IEM's AI Modeling: Short-term COVID-19 Projections
Date: 10/20/21

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 10/20/21 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
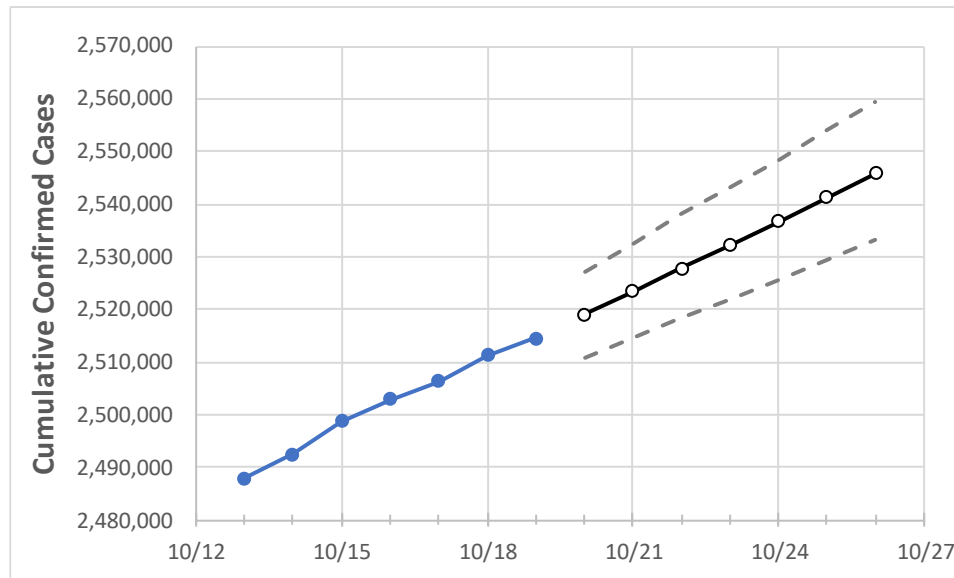
	Actual Confirmed Cases On:				Projected Cases For:						
	10/16	10/17	10/18	10/19	10/20	10/21	10/22	10/23	10/24	10/25	10/26
New York	2,502,914	2,506,247	2,511,182	2,514,422	2,518,999	2,523,415	2,527,834	2,532,250	2,536,769	2,541,356	2,545,883

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:						
	10/16	10/17	10/18	10/19	10/20	10/21	10/22	10/23	10/24	10/25	10/26
Albany	30,443	30,510	30,581	30,633	30,715	30,800	30,881	30,961	31,048	31,130	31,212
Bronx	206,911	207,032	207,152	207,326	207,484	207,638	207,790	207,943	208,092	208,236	208,379
Dutchess	35,358	35,411	35,451	35,490	35,550	35,612	35,670	35,730	35,792	35,853	35,911
Erie	105,215	105,477	105,661	105,791	106,047	106,307	106,559	106,822	107,080	107,354	107,617
Kings	331,696	332,092	332,489	333,028	333,531	334,030	334,528	335,016	335,506	335,998	336,489
Monroe	83,299	83,519	83,708	83,830	84,048	84,272	84,493	84,712	84,945	85,166	85,390
Nassau	213,353	213,603	213,730	213,905	214,134	214,354	214,573	214,793	215,010	215,228	215,438
New York	167,308	167,492	167,593	167,767	167,950	168,131	168,311	168,486	168,663	168,840	169,008
Niagara	23,713	23,795	23,854	23,884	23,949	24,014	24,081	24,147	24,210	24,278	24,346
Onondaga	51,242	51,456	51,624	51,689	51,900	52,116	52,312	52,530	52,743	52,958	53,168
Orange	57,074	57,192	57,270	57,344	57,453	57,562	57,671	57,779	57,891	58,002	58,112
Putnam	12,405	12,420	12,439	12,448	12,472	12,495	12,517	12,542	12,564	12,587	12,612
Queens	314,045	314,262	314,480	314,855	315,141	315,422	315,707	315,983	316,268	316,549	316,815
Rensselaer	14,570	14,618	14,669	14,692	14,746	14,799	14,853	14,906	14,960	15,016	15,069
Richmond	88,396	88,500	88,603	88,731	88,835	88,939	89,039	89,142	89,247	89,350	89,452
Rockland	52,800	52,859	52,918	52,979	53,056	53,132	53,208	53,288	53,367	53,440	53,518
Saratoga	19,975	20,034	20,080	20,111	20,175	20,238	20,304	20,365	20,431	20,496	20,560
Schenectady	16,478	16,525	16,584	16,592	16,651	16,709	16,765	16,825	16,887	16,950	17,011
Suffolk	237,959	238,318	238,494	238,801	239,158	239,509	239,849	240,190	240,535	240,869	241,219
Sullivan	8,362	8,394	8,420	8,431	8,457	8,483	8,509	8,536	8,563	8,590	8,617
Tompkins	6,425	6,463	6,465	6,475	6,492	6,508	6,525	6,541	6,557	6,573	6,590
Ulster	17,148	17,179	17,205	17,224	17,254	17,284	17,313	17,343	17,372	17,402	17,432
Westchester	143,310	143,388	143,434	143,481	143,562	143,641	143,722	143,798	143,874	143,955	144,030

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: | | |
	10/16	10/17	10/18	10/19	10/21	10/23	10/25
Albany	30,443	30,510	30,581	30,633	30,800 (6,160) [1,478] {739}	30,961 (6,192) [1,486] {743}	31,130 (6,226) [1,494] {747}
Bronx	206,911	207,032	207,152	207,326	207,638 (41,528) [9,967] {4,983}	207,943 (41,589) [9,981] {4,991}	208,236 (41,647) [9,995] {4,998}
Dutchess	35,358	35,411	35,451	35,490	35,612 (7,122) [1,709] {855}	35,730 (7,146) [1,715] {858}	35,853 (7,171) [1,721] {860}
Erie	105,215	105,477	105,661	105,791	106,307 (21,261) [5,103] {2,551}	106,822 (21,364) [5,127] {2,564}	107,354 (21,471) [5,153] {2,577}
Kings	331,696	332,092	332,489	333,028	334,030 (66,806) [16,033] {8,017}	335,016 (67,003) [16,081] {8,040}	335,998 (67,200) [16,128] {8,064}
Monroe	83,299	83,519	83,708	83,830	84,272 (16,854) [4,045] {2,023}	84,712 (16,942) [4,066] {2,033}	85,166 (17,033) [4,088] {2,044}
Nassau	213,353	213,603	213,730	213,905	214,354 (42,871) [10,289] {5,144}	214,793 (42,959) [10,310] {5,155}	215,228 (43,046) [10,331] {5,165}
New York	167,308	167,492	167,593	167,767	168,131 (33,626) [8,070] {4,035}	168,486 (33,697) [8,087] {4,044}	168,840 (33,768) [8,104] {4,052}
Niagara	23,713	23,795	23,854	23,884	24,014 (4,803) [1,153] {576}	24,147 (4,829) [1,159] {580}	24,278 (4,856) [1,165] {583}
Onondaga	51,242	51,456	51,624	51,689	52,116 (10,423) [2,502] {1,251}	52,530 (10,506) [2,521] {1,261}	52,958 (10,592) [2,542] {1,271}
Orange	57,074	57,192	57,270	57,344	57,562 (11,512) [2,763] {1,381}	57,779 (11,556) [2,773] {1,387}	58,002 (11,600) [2,784] {1,392}
Putnam	12,405	12,420	12,439	12,448	12,495 (2,499) [600] {300}	12,542 (2,508) [602] {301}	12,587 (2,517) [604] {302}
Queens	314,045	314,262	314,480	314,855	315,422 (63,084) [15,140] {7,570}	315,983 (63,197) [15,167] {7,584}	316,549 (63,310) [15,194] {7,597}
Rensselaer	14,570	14,618	14,669	14,692	14,799 (2,960) [710] {355}	14,906 (2,981) [715] {358}	15,016 (3,003) [721] {360}
Richmond	88,396	88,500	88,603	88,731	88,939 (17,788) [4,269] {2,135}	89,142 (17,828) [4,279] {2,139}	89,350 (17,870) [4,289] {2,144}
Rockland	52,800	52,859	52,918	52,979	53,132 (10,626) [2,550] {1,275}	53,288 (10,658) [2,558] {1,279}	53,440 (10,688) [2,565] {1,283}
Saratoga	19,975	20,034	20,080	20,111	20,238 (4,048) [971] {486}	20,365 (4,073) [978] {489}	20,496 (4,099) [984] {492}
Schenectady	16,478	16,525	16,584	16,592	16,709 (3,342) [802] {401}	16,825 (3,365) [808] {404}	16,950 (3,390) [814] {407}
Suffolk	237,959	238,318	238,494	238,801	239,509 (47,902) [11,496] {5,748}	240,190 (48,038) [11,529] {5,765}	240,869 (48,174) [11,562] {5,781}
Sullivan	8,362	8,394	8,420	8,431	8,483 (1,697) [407] {204}	8,536 (1,707) [410] {205}	8,590 (1,718) [412] {206}
Tompkins	6,425	6,463	6,465	6,475	6,508 (1,302) [312] {156}	6,541 (1,308) [314] {157}	6,573 (1,315) [316] {158}
Ulster	17,148	17,179	17,205	17,224	17,284 (3,457) [830] {415}	17,343 (3,469) [832] {416}	17,402 (3,480) [835] {418}
Westchester	143,310	143,388	143,434	143,481	143,641 (28,728) [6,895] {3,447}	143,798 (28,760) [6,902] {3,451}	143,955 (28,791) [6,910] {3,455}

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.