745	8,781	8,816
Kings	62,295	62,385	62,494	62,577	62,656	62,734	62,814	62,893	62,972	63,052	63,132
Monroe	4,677	4,710	4,742	4,768	4,790	4,812	4,833	4,855	4,877	4,898	4,920
Nassau	43,158	43,203	43,271	43,322	43,376	43,431	43,486	43,543	43,601	43,660	43,720
New York	30,399	30,458	30,518	30,564	30,618	30,672	30,726	30,780	30,833	30,887	30,941
Niagara	1,434	1,440	1,444	1,446	1,449	1,452	1,455	1,458	1,461	1,464	1,467
Onondaga	3,459	3,464	3,477	3,485	3,495	3,505	3,515	3,525	3,534	3,544	3,553
Orange	11,072	11,082	11,088	11,093	11,103	11,113	11,124	11,135	11,145	11,156	11,167
Putnam	1,418	1,421	1,425	1,428	1,430	1,433	1,435	1,437	1,440	1,442	1,444
Queens	67,894	67,968	68,041	68,101	68,171	68,242	68,312	68,382	68,453	68,523	68,593
Rensselaer	718	724	734	736	741	746	751	756	761	767	773
Richmond	14,748	14,764	14,781	14,805	14,828	14,850	14,873	14,897	14,921	14,945	14,969
Rockland	13,860	13,864	13,880	13,882	13,886	13,890	13,894	13,898	13,902	13,905	13,909
Saratoga	709	715	726	732	739	747	755	764	773	782	791
Schenectady	1,018	1,023	1,032	1,035	1,043	1,051	1,060	1,069	1,078	1,087	1,096
Suffolk	43,170	43,224	43,300	43,345	43,408	43,472	43,537	43,603	43,669	43,737	43,805
Sullivan	1,479	1,480	1,483	1,483	1,484	1,484	1,485	1,485	1,486	1,487	1,487
Tompkins	227	228	230	230	232	233	235	237	239	241	243
Ulster	2,010	2,021	2,026	2,028	2,034	2,039	2,045	2,051	2,058	2,064	2,071
Westchester	35,913	35,933	35,974	35,998	36,030	36,061	36,093	36,125	36,157	36,189	36,221

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:		
	7/30	7/31	8/1	8/2	8/4	8/6	8/8
Albany	2,493	2,503	2,515	2,521	2,544 (509) [122] {61}	2,568 (514) [123] {62}	2,593 (519) [124] {62}
Bronx	49,527	49,573	49,626	49,676	49,789 (9,958) [2,390] {1,195}	49,902 (9,980) [2,395] {1,198}	50,015 (10,003) [2,401] {1,200}
Dutchess	4,468	4,490	4,504	4,520	4,541 (908) [218] {109}	4,564 (913) [219] {110}	4,588 (918) [220] {110}
Erie	8,434	8,492	8,548	8,572	8,641 (1,728) [415] {207}	8,710 (1,742) [418] {209}	8,781 (1,756) [421] {211}
Kings	62,295	62,385	62,494	62,577	62,734 (12,547) [3,011] {1,506}	62,893 (12,579) [3,019] {1,509}	63,052 (12,610) [3,027] {1,513}
Monroe	4,677	4,710	4,742	4,768	4,812 (962) [231] {115}	4,855 (971) [233] {117}	4,898 (980) [235] {118}
Nassau	43,158	43,203	43,271	43,322	43,431 (8,686) [2,085] {1,042}	43,543 (8,709) [2,090] {1,045}	43,660 (8,732) [2,096] {1,048}
New York	30,399	30,458	30,518	30,564	30,672 (6,134) [1,472] {736}	30,780 (6,156) [1,477] {739}	30,887 (6,177) [1,483] {741}
Niagara	1,434	1,440	1,444	1,446	1,452 (290) [70] {35}	1,458 (292) [70] {35}	1,464 (293) [70] {35}
Onondaga	3,459	3,464	3,477	3,485	3,505 (701) [168] {84}	3,525 (705) [169] {85}	3,544 (709) [170] {85}
Orange	11,072	11,082	11,088	11,093	11,113 (2,223) [533] {267}	11,135 (2,227) [534] {267}	11,156 (2,231) [536] {268}
Putnam	1,418	1,421	1,425	1,428	1,433 (287) [69] {34}	1,437 (287) [69] {34}	1,442 (288) [69] {35}
Queens	67,894	67,968	68,041	68,101	68,242 (13,648) [3,276] {1,638}	68,382 (13,676) [3,282] {1,641}	68,523 (13,705) [3,289] {1,645}
Rensselaer	718	724	734	736	746 (149) [36] {18}	756 (151) [36] {18}	767 (153) [37] {18}
Richmond	14,748	14,764	14,781	14,805	14,850 (2,970) [713] {356}	14,897 (2,979) [715] {358}	14,945 (2,989) [717] {359}
Rockland	13,860	13,864	13,880	13,882	13,890 (2,778) [667] {333}	13,898 (2,780) [667] {334}	13,905 (2,781) [667] {334}
Saratoga	709	715	726	732	747 (149) [36] {18}	764 (153) [37] {18}	782 (156) [38] {19}
Schenectady	1,018	1,023	1,032	1,035	1,051 (210) [50] {25}	1,069 (214) [51] {26}	1,087 (217) [52] {26}
Suffolk	43,170	43,224	43,300	43,345	43,472 (8,694) [2,087] {1,043}	43,603 (8,721) [2,093] {1,046}	43,737 (8,747) [2,099] {1,050}
Sullivan	1,479	1,480	1,483	1,483	1,484 (297) [71] {36}	1,485 (297) [71] {36}	1,487 (297) [71] {36}
Tompkins	227	228	230	230	233 (47) [11] {6}	237 (47) [11] {6}	241 (48) [12] {6}
Ulster	2,010	2,021	2,026	2,028	2,039 (408) [98] {49}	2,051 (410) [98] {49}	2,064 (413) [99] {50}
Westchester	35,913	35,933	35,974	35,998	36,061 (7,212) [1,731] {865}	36,125 (7,225) [1,734] {867}	36,189 (7,238) [1,737] {869}

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.