IEM's AI Modeling: Short-term COVID-19 Projections
Date: 10/4/21

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 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 10/4/21 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
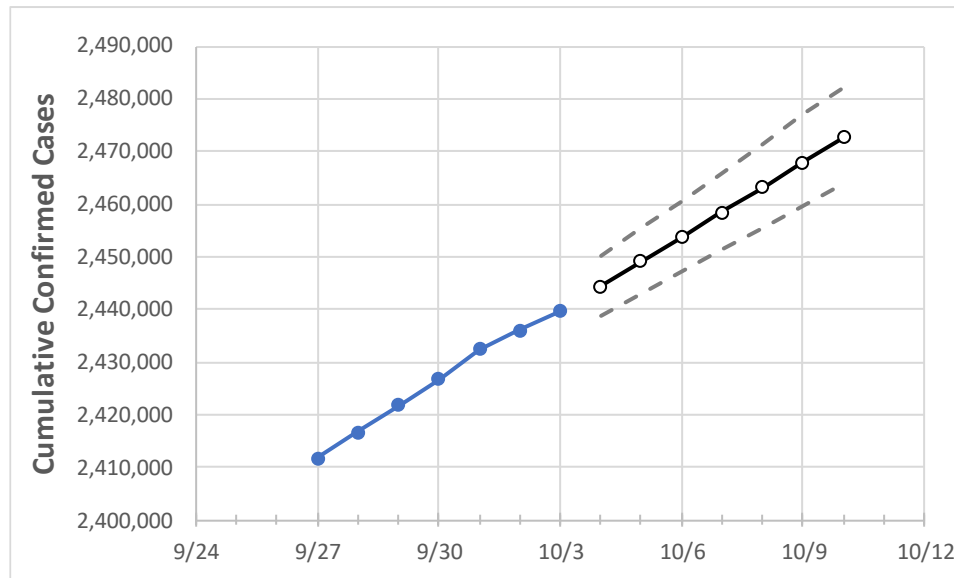
	Actual Confirmed Cases On:				Projected Cases For:						
	9/30	10/1	10/2	10/3	10/4	10/5	10/6	10/7	10/8	10/9	10/10
New York	2,426,683	2,432,444	2,436,048	2,439,639	2,444,348	2,449,092	2,453,766	2,458,467	2,463,172	2,467,996	2,472,640

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:						
	9/30	10/1	10/2	10/3	10/4	10/5	10/6	10/7	10/8	10/9	10/10
Albany	29,092	29,190	29,269	29,378	29,467	29,558	29,650	29,742	29,837	29,932	30,028
Bronx	203,707	204,075	204,075	204,075	204,309	204,548	204,781	205,014	205,256	205,485	205,719
Dutchess	34,329	34,386	34,456	34,519	34,586	34,651	34,717	34,783	34,848	34,915	34,978
Erie	101,007	101,292	101,506	101,835	102,100	102,366	102,630	102,904	103,177	103,463	103,743
Kings	322,907	323,465	323,465	323,465	324,008	324,563	325,119	325,665	326,209	326,760	327,306
Monroe	79,758	80,017	80,252	80,439	80,662	80,887	81,119	81,346	81,580	81,820	82,056
Nassau	209,215	209,487	209,782	209,987	210,269	210,545	210,815	211,085	211,354	211,626	211,885
New York	163,785	164,044	164,312	164,507	164,753	164,991	165,223	165,459	165,691	165,920	166,148
Niagara	22,639	22,731	22,796	22,876	22,948	23,021	23,094	23,168	23,246	23,323	23,403
Onondaga	47,570	47,924	48,123	48,409	48,659	48,906	49,165	49,420	49,699	49,975	50,251
Orange	55,345	55,454	55,569	55,659	55,762	55,862	55,962	56,063	56,164	56,266	56,366
Putnam	12,022	12,050	12,070	12,090	12,114	12,139	12,163	12,188	12,213	12,239	12,264
Queens	308,670	309,155	309,155	309,155	309,549	309,945	310,332	310,722	311,120	311,520	311,915
Rensselaer	13,708	13,771	13,823	13,879	13,933	13,988	14,044	14,099	14,155	14,214	14,272
Richmond	86,674	86,828	86,828	86,828	86,947	87,062	87,177	87,292	87,405	87,520	87,633
Rockland	51,464	51,560	51,646	51,729	51,814	51,900	51,986	52,073	52,158	52,248	52,336
Saratoga	18,930	19,007	19,070	19,114	19,175	19,236	19,298	19,361	19,425	19,491	19,555
Schenectady	15,656	15,713	15,738	15,782	15,829	15,877	15,925	15,972	16,021	16,070	16,119
Suffolk	231,463	231,905	232,356	232,788	233,246	233,701	234,153	234,612	235,056	235,528	235,977
Sullivan	7,993	8,010	8,034	8,050	8,071	8,092	8,113	8,134	8,155	8,177	8,198
Tompkins	6,136	6,151	6,169	6,197	6,218	6,238	6,258	6,277	6,297	6,318	6,337
Ulster	16,631	16,670	16,713	16,737	16,770	16,804	16,837	16,870	16,902	16,936	16,967
Westchester	141,731	141,844	141,942	142,030	142,130	142,227	142,325	142,422	142,514	142,606	142,697

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:		
	9/30	10/1	10/2	10/3	10/5	10/7	10/9
Albany	29,092	29,190	29,269	29,378	29,558 (5,912) [1,419] {709}	29,742 (5,948) [1,428] {714}	29,932 (5,986) [1,437] {718}
Bronx	203,707	204,075	204,075	204,075	204,548 (40,910) [9,818] {4,909}	205,014 (41,003) [9,841] {4,920}	205,485 (41,097) [9,863] {4,932}
Dutchess	34,329	34,386	34,456	34,519	34,651 (6,930) [1,663] {832}	34,783 (6,957) [1,670] {835}	34,915 (6,983) [1,676] {838}
Erie	101,007	101,292	101,506	101,835	102,366 (20,473) [4,914] {2,457}	102,904 (20,581) [4,939] {2,470}	103,463 (20,693) [4,966] {2,483}
Kings	322,907	323,465	323,465	323,465	324,563 (64,913) [15,579] {7,790}	325,665 (65,133) [15,632] {7,816}	326,760 (65,352) [15,685] {7,842}
Monroe	79,758	80,017	80,252	80,439	80,887 (16,177) [3,883] {1,941}	81,346 (16,269) [3,905] {1,952}	81,820 (16,364) [3,927] {1,964}
Nassau	209,215	209,487	209,782	209,987	210,545 (42,109) [10,106] {5,053}	211,085 (42,217) [10,132] {5,066}	211,626 (42,325) [10,158] {5,079}
New York	163,785	164,044	164,312	164,507	164,991 (32,998) [7,920] {3,960}	165,459 (33,092) [7,942] {3,971}	165,920 (33,184) [7,964] {3,982}
Niagara	22,639	22,731	22,796	22,876	23,021 (4,604) [1,105] {553}	23,168 (4,634) [1,112] {556}	23,323 (4,665) [1,120] {560}
Onondaga	47,570	47,924	48,123	48,409	48,906 (9,781) [2,347] {1,174}	49,420 (9,884) [2,372] {1,186}	49,975 (9,995) [2,399] {1,199}
Orange	55,345	55,454	55,569	55,659	55,862 (11,172) [2,681] {1,341}	56,063 (11,213) [2,691] {1,346}	56,266 (11,253) [2,701] {1,350}
Putnam	12,022	12,050	12,070	12,090	12,139 (2,428) [583] {291}	12,188 (2,438) [585] {293}	12,239 (2,448) [587] {294}
Queens	308,670	309,155	309,155	309,155	309,945 (61,989) [14,877] {7,439}	310,722 (62,144) [14,915] {7,457}	311,520 (62,304) [14,953] {7,476}
Rensselaer	13,708	13,771	13,823	13,879	13,988 (2,798) [671] {336}	14,099 (2,820) [677] {338}	14,214 (2,843) [682] {341}
Richmond	86,674	86,828	86,828	86,828	87,062 (17,412) [4,179] {2,089}	87,292 (17,458) [4,190] {2,095}	87,520 (17,504) [4,201] {2,100}
Rockland	51,464	51,560	51,646	51,729	51,900 (10,380) [2,491] {1,246}	52,073 (10,415) [2,500] {1,250}	52,248 (10,450) [2,508] {1,254}
Saratoga	18,930	19,007	19,070	19,114	19,236 (3,847) [923] {462}	19,361 (3,872) [929] {465}	19,491 (3,898) [936] {468}
Schenectady	15,656	15,713	15,738	15,782	15,877 (3,175) [762] {381}	15,972 (3,194) [767] {383}	16,070 (3,214) [771] {386}
Suffolk	231,463	231,905	232,356	232,788	233,701 (46,740) [11,218] {5,609}	234,612 (46,922) [11,261] {5,631}	235,528 (47,106) [11,305] {5,653}
Sullivan	7,993	8,010	8,034	8,050	8,092 (1,618) [388] {194}	8,134 (1,627) [390] {195}	8,177 (1,635) [392] {196}
Tompkins	6,136	6,151	6,169	6,197	6,238 (1,248) [299] {150}	6,277 (1,255) [301] {151}	6,318 (1,264) [303] {152}
Ulster	16,631	16,670	16,713	16,737	16,804 (3,361) [807] {403}	16,870 (3,374) [810] {405}	16,936 (3,387) [813] {406}
Westchester	141,731	141,844	141,942	142,030	142,227 (28,445) [6,827] {3,413}	142,422 (28,484) [6,836] {3,418}	142,606 (28,521) [6,845] {3,423}

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.