IEM's AI Modeling: Short-term COVID-19 Projections
Date: 10/27/21

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 10/27/21 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
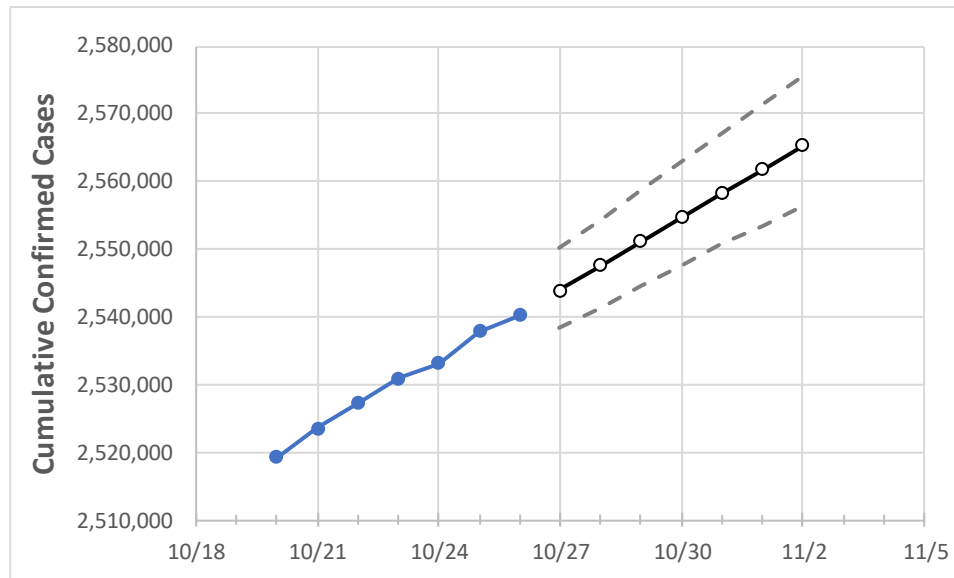
	Actual Confirmed Cases On:				Projected Cases For:						
	10/23	10/24	10/25	10/26	10/27	10/28	10/29	10/30	10/31	11/1	11/2
New York	2,530,860	2,533,155	2,537,823	2,540,255	2,543,939	2,547,582	2,551,108	2,554,742	2,558,235	2,561,784	2,565,296

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:						
	10/23	10/24	10/25	10/26	10/27	10/28	10/29	10/30	10/31	11/1	11/2
Albany	31,020	31,074	31,130	31,174	31,256	31,332	31,410	31,490	31,567	31,644	31,724
Bronx	207,919	208,037	208,154	208,298	208,427	208,555	208,681	208,803	208,929	209,050	209,166
Dutchess	35,740	35,776	35,811	35,834	35,880	35,924	35,969	36,014	36,058	36,100	36,145
Erie	106,959	107,130	107,358	107,549	107,796	108,036	108,271	108,508	108,757	108,997	109,239
Kings	334,704	335,017	335,330	335,595	335,964	336,325	336,681	337,024	337,375	337,720	338,051
Monroe	84,784	84,941	85,120	85,204	85,406	85,608	85,807	86,009	86,208	86,416	86,614
Nassau	214,772	214,930	215,085	215,227	215,412	215,588	215,760	215,932	216,102	216,274	216,436
New York	168,405	168,548	168,703	168,806	168,956	169,102	169,242	169,388	169,528	169,669	169,805
Niagara	24,170	24,203	24,280	24,331	24,393	24,458	24,523	24,585	24,651	24,714	24,779
Onondaga	52,355	52,461	52,624	52,686	52,839	52,987	53,131	53,280	53,421	53,557	53,703
Orange	57,712	57,778	57,824	57,878	57,960	58,043	58,123	58,206	58,286	58,365	58,445
Putnam	12,529	12,541	12,550	12,557	12,573	12,588	12,603	12,618	12,632	12,646	12,661
Queens	315,798	316,000	316,202	316,390	316,614	316,828	317,046	317,254	317,457	317,671	317,874
Rensselaer	14,902	14,947	15,006	15,024	15,070	15,115	15,159	15,203	15,249	15,292	15,336
Richmond	89,124	89,215	89,305	89,397	89,497	89,596	89,692	89,792	89,889	89,987	90,087
Rockland	53,233	53,278	53,317	53,368	53,421	53,473	53,524	53,574	53,623	53,673	53,719
Saratoga	20,424	20,485	20,545	20,582	20,649	20,714	20,780	20,845	20,911	20,978	21,044
Schenectady	16,876	16,899	16,970	16,992	17,049	17,107	17,168	17,226	17,287	17,348	17,407
Suffolk	240,189	240,469	240,693	240,888	241,186	241,479	241,769	242,045	242,331	242,611	242,888
Sullivan	8,511	8,526	8,541	8,557	8,579	8,600	8,621	8,643	8,665	8,686	8,708
Tompkins	6,549	6,574	6,580	6,583	6,599	6,615	6,630	6,646	6,662	6,677	6,693
Ulster	17,327	17,349	17,373	17,394	17,418	17,442	17,466	17,490	17,513	17,536	17,559
Westchester	143,776	143,852	143,938	143,987	144,054	144,120	144,184	144,246	144,309	144,374	144,432

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:		
	10/23	10/24	10/25	10/26	10/28	10/30	11/1
Albany	31,020	31,074	31,130	31,174	31,332 (6,266) [1,504] {752}	31,490 (6,298) [1,511] {756}	31,644 (6,329) [1,519] {759}
Bronx	207,919	208,037	208,154	208,298	208,555 (41,711) [10,011] {5,005}	208,803 (41,761) [10,023] {5,011}	209,050 (41,810) [10,034] {5,017}
Dutchess	35,740	35,776	35,811	35,834	35,924 (7,185) [1,724] {862}	36,014 (7,203) [1,729] {864}	36,100 (7,220) [1,733] {866}
Erie	106,959	107,130	107,358	107,549	108,036 (21,607) [5,186] {2,593}	108,508 (21,702) [5,208] {2,604}	108,997 (21,799) [5,232] {2,616}
Kings	334,704	335,017	335,330	335,595	336,325 (67,265) [16,144] {8,072}	337,024 (67,405) [16,177] {8,089}	337,720 (67,544) [16,211] {8,105}
Monroe	84,784	84,941	85,120	85,204	85,608 (17,122) [4,109] {2,055}	86,009 (17,202) [4,128] {2,064}	86,416 (17,283) [4,148] {2,074}
Nassau	214,772	214,930	215,085	215,227	215,588 (43,118) [10,348] {5,174}	215,932 (43,186) [10,365] {5,182}	216,274 (43,255) [10,381] {5,191}
New York	168,405	168,548	168,703	168,806	169,102 (33,820) [8,117] {4,058}	169,388 (33,878) [8,131] {4,065}	169,669 (33,934) [8,144] {4,072}
Niagara	24,170	24,203	24,280	24,331	24,458 (4,892) [1,174] {587}	24,585 (4,917) [1,180] {590}	24,714 (4,943) [1,186] {593}
Onondaga	52,355	52,461	52,624	52,686	52,987 (10,597) [2,543] {1,272}	53,280 (10,656) [2,557] {1,279}	53,557 (10,711) [2,571] {1,285}
Orange	57,712	57,778	57,824	57,878	58,043 (11,609) [2,786] {1,393}	58,206 (11,641) [2,794] {1,397}	58,365 (11,673) [2,802] {1,401}
Putnam	12,529	12,541	12,550	12,557	12,588 (2,518) [604] {302}	12,618 (2,524) [606] {303}	12,646 (2,529) [607] {304}
Queens	315,798	316,000	316,202	316,390	316,828 (63,366) [15,208] {7,604}	317,254 (63,451) [15,228] {7,614}	317,671 (63,534) [15,248] {7,624}
Rensselaer	14,902	14,947	15,006	15,024	15,115 (3,023) [726] {363}	15,203 (3,041) [730] {365}	15,292 (3,058) [734] {367}
Richmond	89,124	89,215	89,305	89,397	89,596 (17,919) [4,301] {2,150}	89,792 (17,958) [4,310] {2,155}	89,987 (17,997) [4,319] {2,160}
Rockland	53,233	53,278	53,317	53,368	53,473 (10,695) [2,567] {1,283}	53,574 (10,715) [2,572] {1,286}	53,673 (10,735) [2,576] {1,288}
Saratoga	20,424	20,485	20,545	20,582	20,714 (4,143) [994] {497}	20,845 (4,169) [1,001] {500}	20,978 (4,196) [1,007] {503}
Schenectady	16,876	16,899	16,970	16,992	17,107 (3,421) [821] {411}	17,226 (3,445) [827] {413}	17,348 (3,470) [833] {416}
Suffolk	240,189	240,469	240,693	240,888	241,479 (48,296) [11,591] {5,796}	242,045 (48,409) [11,618] {5,809}	242,611 (48,522) [11,645] {5,823}
Sullivan	8,511	8,526	8,541	8,557	8,600 (1,720) [413] {206}	8,643 (1,729) [415] {207}	8,686 (1,737) [417] {208}
Tompkins	6,549	6,574	6,580	6,583	6,615 (1,323) [318] {159}	6,646 (1,329) [319] {159}	6,677 (1,335) [321] {160}
Ulster	17,327	17,349	17,373	17,394	17,442 (3,488) [837] {419}	17,490 (3,498) [840] {420}	17,536 (3,507) [842] {421}
Westchester	143,776	143,852	143,938	143,987	144,120 (28,824) [6,918] {3,459}	144,246 (28,849) [6,924] {3,462}	144,374 (28,875) [6,930] {3,465}

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.