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

Date: 10/26/20

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 10/26/20 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.

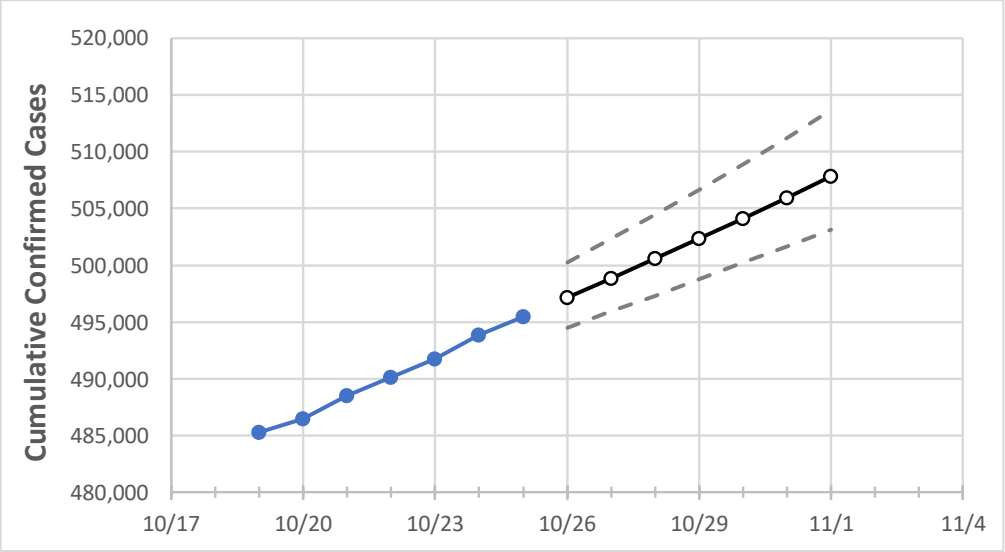
IEM's Modeling Lead

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:						
	10/22	10/23	10/24	10/25	10/26	10/27	10/28	10/29	10/30	10/31	11/1
New York	490,134	491,771	493,832	495,464	497,138	498,842	500,577	502,342	504,138	505,966	507,826

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 20%, and are often within 10%, of actual confirmed cases.

New York Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	10/22	10/23	10/24	10/25	10/26	10/27	10/28	10/29	10/30	10/31	11/1
Albany	3,488	3,516	3,549	3,577	3,599	3,623	3,646	3,671	3,696	3,722	3,749
Bronx	54,706	54,792	54,892	55,011	55,101	55,193	55,286	55,382	55,479	55,578	55,679
Dutchess	5,382	5,403	5,421	5,438	5,454	5,471	5,489	5,507	5,526	5,545	5,565
Erie	12,650	12,705	12,782	12,819	12,868	12,918	12,968	13,018	13,069	13,120	13,171
Kings	73,935	74,114	74,339	74,553	74,746	74,939	75,131	75,322	75,512	75,702	75,890
Monroe	6,917	6,992	7,070	7,111	7,178	7,248	7,322	7,399	7,481	7,566	7,655
Nassau	48,941	49,042	49,203	49,312	49,416	49,521	49,628	49,736	49,846	49,957	50,070
New York	35,345	35,459	35,610	35,723	35,839	35,958	36,081	36,208	36,339	36,473	36,612
Niagara	1,997	2,016	2,032	2,041	2,053	2,065	2,077	2,090	2,103	2,117	2,131
Onondaga	5,170	5,222	5,277	5,309	5,352	5,395	5,440	5,486	5,534	5,583	5,633
Orange	13,303	13,342	13,413	13,457	13,496	13,534	13,573	13,611	13,650	13,688	13,725
Putnam	1,768	1,780	1,788	1,794	1,802	1,810	1,818	1,827	1,835	1,844	1,854
Queens	75,698	75,853	76,057	76,220	76,375	76,532	76,690	76,851	77,013	77,177	77,343
Rensselaer	1,058	1,064	1,073	1,080	1,088	1,097	1,106	1,116	1,125	1,136	1,146
Richmond	16,892	16,929	17,004	17,048	17,096	17,146	17,196	17,247	17,299	17,352	17,407
Rockland	17,524	17,581	17,635	17,685	17,746	17,807	17,868	17,930	17,991	18,052	18,113
Saratoga	1,244	1,265	1,295	1,308	1,321	1,335	1,350	1,365	1,381	1,398	1,415
Schenectady	1,522	1,530	1,539	1,546	1,554	1,563	1,572	1,582	1,592	1,603	1,614
Suffolk	48,308	48,399	48,562	48,663	48,757	48,852	48,950	49,049	49,150	49,253	49,358
Sullivan	1,709	1,714	1,725	1,743	1,750	1,757	1,765	1,773	1,782	1,791	1,801
Tompkins	579	585	593	603	614	625	637	649	662	675	689
Ulster	2,436	2,450	2,459	2,471	2,479	2,488	2,497	2,506	2,516	2,525	2,535
Westchester	39,789	39,890	40,041	40,131	40,237	40,347	40,460	40,576	40,697	40,821	40,949

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:		
	10/22	10/23	10/24	10/25	10/27	10/29	10/31
Albany	3,488	3,516	3,549	3,577	3,623 (725) [174] {87}	3,671 (734) [176] {88}	3,722 (744) [179] {89}
Bronx	54,706	54,792	54,892	55,011	55,193 (11,039) [2,649] {1,325}	55,382 (11,076) [2,658] {1,329}	55,578 (11,116) [2,668] {1,
Dutchess	5,382	5,403	5,421	5,438	5,471 (1,094) [263] {131}	5,507 (1,101) [264] {132}	5,545 (1,109) [266] {133
Erie	12,650	12,705	12,782	12,819	12,918 (2,584) [620] {310}	13,018 (2,604) [625] {312}	13,120 (2,624) [630] {31
Kings	73,935	74,114	74,339	74,553	74,939 (14,988) [3,597] {1,799}	75,322 (15,064) [3,615] {1,808}	75,702 (15,140) [3,634] {1,
Monroe	6,917	6,992	7,070	7,111	7,248 (1,450) [348] {174}	7,399 (1,480) [355] {178}	7,566 (1,513) [363] {182
Nassau	48,941	49,042	49,203	49,312	49,521 (9,904) [2,377] {1,189}	49,736 (9,947) [2,387] {1,194}	49,957 (9,991) [2,398] {1,1
New York	35,345	35,459	35,610	35,723	35,958 (7,192) [1,726] {863}	36,208 (7,242) [1,738] {869}	36,473 (7,295) [1,751] {8
Niagara	1,997	2,016	2,032	2,041	2,065 (413) [99] {50}	2,090 (418) [100] {50}	2,117 (423) [102] {51}
Onondaga	5,170	5,222	5,277	5,309	5,395 (1,079) [259] {129}	5,486 (1,097) [263] {132}	5,583 (1,117) [268] {134
Orange	13,303	13,342	13,413	13,457	13,534 (2,707) [650] {325}	13,611 (2,722) [653] {327}	13,688 (2,738) [657] {32
Putnam	1,768	1,780	1,788	1,794	1,810 (362) [87] {43}	1,827 (365) [88] {44}	1,844 (369) [89] {44}
Queens	75,698	75,853	76,057	76,220	76,532 (15,306) [3,674] {1,837}	76,851 (15,370) [3,689] {1,844}	77,177 (15,435) [3,705] {1,
Rensselaer	1,058	1,064	1,073	1,080	1,097 (219) [53] {26}	1,116 (223) [54] {27}	1,136 (227) [55] {27}
Richmond	16,892	16,929	17,004	17,048	17,146 (3,429) [823] {411}	17,247 (3,449) [828] {414}	17,352 (3,470) [833] {41
Rockland	17,524	17,581	17,635	17,685	17,807 (3,561) [855] {427}	17,930 (3,586) [861] {430}	18,052 (3,610) [866] {43
Saratoga	1,244	1,265	1,295	1,308	1,335 (267) [64] {32}	1,365 (273) [66] {33}	1,398 (280) [67] {34}
Schenectady	1,522	1,530	1,539	1,546	1,563 (313) [75] {38}	1,582 (316) [76] {38}	1,603 (321) [77] {38}
Suffolk	48,308	48,399	48,562	48,663	48,852 (9,770) [2,345] {1,172}	49,049 (9,810) [2,354] {1,177}	49,253 (9,851) [2,364] {1,1
Sullivan	1,709	1,714	1,725	1,743	1,757 (351) [84] {42}	1,773 (355) [85] {43}	1,791 (358) [86] {43}
Tompkins	579	585	593	603	625 (125) [30] {15}	649 (130) [31] {16}	675 (135) [32] {16}
Ulster	2,436	2,450	2,459	2,471	2,488 (498) [119] {60}	2,506 (501) [120] {60}	2,525 (505) [121] {61}
Westchester	39,789	39,890	40,041	40,131	40,347 (8,069) [1,937] {968}	40,576 (8,115) [1,948] {974}	40,821 (8,164) [1,959] {9

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.