IEM's AI Modeling: Short-term COVID-19 Projections
Date: 8/4/21

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 10%, and are often within 5%, of actual confirmed cases.

The projections shown in this document are based on data pulled in as of 8/4/21 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
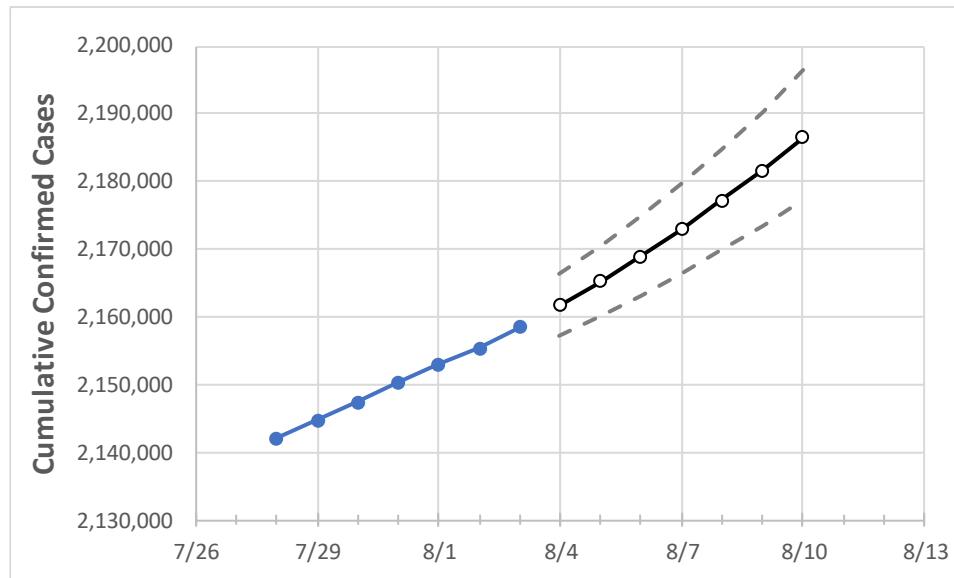
	Actual Confirmed Cases On:				**Projected Cases For:**						
	7/31	8/1	8/2	8/3	8/4	8/5	8/6	8/7	8/8	8/9	8/10
New York	2,150,390	2,152,964	2,155,356	2,158,388	2,161,693	2,165,200	2,168,952	2,172,926	2,177,183	2,181,709	2,186,532

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 10%, and are often within 5%, 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	25,059	25,085	25,107	25,156	25,198	25,244	25,294	25,349	25,410	25,477	25,548
Bronx	186,838	187,026	187,184	187,440	187,693	187,964	188,251	188,555	188,887	189,234	189,600
Dutchess	29,870	29,914	29,942	29,976	30,014	30,056	30,101	30,150	30,202	30,257	30,318
Erie	90,689	90,783	90,820	90,919	91,024	91,138	91,260	91,391	91,530	91,681	91,841
Kings	287,912	288,387	288,804	289,281	289,850	290,451	291,090	291,772	292,487	293,245	294,041
Monroe	69,970	70,032	70,071	70,134	70,206	70,281	70,362	70,448	70,539	70,638	70,741
Nassau	187,302	187,515	187,735	188,050	188,363	188,699	189,055	189,434	189,838	190,265	190,724
New York	143,076	143,332	143,565	143,830	144,168	144,521	144,896	145,286	145,702	146,131	146,586
Niagara	20,266	20,290	20,299	20,315	20,336	20,358	20,382	20,408	20,436	20,466	20,498
Onondaga	39,537	39,580	39,603	39,672	39,729	39,791	39,857	39,930	40,008	40,094	40,189
Orange	49,040	49,105	49,140	49,181	49,242	49,307	49,375	49,449	49,528	49,612	49,703
Putnam	10,751	10,768	10,777	10,783	10,799	10,816	10,834	10,855	10,878	10,901	10,928
Queens	282,628	282,930	283,245	283,655	284,070	284,512	284,987	285,492	286,027	286,594	287,197
Rensselaer	11,439	11,463	11,474	11,494	11,517	11,543	11,570	11,601	11,634	11,669	11,709
Richmond	77,227	77,354	77,492	77,623	77,773	77,932	78,102	78,283	78,471	78,669	78,885
Rockland	47,494	47,523	47,553	47,596	47,636	47,678	47,723	47,770	47,822	47,877	47,935
Saratoga	15,767	15,786	15,810	15,842	15,885	15,933	15,985	16,044	16,107	16,175	16,251
Schenectady	13,383	13,400	13,411	13,432	13,457	13,484	13,514	13,547	13,584	13,623	13,670
Suffolk	204,334	204,564	204,787	205,096	205,409	205,748	206,115	206,515	206,946	207,408	207,904
Sullivan	6,779	6,792	6,800	6,812	6,824	6,838	6,854	6,871	6,889	6,910	6,933
Tompkins	4,452	4,459	4,465	4,469	4,480	4,492	4,506	4,520	4,536	4,554	4,573
Ulster	14,131	14,148	14,164	14,186	14,208	14,232	14,257	14,285	14,315	14,348	14,383
Westchester	131,475	131,612	131,710	131,857	132,015	132,184	132,365	132,556	132,761	132,982	133,218

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	25,059	25,085	25,107	25,156	25,244 (5,049) [1,212] {606}	25,349 (5,070) [1,217] {608}	25,477 (5,095) [1,223] {611}
Bronx	186,838	187,026	187,184	187,440	187,964 (37,593) [9,022] {4,511}	188,555 (37,711) [9,051] {4,525}	189,234 (37,847) [9,083] {4,542}
Dutchess	29,870	29,914	29,942	29,976	30,056 (6,011) [1,443] {721}	30,150 (6,030) [1,447] {724}	30,257 (6,051) [1,452] {726}
Erie	90,689	90,783	90,820	90,919	91,138 (18,228) [4,375] {2,187}	91,391 (18,278) [4,387] {2,193}	91,681 (18,336) [4,401] {2,200}
Kings	287,912	288,387	288,804	289,281	290,451 (58,090) [13,942] {6,971}	291,772 (58,354) [14,005] {7,003}	293,245 (58,649) [14,076] {7,038}
Monroe	69,970	70,032	70,071	70,134	70,281 (14,056) [3,373] {1,687}	70,448 (14,090) [3,382] {1,691}	70,638 (14,128) [3,391] {1,695}
Nassau	187,302	187,515	187,735	188,050	188,699 (37,740) [9,058] {4,529}	189,434 (37,887) [9,093] {4,546}	190,265 (38,053) [9,133] {4,566}
New York	143,076	143,332	143,565	143,830	144,521 (28,904) [6,937] {3,468}	145,286 (29,057) [6,974] {3,487}	146,131 (29,226) [7,014] {3,507}
Niagara	20,266	20,290	20,299	20,315	20,358 (4,072) [977] {489}	20,408 (4,082) [980] {490}	20,466 (4,093) [982] {491}
Onondaga	39,537	39,580	39,603	39,672	39,791 (7,958) [1,910] {955}	39,930 (7,986) [1,917] {958}	40,094 (8,019) [1,925] {962}
Orange	49,040	49,105	49,140	49,181	49,307 (9,861) [2,367] {1,183}	49,449 (9,890) [2,374] {1,187}	49,612 (9,922) [2,381] {1,191}
Putnam	10,751	10,768	10,777	10,783	10,816 (2,163) [519] {260}	10,855 (2,171) [521] {261}	10,901 (2,180) [523] {262}
Queens	282,628	282,930	283,245	283,655	284,512 (56,902) [13,657] {6,828}	285,492 (57,098) [13,704] {6,852}	286,594 (57,319) [13,757] {6,878}
Rensselaer	11,439	11,463	11,474	11,494	11,543 (2,309) [554] {277}	11,601 (2,320) [557] {278}	11,669 (2,334) [560] {280}
Richmond	77,227	77,354	77,492	77,623	77,932 (15,586) [3,741] {1,870}	78,283 (15,657) [3,758] {1,879}	78,669 (15,734) [3,776] {1,888}
Rockland	47,494	47,523	47,553	47,596	47,678 (9,536) [2,289] {1,144}	47,770 (9,554) [2,293] {1,146}	47,877 (9,575) [2,298] {1,149}
Saratoga	15,767	15,786	15,810	15,842	15,933 (3,187) [765] {382}	16,044 (3,209) [770] {385}	16,175 (3,235) [776] {388}
Schenectady	13,383	13,400	13,411	13,432	13,484 (2,697) [647] {324}	13,547 (2,709) [650] {325}	13,623 (2,725) [654] {327}
Suffolk	204,334	204,564	204,787	205,096	205,748 (41,150) [9,876] {4,938}	206,515 (41,303) [9,913] {4,956}	207,408 (41,482) [9,956] {4,978}
Sullivan	6,779	6,792	6,800	6,812	6,838 (1,368) [328] {164}	6,871 (1,374) [330] {165}	6,910 (1,382) [332] {166}
Tompkins	4,452	4,459	4,465	4,469	4,492 (898) [216] {108}	4,520 (904) [217] {108}	4,554 (911) [219] {109}
Ulster	14,131	14,148	14,164	14,186	14,232 (2,846) [683] {342}	14,285 (2,857) [686] {343}	14,348 (2,870) [689] {344}
Westchester	131,475	131,612	131,710	131,857	132,184 (26,437) [6,345] {3,172}	132,556 (26,511) [6,363] {3,181}	132,982 (26,596) [6,383] {3,192}

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.