IEM's AI Modeling: Short-term COVID-19 Projections
Date: 5/14/21

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 5/14/21 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
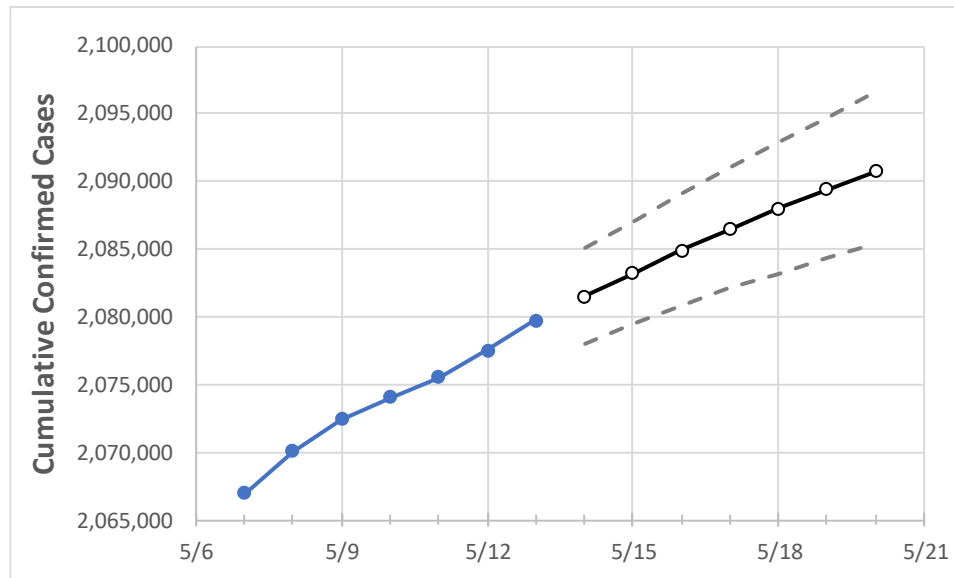
	Actual Confirmed Cases On:				Projected Cases For:						
	5/10	5/11	5/12	5/13	5/14	5/15	5/16	5/17	5/18	5/19	5/20
New York	2,074,079	2,075,539	2,077,563	2,079,749	2,081,509	2,083,215	2,084,879	2,086,446	2,087,981	2,089,405	2,090,782

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:						
	5/10	5/11	5/12	5/13	5/14	5/15	5/16	5/17	5/18	5/19	5/20
Albany	24,334	24,349	24,368	24,385	24,399	24,413	24,426	24,439	24,451	24,462	24,473
Bronx	180,623	180,697	180,878	181,041	181,171	181,301	181,421	181,538	181,644	181,747	181,846
Dutchess	29,038	29,064	29,085	29,107	29,133	29,159	29,182	29,205	29,227	29,249	29,268
Erie	87,790	87,877	87,972	88,115	88,219	88,313	88,406	88,493	88,576	88,654	88,727
Kings	276,081	276,228	276,509	276,788	277,020	277,246	277,457	277,653	277,844	278,033	278,207
Monroe	65,791	65,936	66,085	66,320	66,502	66,678	66,860	67,033	67,208	67,380	67,550
Nassau	181,727	181,804	181,920	182,027	182,114	182,195	182,272	182,341	182,408	182,474	182,535
New York	136,330	136,399	136,507	136,600	136,682	136,760	136,836	136,905	136,968	137,032	137,094
Niagara	19,527	19,556	19,595	19,634	19,668	19,701	19,732	19,762	19,791	19,820	19,848
Onondaga	37,744	37,769	37,841	37,901	37,954	38,004	38,054	38,101	38,148	38,191	38,235
Orange	47,682	47,706	47,738	47,777	47,809	47,839	47,867	47,894	47,920	47,944	47,967
Putnam	10,516	10,521	10,528	10,531	10,537	10,542	10,547	10,552	10,556	10,560	10,564
Queens	273,084	273,237	273,483	273,708	273,902	274,086	274,260	274,423	274,583	274,728	274,865
Rensselaer	11,037	11,049	11,054	11,072	11,082	11,091	11,100	11,108	11,117	11,125	11,133
Richmond	73,682	73,733	73,789	73,857	73,914	73,966	74,016	74,063	74,109	74,151	74,192
Rockland	46,553	46,564	46,586	46,607	46,624	46,640	46,655	46,669	46,682	46,695	46,707
Saratoga	14,994	15,014	15,055	15,071	15,091	15,111	15,131	15,150	15,169	15,188	15,207
Schenectady	12,909	12,924	12,938	12,948	12,965	12,983	12,999	13,016	13,032	13,048	13,063
Suffolk	198,802	198,906	199,025	199,148	199,254	199,355	199,450	199,540	199,624	199,701	199,778
Sullivan	6,508	6,517	6,525	6,533	6,541	6,548	6,555	6,561	6,568	6,574	6,580
Tompkins	4,210	4,214	4,216	4,221	4,226	4,231	4,236	4,241	4,246	4,251	4,256
Ulster	13,691	13,705	13,717	13,733	13,746	13,759	13,771	13,783	13,794	13,805	13,815
Westchester	128,531	128,584	128,624	128,703	128,756	128,805	128,852	128,896	128,938	128,976	129,011

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:		
	5/10	5/11	5/12	5/13	5/15	5/17	5/19
Albany	24,334	24,349	24,368	24,385	24,413 (4,883) [1,172] {586}	24,439 (4,888) [1,173] {587}	24,462 (4,892) [1,174] {587}
Bronx	180,623	180,697	180,878	181,041	181,301 (36,260) [8,702] {4,351}	181,538 (36,308) [8,714] {4,357}	181,747 (36,349) [8,724] {4,362}
Dutchess	29,038	29,064	29,085	29,107	29,159 (5,832) [1,400] {700}	29,205 (5,841) [1,402] {701}	29,249 (5,850) [1,404] {702}
Erie	87,790	87,877	87,972	88,115	88,313 (17,663) [4,239] {2,120}	88,493 (17,699) [4,248] {2,124}	88,654 (17,731) [4,255] {2,128}
Kings	276,081	276,228	276,509	276,788	277,246 (55,449) [13,308] {6,654}	277,653 (55,531) [13,327] {6,664}	278,033 (55,607) [13,346] {6,673}
Monroe	65,791	65,936	66,085	66,320	66,678 (13,336) [3,201] {1,600}	67,033 (13,407) [3,218] {1,609}	67,380 (13,476) [3,234] {1,617}
Nassau	181,727	181,804	181,920	182,027	182,195 (36,439) [8,745] {4,373}	182,341 (36,468) [8,752] {4,376}	182,474 (36,495) [8,759] {4,379}
New York	136,330	136,399	136,507	136,600	136,760 (27,352) [6,564] {3,282}	136,905 (27,381) [6,571] {3,286}	137,032 (27,406) [6,578] {3,289}
Niagara	19,527	19,556	19,595	19,634	19,701 (3,940) [946] {473}	19,762 (3,952) [949] {474}	19,820 (3,964) [951] {476}
Onondaga	37,744	37,769	37,841	37,901	38,004 (7,601) [1,824] {912}	38,101 (7,620) [1,829] {914}	38,191 (7,638) [1,833] {917}
Orange	47,682	47,706	47,738	47,777	47,839 (9,568) [2,296] {1,148}	47,894 (9,579) [2,299] {1,149}	47,944 (9,589) [2,301] {1,151}
Putnam	10,516	10,521	10,528	10,531	10,542 (2,108) [506] {253}	10,552 (2,110) [506] {253}	10,560 (2,112) [507] {253}
Queens	273,084	273,237	273,483	273,708	274,086 (54,817) [13,156] {6,578}	274,423 (54,885) [13,172] {6,586}	274,728 (54,946) [13,187] {6,593}
Rensselaer	11,037	11,049	11,054	11,072	11,091 (2,218) [532] {266}	11,108 (2,222) [533] {267}	11,125 (2,225) [534] {267}
Richmond	73,682	73,733	73,789	73,857	73,966 (14,793) [3,550] {1,775}	74,063 (14,813) [3,555] {1,778}	74,151 (14,830) [3,559] {1,780}
Rockland	46,553	46,564	46,586	46,607	46,640 (9,328) [2,239] {1,119}	46,669 (9,334) [2,240] {1,120}	46,695 (9,339) [2,241] {1,121}
Saratoga	14,994	15,014	15,055	15,071	15,111 (3,022) [725] {363}	15,150 (3,030) [727] {364}	15,188 (3,038) [729] {365}
Schenectady	12,909	12,924	12,938	12,948	12,983 (2,597) [623] {312}	13,016 (2,603) [625] {312}	13,048 (2,610) [626] {313}
Suffolk	198,802	198,906	199,025	199,148	199,355 (39,871) [9,569] {4,785}	199,540 (39,908) [9,578] {4,789}	199,701 (39,940) [9,586] {4,793}
Sullivan	6,508	6,517	6,525	6,533	6,548 (1,310) [314] {157}	6,561 (1,312) [315] {157}	6,574 (1,315) [316] {158}
Tompkins	4,210	4,214	4,216	4,221	4,231 (846) [203] {102}	4,241 (848) [204] {102}	4,251 (850) [204] {102}
Ulster	13,691	13,705	13,717	13,733	13,759 (2,752) [660] {330}	13,783 (2,757) [662] {331}	13,805 (2,761) [663] {331}
Westchester	128,531	128,584	128,624	128,703	128,805 (25,761) [6,183] {3,091}	128,896 (25,779) [6,187] {3,094}	128,976 (25,795) [6,191] {3,095}

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.