IEM's AI Modeling: Short-term COVID-19 Projections

Date: 10/29/21

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

The projections shown in this document are based on data pulled in as of 10/29/21 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.

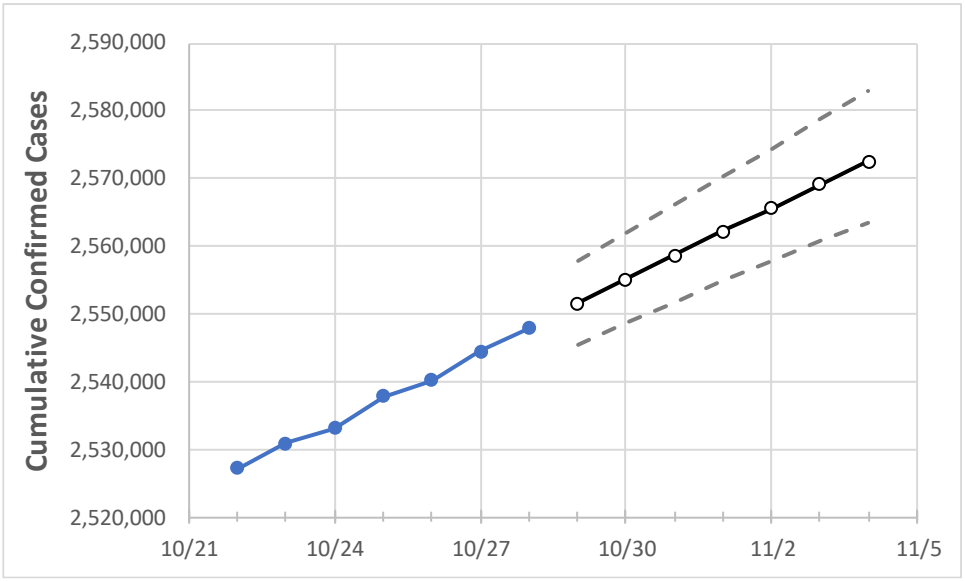
IEM's Modeling Lead

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:						
	10/25	10/26	10/27	10/28	10/29	10/30	10/31	11/1	11/2	11/3	11/4
New York	2,537,823	2,540,255	2,544,431	2,547,865	2,551,568	2,555,162	2,558,603	2,562,163	2,565,628	2,569,066	2,572,602

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:						
	10/25	10/26	10/27	10/28	10/29	10/30	10/31	11/1	11/2	11/3	11/4
Albany	31,130	31,174	31,274	31,373	31,455	31,536	31,619	31,703	31,786	31,869	31,953
Bronx	208,154	208,298	208,382	208,382	208,503	208,620	208,735	208,850	208,966	209,079	209,190
Dutchess	35,811	35,834	35,864	35,929	35,974	36,017	36,061	36,103	36,147	36,188	36,230
Erie	107,358	107,549	107,938	108,224	108,494	108,756	109,015	109,283	109,556	109,823	110,095
Kings	335,330	335,595	335,849	335,849	336,188	336,517	336,853	337,180	337,504	337,821	338,137
Monroe	85,120	85,204	85,441	85,673	85,878	86,082	86,279	86,482	86,683	86,886	87,087
Nassau	215,085	215,227	215,425	215,664	215,847	216,031	216,209	216,387	216,577	216,745	216,922
New York	168,703	168,806	168,945	169,180	169,333	169,486	169,637	169,785	169,934	170,085	170,232
Niagara	24,280	24,331	24,431	24,479	24,547	24,611	24,676	24,744	24,809	24,878	24,942
Onondaga	52,624	52,686	52,942	53,074	53,228	53,378	53,528	53,678	53,819	53,977	54,121
Orange	57,824	57,878	57,971	58,063	58,145	58,227	58,305	58,387	58,464	58,543	58,620
Putnam	12,550	12,557	12,578	12,600	12,616	12,631	12,646	12,661	12,676	12,691	12,705
Queens	316,202	316,390	316,522	316,522	316,731	316,940	317,140	317,341	317,538	317,734	317,919
Rensselaer	15,006	15,024	15,081	15,127	15,173	15,221	15,264	15,309	15,357	15,403	15,448
Richmond	89,305	89,397	89,460	89,460	89,554	89,648	89,739	89,831	89,924	90,016	90,109
Rockland	53,317	53,368	53,426	53,518	53,576	53,633	53,688	53,745	53,799	53,854	53,909
Saratoga	20,545	20,582	20,661	20,720	20,786	20,854	20,920	20,986	21,053	21,124	21,189
Schenectady	16,970	16,992	17,072	17,112	17,170	17,228	17,287	17,345	17,404	17,468	17,525
Suffolk	240,693	240,888	241,171	241,522	241,816	242,101	242,385	242,676	242,953	243,241	243,507
Sullivan	8,541	8,557	8,577	8,608	8,630	8,652	8,674	8,695	8,718	8,740	8,762
Tompkins	6,580	6,583	6,607	6,625	6,642	6,657	6,674	6,691	6,707	6,723	6,740
Ulster	17,373	17,394	17,421	17,458	17,484	17,510	17,534	17,560	17,585	17,611	17,636
Westchester	143,938	143,987	144,050	144,164	144,233	144,304	144,373	144,439	144,509	144,575	144,640

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:		
	10/25	10/26	10/27	10/28	10/30	11/1	11/3
Albany	31,130	31,174	31,274	31,373	31,536 (6,307) [1,514] {757}	31,703 (6,341) [1,522] {761}	31,869 (6,374) [1,530] {765}
Bronx	208,154	208,298	208,382	208,382	208,620 (41,724) [10,014] {5,007}	208,850 (41,770) [10,025] {5,012}	209,079 (41,816) [10,036] {5,018}
Dutchess	35,811	35,834	35,864	35,929	36,017 (7,203) [1,729] {864}	36,103 (7,221) [1,733] {866}	36,188 (7,238) [1,737] {869}
Erie	107,358	107,549	107,938	108,224	108,756 (21,751) [5,220] {2,610}	109,283 (21,857) [5,246] {2,623}	109,823 (21,965) [5,272] {2,636}
Kings	335,330	335,595	335,849	335,849	336,517 (67,303) [16,153] {8,076}	337,180 (67,436) [16,185] {8,092}	337,821 (67,564) [16,215] {8,108}
Monroe	85,120	85,204	85,441	85,673	86,082 (17,216) [4,132] {2,066}	86,482 (17,296) [4,151] {2,076}	86,886 (17,377) [4,171] {2,085}
Nassau	215,085	215,227	215,425	215,664	216,031 (43,206) [10,369] {5,185}	216,387 (43,277) [10,387] {5,193}	216,745 (43,349) [10,404] {5,202}
New York	168,703	168,806	168,945	169,180	169,486 (33,897) [8,135] {4,068}	169,785 (33,957) [8,150] {4,075}	170,085 (34,017) [8,164] {4,082}
Niagara	24,280	24,331	24,431	24,479	24,611 (4,922) [1,181] {591}	24,744 (4,949) [1,188] {594}	24,878 (4,976) [1,194] {597}
Onondaga	52,624	52,686	52,942	53,074	53,378 (10,676) [2,562] {1,281}	53,678 (10,736) [2,577] {1,288}	53,977 (10,795) [2,591] {1,295}
Orange	57,824	57,878	57,971	58,063	58,227 (11,645) [2,795] {1,397}	58,387 (11,677) [2,803] {1,401}	58,543 (11,709) [2,810] {1,405}
Putnam	12,550	12,557	12,578	12,600	12,631 (2,526) [606] {303}	12,661 (2,532) [608] {304}	12,691 (2,538) [609] {305}
Queens	316,202	316,390	316,522	316,522	316,940 (63,388) [15,213] {7,607}	317,341 (63,468) [15,232] {7,616}	317,734 (63,547) [15,251] {7,626}
Rensselaer	15,006	15,024	15,081	15,127	15,221 (3,044) [731] {365}	15,309 (3,062) [735] {367}	15,403 (3,081) [739] {370}
Richmond	89,305	89,397	89,460	89,460	89,648 (17,930) [4,303] {2,152}	89,831 (17,966) [4,312] {2,156}	90,016 (18,003) [4,321] {2,160}
Rockland	53,317	53,368	53,426	53,518	53,633 (10,727) [2,574] {1,287}	53,745 (10,749) [2,580] {1,290}	53,854 (10,771) [2,585] {1,292}
Saratoga	20,545	20,582	20,661	20,720	20,854 (4,171) [1,001] {500}	20,986 (4,197) [1,007] {504}	21,124 (4,225) [1,014] {507}
Schenectady	16,970	16,992	17,072	17,112	17,228 (3,446) [827] {413}	17,345 (3,469) [833] {416}	17,468 (3,494) [838] {419}
Suffolk	240,693	240,888	241,171	241,522	242,101 (48,420) [11,621] {5,810}	242,676 (48,535) [11,648] {5,824}	243,241 (48,648) [11,676] {5,838}
Sullivan	8,541	8,557	8,577	8,608	8,652 (1,730) [415] {208}	8,695 (1,739) [417] {209}	8,740 (1,748) [420] {210}
Tompkins	6,580	6,583	6,607	6,625	6,657 (1,331) [320] {160}	6,691 (1,338) [321] {161}	6,723 (1,345) [323] {161}
Ulster	17,373	17,394	17,421	17,458	17,510 (3,502) [840] {420}	17,560 (3,512) [843] {421}	17,611 (3,522) [845] {423}
Westchester	143,938	143,987	144,050	144,164	144,304 (28,861) [6,927] {3,463}	144,439 (28,888) [6,933] {3,467}	144,575 (28,915) [6,940] {3,470}

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.