IEM's AI Modeling: Short-term COVID-19 Projections
Date: 8/4/20

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 8/4/20 12 p.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
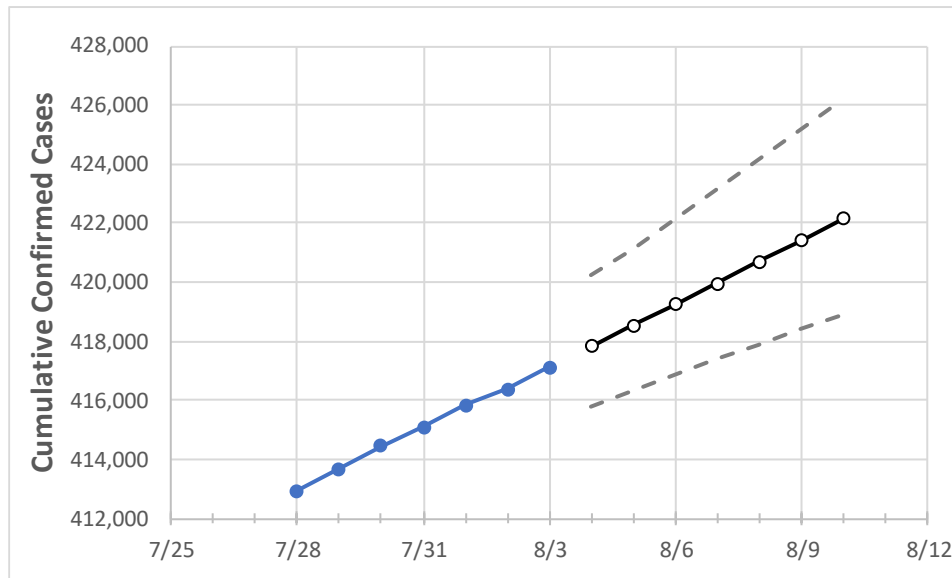
	Actual Confirmed Cases On:				Projected Cases For:						
	7/31	8/1	8/2	8/3	8/4	8/5	8/6	8/7	8/8	8/9	8/10
New York	415,083	415,836	416,367	417,112	417,818	418,528	419,243	419,962	420,685	421,412	422,143

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:						
	7/31	8/1	8/2	8/3	8/4	8/5	8/6	8/7	8/8	8/9	8/10
Albany	2,503	2,515	2,521	2,531	2,542	2,554	2,566	2,578	2,591	2,603	2,616
Bronx	49,573	49,626	49,676	49,714	49,767	49,821	49,874	49,928	49,982	50,035	50,089
Dutchess	4,490	4,504	4,520	4,543	4,556	4,570	4,584	4,599	4,614	4,630	4,647
Erie	8,492	8,548	8,572	8,626	8,663	8,699	8,737	8,774	8,812	8,849	8,888
Kings	62,385	62,494	62,577	62,641	62,718	62,794	62,871	62,948	63,025	63,103	63,180
Monroe	4,710	4,742	4,768	4,790	4,812	4,833	4,855	4,876	4,898	4,919	4,940
Nassau	43,203	43,271	43,322	43,480	43,541	43,603	43,667	43,732	43,799	43,868	43,938
New York	30,458	30,518	30,564	30,621	30,673	30,725	30,776	30,828	30,879	30,930	30,981
Niagara	1,440	1,444	1,446	1,449	1,452	1,455	1,458	1,460	1,463	1,466	1,468
Onondaga	3,464	3,477	3,485	3,490	3,499	3,508	3,517	3,526	3,535	3,543	3,551
Orange	11,082	11,088	11,093	11,096	11,104	11,113	11,121	11,129	11,138	11,146	11,154
Putnam	1,421	1,425	1,428	1,433	1,436	1,438	1,441	1,443	1,446	1,449	1,452
Queens	67,968	68,041	68,101	68,166	68,235	68,304	68,373	68,441	68,510	68,578	68,646
Rensselaer	724	734	736	740	745	750	755	760	766	771	777
Richmond	14,764	14,781	14,805	14,822	14,844	14,866	14,888	14,910	14,933	14,956	14,979
Rockland	13,864	13,880	13,882	13,885	13,889	13,893	13,896	13,900	13,904	13,907	13,910
Saratoga	715	726	732	733	739	745	752	758	765	772	778
Schenectady	1,023	1,032	1,035	1,037	1,044	1,051	1,058	1,065	1,072	1,080	1,087
Suffolk	43,224	43,300	43,345	43,495	43,568	43,642	43,718	43,795	43,874	43,954	44,035
Sullivan	1,480	1,483	1,483	1,483	1,484	1,484	1,485	1,485	1,486	1,487	1,487
Tompkins	228	230	230	230	232	233	235	237	239	241	243
Ulster	2,021	2,026	2,028	2,031	2,036	2,041	2,047	2,052	2,058	2,064	2,070
Westchester	35,933	35,974	35,998	36,014	36,043	36,072	36,102	36,131	36,160	36,189	36,218

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:		
	7/31	8/1	8/2	8/3	8/5	8/7	8/9
Albany	2,503	2,515	2,521	2,531	2,554 (511) [123] {61}	2,578 (516) [124] {62}	2,603 (521) [125] {62}
Bronx	49,573	49,626	49,676	49,714	49,821 (9,964) [2,391] {1,196}	49,928 (9,986) [2,397] {1,198}	50,035 (10,007) [2,402] {1,201}
Dutchess	4,490	4,504	4,520	4,543	4,570 (914) [219] {110}	4,599 (920) [221] {110}	4,630 (926) [222] {111}
Erie	8,492	8,548	8,572	8,626	8,699 (1,740) [418] {209}	8,774 (1,755) [421] {211}	8,849 (1,770) [425] {212}
Kings	62,385	62,494	62,577	62,641	62,794 (12,559) [3,014] {1,507}	62,948 (12,590) [3,022] {1,511}	63,103 (12,621) [3,029] {1,514}
Monroe	4,710	4,742	4,768	4,790	4,833 (967) [232] {116}	4,876 (975) [234] {117}	4,919 (984) [236] {118}
Nassau	43,203	43,271	43,322	43,480	43,603 (8,721) [2,093] {1,046}	43,732 (8,746) [2,099] {1,050}	43,868 (8,774) [2,106] {1,053}
New York	30,458	30,518	30,564	30,621	30,725 (6,145) [1,475] {737}	30,828 (6,166) [1,480] {740}	30,930 (6,186) [1,485] {742}
Niagara	1,440	1,444	1,446	1,449	1,455 (291) [70] {35}	1,460 (292) [70] {35}	1,466 (293) [70] {35}
Onondaga	3,464	3,477	3,485	3,490	3,508 (702) [168] {84}	3,526 (705) [169] {85}	3,543 (709) [170] {85}
Orange	11,082	11,088	11,093	11,096	11,113 (2,223) [533] {267}	11,129 (2,226) [534] {267}	11,146 (2,229) [535] {268}
Putnam	1,421	1,425	1,428	1,433	1,438 (288) [69] {35}	1,443 (289) [69] {35}	1,449 (290) [70] {35}
Queens	67,968	68,041	68,101	68,166	68,304 (13,661) [3,279] {1,639}	68,441 (13,688) [3,285] {1,643}	68,578 (13,716) [3,292] {1,646}
Rensselaer	724	734	736	740	750 (150) [36] {18}	760 (152) [36] {18}	771 (154) [37] {19}
Richmond	14,764	14,781	14,805	14,822	14,866 (2,973) [714] {357}	14,910 (2,982) [716] {358}	14,956 (2,991) [718] {359}
Rockland	13,864	13,880	13,882	13,885	13,893 (2,779) [667] {333}	13,900 (2,780) [667] {334}	13,907 (2,781) [668] {334}
Saratoga	715	726	732	733	745 (149) [36] {18}	758 (152) [36] {18}	772 (154) [37] {19}
Schenectady	1,023	1,032	1,035	1,037	1,051 (210) [50] {25}	1,065 (213) [51] {26}	1,080 (216) [52] {26}
Suffolk	43,224	43,300	43,345	43,495	43,642 (8,728) [2,095] {1,047}	43,795 (8,759) [2,102] {1,051}	43,954 (8,791) [2,110] {1,055}
Sullivan	1,480	1,483	1,483	1,483	1,484 (297) [71] {36}	1,485 (297) [71] {36}	1,487 (297) [71] {36}
Tompkins	228	230	230	230	233 (47) [11] {6}	237 (47) [11] {6}	241 (48) [12] {6}
Ulster	2,021	2,026	2,028	2,031	2,041 (408) [98] {49}	2,052 (410) [99] {49}	2,064 (413) [99] {50}
Westchester	35,933	35,974	35,998	36,014	36,072 (7,214) [1,731] {866}	36,131 (7,226) [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.