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

Date: 11/8/21

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 11/8/21 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.

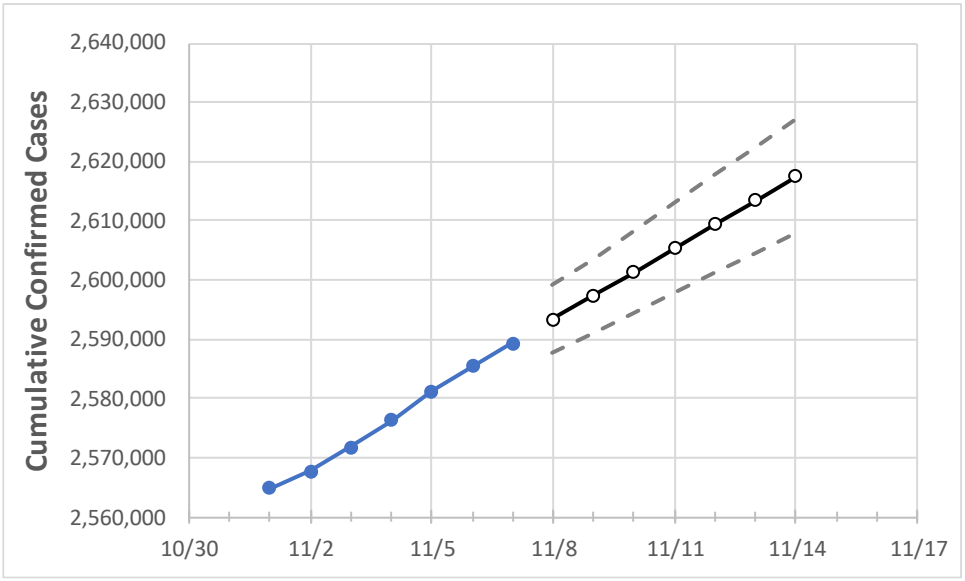
IEM's Modeling Lead

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:						
	11/4	11/5	11/6	11/7	11/8	11/9	11/10	11/11	11/12	11/13	11/14
New York	2,576,396	2,581,256	2,585,365	2,589,297	2,593,281	2,597,333	2,601,347	2,605,353	2,609,455	2,613,485	2,617,559

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:						
	11/4	11/5	11/6	11/7	11/8	11/9	11/10	11/11	11/12	11/13	11/14
Albany	31,915	31,992	32,078	32,146	32,221	32,296	32,372	32,447	32,523	32,597	32,671
Bronx	209,321	209,426	209,426	209,426	209,526	209,631	209,729	209,831	209,931	210,032	210,130
Dutchess	36,221	36,285	36,352	36,401	36,444	36,489	36,534	36,578	36,622	36,667	36,710
Erie	110,558	111,012	111,452	111,900	112,308	112,720	113,150	113,576	114,016	114,471	114,941
Kings	338,796	339,169	339,169	339,169	339,497	339,808	340,133	340,457	340,781	341,095	341,407
Monroe	87,445	87,760	88,122	88,521	88,825	89,131	89,439	89,763	90,090	90,420	90,751
Nassau	217,038	217,281	217,518	217,726	217,936	218,149	218,367	218,582	218,796	219,019	219,235
New York	170,193	170,384	170,642	170,859	171,031	171,198	171,369	171,536	171,712	171,885	172,050
Niagara	25,049	25,165	25,267	25,360	25,453	25,550	25,643	25,741	25,841	25,942	26,046
Onondaga	54,275	54,461	54,627	54,811	54,976	55,139	55,299	55,463	55,627	55,795	55,953
Orange	58,682	58,783	58,903	59,000	59,087	59,173	59,262	59,351	59,438	59,530	59,619
Putnam	12,677	12,698	12,707	12,716	12,726	12,737	12,747	12,756	12,767	12,777	12,785
Queens	318,108	318,329	318,329	318,329	318,506	318,686	318,861	319,031	319,211	319,381	319,551
Rensselaer	15,490	15,562	15,630	15,702	15,760	15,818	15,877	15,938	15,998	16,058	16,120
Richmond	90,045	90,131	90,131	90,131	90,197	90,263	90,327	90,392	90,454	90,518	90,578
Rockland	53,878	53,959	54,014	54,049	54,101	54,152	54,201	54,252	54,302	54,352	54,401
Saratoga	21,282	21,366	21,455	21,555	21,640	21,726	21,813	21,901	21,989	22,081	22,173
Schenectady	17,480	17,529	17,590	17,657	17,712	17,765	17,819	17,870	17,923	17,976	18,029
Suffolk	243,299	243,659	244,021	244,348	244,634	244,931	245,219	245,505	245,798	246,093	246,381
Sullivan	8,745	8,764	8,781	8,802	8,821	8,840	8,859	8,878	8,896	8,916	8,934
Tompkins	6,723	6,748	6,768	6,798	6,815	6,832	6,849	6,866	6,884	6,901	6,918
Ulster	17,655	17,687	17,728	17,760	17,791	17,822	17,854	17,886	17,918	17,950	17,982
Westchester	144,678	144,776	144,859	144,943	145,021	145,101	145,179	145,259	145,339	145,421	145,501

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:		
	11/4	11/5	11/6	11/7	11/9	11/11	11/13
Albany	31,915	31,992	32,078	32,146	32,296 (6,459) [1,550] {775}	32,447 (6,489) [1,557] {779}	32,597 (6,519) [1,565] {782}
Bronx	209,321	209,426	209,426	209,426	209,631 (41,926) [10,062] {5,031}	209,831 (41,966) [10,072] {5,036}	210,032 (42,006) [10,082] {5,041}
Dutchess	36,221	36,285	36,352	36,401	36,489 (7,298) [1,751] {876}	36,578 (7,316) [1,756] {878}	36,667 (7,333) [1,760] {880}
Erie	110,558	111,012	111,452	111,900	112,720 (22,544) [5,411] {2,705}	113,576 (22,715) [5,452] {2,726}	114,471 (22,894) [5,495] {2,747}
Kings	338,796	339,169	339,169	339,169	339,808 (67,962) [16,311] {8,155}	340,457 (68,091) [16,342] {8,171}	341,095 (68,219) [16,373] {8,186}
Monroe	87,445	87,760	88,122	88,521	89,131 (17,826) [4,278] {2,139}	89,763 (17,953) [4,309] {2,154}	90,420 (18,084) [4,340] {2,170}
Nassau	217,038	217,281	217,518	217,726	218,149 (43,630) [10,471] {5,236}	218,582 (43,716) [10,492] {5,246}	219,019 (43,804) [10,513] {5,256}
New York	170,193	170,384	170,642	170,859	171,198 (34,240) [8,218] {4,109}	171,536 (34,307) [8,234] {4,117}	171,885 (34,377) [8,250] {4,125}
Niagara	25,049	25,165	25,267	25,360	25,550 (5,110) [1,226] {613}	25,741 (5,148) [1,236] {618}	25,942 (5,188) [1,245] {623}
Onondaga	54,275	54,461	54,627	54,811	55,139 (11,028) [2,647] {1,323}	55,463 (11,093) [2,662] {1,331}	55,795 (11,159) [2,678] {1,339}
Orange	58,682	58,783	58,903	59,000	59,173 (11,835) [2,840] {1,420}	59,351 (11,870) [2,849] {1,424}	59,530 (11,906) [2,857] {1,429}
Putnam	12,677	12,698	12,707	12,716	12,737 (2,547) [611] {306}	12,756 (2,551) [612] {306}	12,777 (2,555) [613] {307}
Queens	318,108	318,329	318,329	318,329	318,686 (63,737) [15,297] {7,648}	319,031 (63,806) [15,313] {7,657}	319,381 (63,876) [15,330] {7,665}
Rensselaer	15,490	15,562	15,630	15,702	15,818 (3,164) [759] {380}	15,938 (3,188) [765] {383}	16,058 (3,212) [771] {385}
Richmond	90,045	90,131	90,131	90,131	90,263 (18,053) [4,333] {2,166}	90,392 (18,078) [4,339] {2,169}	90,518 (18,104) [4,345] {2,172}
Rockland	53,878	53,959	54,014	54,049	54,152 (10,830) [2,599] {1,300}	54,252 (10,850) [2,604] {1,302}	54,352 (10,870) [2,609] {1,304}
Saratoga	21,282	21,366	21,455	21,555	21,726 (4,345) [1,043] {521}	21,901 (4,380) [1,051] {526}	22,081 (4,416) [1,060] {530}
Schenectady	17,480	17,529	17,590	17,657	17,765 (3,553) [853] {426}	17,870 (3,574) [858] {429}	17,976 (3,595) [863] {431}
Suffolk	243,299	243,659	244,021	244,348	244,931 (48,986) [11,757] {5,878}	245,505 (49,101) [11,784] {5,892}	246,093 (49,219) [11,812] {5,906}
Sullivan	8,745	8,764	8,781	8,802	8,840 (1,768) [424] {212}	8,878 (1,776) [426] {213}	8,916 (1,783) [428] {214}
Tompkins	6,723	6,748	6,768	6,798	6,832 (1,366) [328] {164}	6,866 (1,373) [330] {165}	6,901 (1,380) [331] {166}
Ulster	17,655	17,687	17,728	17,760	17,822 (3,564) [855] {428}	17,886 (3,577) [859] {429}	17,950 (3,590) [862] {431}
Westchester	144,678	144,776	144,859	144,943	145,101 (29,020) [6,965] {3,482}	145,259 (29,052) [6,972] {3,486}	145,421 (29,084) [6,980] {3,490}

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.