IEM's AI Modeling: Short-term COVID-19 Projections
Date: 8/6/20

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 8/6/20 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
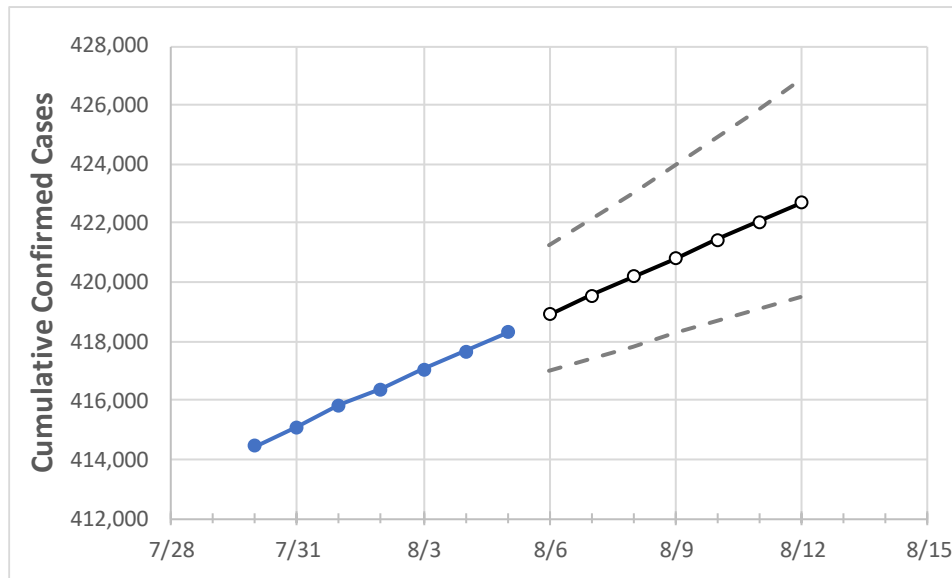
	Actual Confirmed Cases On:				Projected Cases For:						
	8/2	8/3	8/4	8/5	8/6	8/7	8/8	8/9	8/10	8/11	8/12
New York	416,367	417,041	417,658	418,292	418,920	419,547	420,176	420,804	421,433	422,062	422,691

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:						
	8/2	8/3	8/4	8/5	8/6	8/7	8/8	8/9	8/10	8/11	8/12
Albany	2,521	2,531	2,543	2,556	2,566	2,576	2,587	2,597	2,608	2,619	2,630
Bronx	49,676	49,714	49,823	49,906	49,958	50,010	50,062	50,114	50,166	50,218	50,269
Dutchess	4,520	4,543	4,557	4,568	4,582	4,598	4,614	4,630	4,648	4,667	4,686
Erie	8,572	8,626	8,667	8,702	8,740	8,778	8,817	8,856	8,896	8,937	8,978
Kings	62,577	62,641	62,715	62,790	62,861	62,932	63,002	63,072	63,142	63,212	63,281
Monroe	4,768	4,790	4,821	4,841	4,862	4,883	4,904	4,925	4,946	4,967	4,987
Nassau	43,322	43,436	43,459	43,482	43,529	43,575	43,622	43,670	43,718	43,765	43,814
New York	30,564	30,621	30,677	30,734	30,780	30,826	30,872	30,917	30,961	31,006	31,050
Niagara	1,446	1,449	1,458	1,466	1,469	1,473	1,476	1,480	1,483	1,486	1,489
Onondaga	3,485	3,490	3,515	3,525	3,534	3,543	3,552	3,561	3,569	3,577	3,585
Orange	11,093	11,096	11,105	11,113	11,121	11,128	11,136	11,143	11,150	11,158	11,165
Putnam	1,428	1,433	1,437	1,439	1,442	1,445	1,448	1,451	1,455	1,458	1,462
Queens	68,101	68,166	68,225	68,297	68,358	68,418	68,479	68,538	68,597	68,656	68,714
Rensselaer	736	740	748	755	760	765	771	777	783	789	795
Richmond	14,805	14,822	14,840	14,854	14,872	14,889	14,907	14,924	14,941	14,959	14,976
Rockland	13,882	13,885	13,893	13,903	13,907	13,911	13,915	13,919	13,923	13,927	13,930
Saratoga	732	733	739	744	749	755	761	766	772	778	784
Schenectady	1,035	1,037	1,041	1,045	1,050	1,055	1,060	1,065	1,070	1,076	1,081
Suffolk	43,345	43,468	43,511	43,553	43,616	43,679	43,743	43,808	43,874	43,940	44,007
Sullivan	1,483	1,484	1,484	1,485	1,486	1,486	1,487	1,487	1,488	1,488	1,489
Tompkins	230	231	231	231	232	232	233	233	234	234	235
Ulster	2,028	2,031	2,039	2,039	2,046	2,053	2,061	2,069	2,077	2,086	2,095
Westchester	35,998	36,014	36,049	36,075	36,101	36,127	36,152	36,178	36,203	36,228	36,253

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:		
	8/2	8/3	8/4	8/5	8/7	8/9	8/11
Albany	2,521	2,531	2,543	2,556	2,576 (515) [124] {62}	2,597 (519) [125] {62}	2,619 (524) [126] {63}
Bronx	49,676	49,714	49,823	49,906	50,010 (10,002) [2,400] {1,200}	50,114 (10,023) [2,405] {1,203}	50,218 (10,044) [2,410] {1,205}
Dutchess	4,520	4,543	4,557	4,568	4,598 (920) [221] {110}	4,630 (926) [222] {111}	4,667 (933) [224] {112}
Erie	8,572	8,626	8,667	8,702	8,778 (1,756) [421] {211}	8,856 (1,771) [425] {213}	8,937 (1,787) [429] {214}
Kings	62,577	62,641	62,715	62,790	62,932 (12,586) [3,021] {1,510}	63,072 (12,614) [3,027] {1,514}	63,212 (12,642) [3,034] {1,517}
Monroe	4,768	4,790	4,821	4,841	4,883 (977) [234] {117}	4,925 (985) [236] {118}	4,967 (993) [238] {119}
Nassau	43,322	43,436	43,459	43,482	43,575 (8,715) [2,092] {1,046}	43,670 (8,734) [2,096] {1,048}	43,765 (8,753) [2,101] {1,050}
New York	30,564	30,621	30,677	30,734	30,826 (6,165) [1,480] {740}	30,917 (6,183) [1,484] {742}	31,006 (6,201) [1,488] {744}
Niagara	1,446	1,449	1,458	1,466	1,473 (295) [71] {35}	1,480 (296) [71] {36}	1,486 (297) [71] {36}
Onondaga	3,485	3,490	3,515	3,525	3,543 (709) [170] {85}	3,561 (712) [171] {85}	3,577 (715) [172] {86}
Orange	11,093	11,096	11,105	11,113	11,128 (2,226) [534] {267}	11,143 (2,229) [535] {267}	11,158 (2,232) [536] {268}
Putnam	1,428	1,433	1,437	1,439	1,445 (289) [69] {35}	1,451 (290) [70] {35}	1,458 (292) [70] {35}
Queens	68,101	68,166	68,225	68,297	68,418 (13,684) [3,284] {1,642}	68,538 (13,708) [3,290] {1,645}	68,656 (13,731) [3,295] {1,648}
Rensselaer	736	740	748	755	765 (153) [37] {18}	777 (155) [37] {19}	789 (158) [38] {19}
Richmond	14,805	14,822	14,840	14,854	14,889 (2,978) [715] {357}	14,924 (2,985) [716] {358}	14,959 (2,992) [718] {359}
Rockland	13,882	13,885	13,893	13,903	13,911 (2,782) [668] {334}	13,919 (2,784) [668] {334}	13,927 (2,785) [668] {334}
Saratoga	732	733	739	744	755 (151) [36] {18}	766 (153) [37] {18}	778 (156) [37] {19}
Schenectady	1,035	1,037	1,041	1,045	1,055 (211) [51] {25}	1,065 (213) [51] {26}	1,076 (215) [52] {26}
Suffolk	43,345	43,468	43,511	43,553	43,679 (8,736) [2,097] {1,048}	43,808 (8,762) [2,103] {1,051}	43,940 (8,788) [2,109] {1,055}
Sullivan	1,483	1,484	1,484	1,485	1,486 (297) [71] {36}	1,487 (297) [71] {36}	1,488 (298) [71] {36}
Tompkins	230	231	231	231	232 (46) [11] {6}	233 (47) [11] {6}	234 (47) [11] {6}
Ulster	2,028	2,031	2,039	2,039	2,053 (411) [99] {49}	2,069 (414) [99] {50}	2,086 (417) [100] {50}
Westchester	35,998	36,014	36,049	36,075	36,127 (7,225) [1,734] {867}	36,178 (7,236) [1,737] {868}	36,228 (7,246) [1,739] {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.