IEM's AI Modeling: Short-term COVID-19 Projections
Date: 8/16/21

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 8/16/21 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
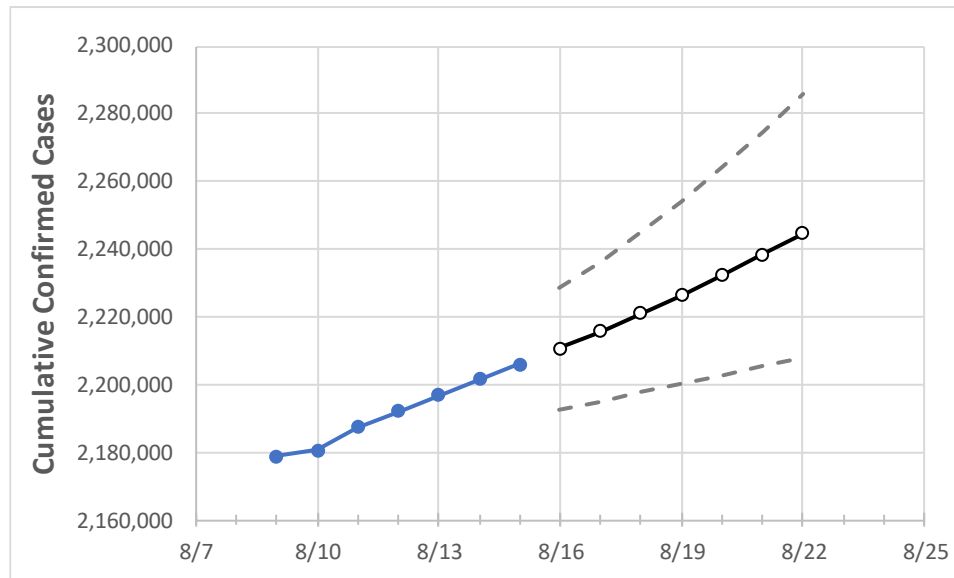
	Actual Confirmed Cases On:				Projected Cases For:						
	8/12	8/13	8/14	8/15	8/16	8/17	8/18	8/19	8/20	8/21	8/22
New York	2,192,224	2,196,866	2,201,468	2,205,869	2,210,827	2,215,823	2,221,086	2,226,503	2,232,347	2,238,408	2,244,702

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:						
	8/12	8/13	8/14	8/15	8/16	8/17	8/18	8/19	8/20	8/21	8/22
Albany	25,607	25,670	25,741	25,808	25,881	25,957	26,038	26,123	26,214	26,308	26,407
Bronx	189,875	190,228	190,615	190,854	191,208	191,573	191,954	192,352	192,763	193,189	193,628
Dutchess	30,557	30,624	30,713	30,806	30,907	31,013	31,128	31,253	31,384	31,524	31,675
Erie	91,826	91,941	92,076	92,204	92,341	92,482	92,630	92,784	92,944	93,114	93,288
Kings	294,568	295,214	295,902	296,511	297,225	297,972	298,739	299,529	300,346	301,194	302,045
Monroe	71,218	71,361	71,476	71,617	71,796	71,985	72,187	72,402	72,634	72,880	73,144
Nassau	191,088	191,540	191,875	192,254	192,689	193,145	193,610	194,097	194,612	195,142	195,688
New York	147,073	147,453	147,899	148,586	149,077	149,596	150,113	150,658	151,233	151,820	152,438
Niagara	20,506	20,529	20,552	20,575	20,600	20,627	20,654	20,684	20,714	20,745	20,777
Onondaga	40,301	40,404	40,520	40,621	40,737	40,860	40,992	41,132	41,280	41,440	41,610
Orange	50,098	50,222	50,334	50,436	50,582	50,738	50,904	51,081	51,267	51,465	51,675
Putnam	10,920	10,948	10,975	10,993	11,018	11,045	11,073	11,103	11,136	11,170	11,206
Queens	287,828	288,341	288,975	289,434	290,030	290,650	291,291	291,958	292,648	293,364	294,106
Rensselaer	11,720	11,755	11,793	11,828	11,866	11,907	11,950	11,995	12,043	12,094	12,148
Richmond	79,082	79,261	79,437	79,620	79,823	80,034	80,252	80,476	80,708	80,948	81,202
Rockland	48,188	48,247	48,275	48,302	48,369	48,441	48,514	48,589	48,665	48,745	48,827
Saratoga	16,218	16,312	16,359	16,408	16,469	16,534	16,601	16,672	16,746	16,824	16,906
Schenectady	13,695	13,753	13,794	13,826	13,875	13,928	13,983	14,043	14,107	14,176	14,248
Suffolk	208,020	208,440	208,796	209,136	209,554	209,977	210,421	210,881	211,349	211,836	212,348
Sullivan	6,947	6,965	6,989	7,001	7,021	7,043	7,065	7,089	7,113	7,140	7,167
Tompkins	4,590	4,613	4,628	4,644	4,664	4,686	4,709	4,734	4,761	4,789	4,819
Ulster	14,438	14,459	14,506	14,552	14,597	14,644	14,695	14,748	14,805	14,867	14,931
Westchester	133,425	133,627	133,813	134,021	134,253	134,493	134,739	134,999	135,269	135,548	135,843

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:		
	8/12	8/13	8/14	8/15	8/17	8/19	8/21
Albany	25,607	25,670	25,741	25,808	25,957 (5,191) [1,246] {623}	26,123 (5,225) [1,254] {627}	26,308 (5,262) [1,263] {631}
Bronx	189,875	190,228	190,615	190,854	191,573 (38,315) [9,195] {4,598}	192,352 (38,470) [9,233] {4,616}	193,189 (38,638) [9,273] {4,637}
Dutchess	30,557	30,624	30,713	30,806	31,013 (6,203) [1,489] {744}	31,253 (6,251) [1,500] {750}	31,524 (6,305) [1,513] {757}
Erie	91,826	91,941	92,076	92,204	92,482 (18,496) [4,439] {2,220}	92,784 (18,557) [4,454] {2,227}	93,114 (18,623) [4,469] {2,235}
Kings	294,568	295,214	295,902	296,511	297,972 (59,594) [14,303] {7,151}	299,529 (59,906) [14,377] {7,189}	301,194 (60,239) [14,457] {7,229}
Monroe	71,218	71,361	71,476	71,617	71,985 (14,397) [3,455] {1,728}	72,402 (14,480) [3,475] {1,738}	72,880 (14,576) [3,498] {1,749}
Nassau	191,088	191,540	191,875	192,254	193,145 (38,629) [9,271] {4,635}	194,097 (38,819) [9,317] {4,658}	195,142 (39,028) [9,367] {4,683}
New York	147,073	147,453	147,899	148,586	149,596 (29,919) [7,181] {3,590}	150,658 (30,132) [7,232] {3,616}	151,820 (30,364) [7,287] {3,644}
Niagara	20,506	20,529	20,552	20,575	20,627 (4,125) [990] {495}	20,684 (4,137) [993] {496}	20,745 (4,149) [996] {498}
Onondaga	40,301	40,404	40,520	40,621	40,860 (8,172) [1,961] {981}	41,132 (8,226) [1,974] {987}	41,440 (8,288) [1,989] {995}
Orange	50,098	50,222	50,334	50,436	50,738 (10,148) [2,435] {1,218}	51,081 (10,216) [2,452] {1,226}	51,465 (10,293) [2,470] {1,235}
Putnam	10,920	10,948	10,975	10,993	11,045 (2,209) [530] {265}	11,103 (2,221) [533] {266}	11,170 (2,234) [536] {268}
Queens	287,828	288,341	288,975	289,434	290,650 (58,130) [13,951] {6,976}	291,958 (58,392) [14,014] {7,007}	293,364 (58,673) [14,081] {7,041}
Rensselaer	11,720	11,755	11,793	11,828	11,907 (2,381) [572] {286}	11,995 (2,399) [576] {288}	12,094 (2,419) [581] {290}
Richmond	79,082	79,261	79,437	79,620	80,034 (16,007) [3,842] {1,921}	80,476 (16,095) [3,863] {1,931}	80,948 (16,190) [3,886] {1,943}
Rockland	48,188	48,247	48,275	48,302	48,441 (9,688) [2,325] {1,163}	48,589 (9,718) [2,332] {1,166}	48,745 (9,749) [2,340] {1,170}
Saratoga	16,218	16,312	16,359	16,408	16,534 (3,307) [794] {397}	16,672 (3,334) [800] {400}	16,824 (3,365) [808] {404}
Schenectady	13,695	13,753	13,794	13,826	13,928 (2,786) [669] {334}	14,043 (2,809) [674] {337}	14,176 (2,835) [680] {340}
Suffolk	208,020	208,440	208,796	209,136	209,977 (41,995) [10,079] {5,039}	210,881 (42,176) [10,122] {5,061}	211,836 (42,367) [10,168] {5,084}
Sullivan	6,947	6,965	6,989	7,001	7,043 (1,409) [338] {169}	7,089 (1,418) [340] {170}	7,140 (1,428) [343] {171}
Tompkins	4,590	4,613	4,628	4,644	4,686 (937) [225] {112}	4,734 (947) [227] {114}	4,789 (958) [230] {115}
Ulster	14,438	14,459	14,506	14,552	14,644 (2,929) [703] {351}	14,748 (2,950) [708] {354}	14,867 (2,973) [714] {357}
Westchester	133,425	133,627	133,813	134,021	134,493 (26,899) [6,456] {3,228}	134,999 (27,000) [6,480] {3,240}	135,548 (27,110) [6,506] {3,253}

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.