IEM's AI Modeling: Short-term COVID-19 Projections
Date: 4/29/21

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 4/29/21 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
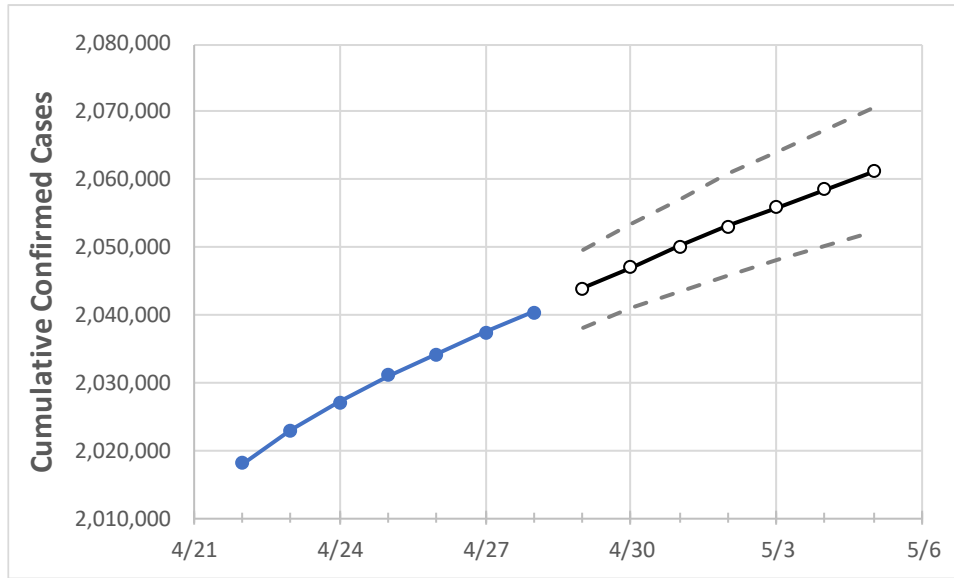
	Actual Confirmed Cases On:				Projected Cases For:						
	4/25	4/26	4/27	4/28	4/29	4/30	5/1	5/2	5/3	5/4	5/5
New York	2,031,093	2,034,102	2,037,414	2,040,448	2,043,853	2,047,058	2,050,144	2,053,080	2,055,870	2,058,557	2,061,181

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:						
	4/25	4/26	4/27	4/28	4/29	4/30	5/1	5/2	5/3	5/4	5/5
Albany	23,976	24,009	24,038	24,056	24,091	24,124	24,156	24,188	24,218	24,248	24,277
Bronx	177,489	177,686	178,009	178,170	178,455	178,722	178,985	179,242	179,487	179,727	179,959
Dutchess	28,392	28,441	28,480	28,533	28,578	28,621	28,661	28,700	28,737	28,772	28,804
Erie	84,866	85,081	85,314	85,537	85,793	86,047	86,297	86,537	86,767	86,985	87,194
Kings	269,887	270,349	270,965	271,368	271,900	272,415	272,901	273,375	273,823	274,260	274,695
Monroe	62,728	62,911	63,052	63,253	63,468	63,675	63,881	64,089	64,291	64,492	64,684
Nassau	179,350	179,572	179,724	179,895	180,094	180,280	180,459	180,633	180,800	180,951	181,093
New York	134,070	134,200	134,360	134,541	134,735	134,923	135,104	135,269	135,431	135,584	135,736
Niagara	18,770	18,816	18,870	18,926	18,980	19,035	19,086	19,137	19,187	19,234	19,281
Onondaga	36,643	36,689	36,760	36,853	36,934	37,014	37,095	37,174	37,253	37,331	37,408
Orange	46,818	46,892	46,944	47,038	47,113	47,185	47,255	47,321	47,388	47,450	47,508
Putnam	10,362	10,374	10,379	10,389	10,404	10,418	10,431	10,445	10,457	10,469	10,480
Queens	267,966	268,351	268,912	269,261	269,726	270,172	270,606	271,014	271,416	271,795	272,154
Rensselaer	10,823	10,846	10,857	10,867	10,883	10,899	10,914	10,928	10,942	10,955	10,967
Richmond	72,136	72,269	72,408	72,506	72,647	72,784	72,913	73,039	73,160	73,275	73,388
Rockland	46,083	46,113	46,149	46,181	46,218	46,251	46,283	46,313	46,341	46,368	46,392
Saratoga	14,635	14,657	14,680	14,704	14,726	14,746	14,767	14,787	14,804	14,821	14,838
Schenectady	12,575	12,598	12,622	12,646	12,666	12,685	12,703	12,721	12,739	12,756	12,773
Suffolk	195,864	196,101	196,305	196,535	196,762	196,977	197,181	197,371	197,553	197,718	197,886
Sullivan	6,320	6,332	6,347	6,366	6,384	6,402	6,419	6,436	6,452	6,468	6,483
Tompkins	4,113	4,115	4,116	4,123	4,129	4,134	4,139	4,145	4,150	4,155	4,160
Ulster	13,323	13,359	13,387	13,412	13,446	13,479	13,511	13,543	13,573	13,602	13,631
Westchester	127,046	127,179	127,273	127,393	127,537	127,675	127,807	127,933	128,051	128,167	128,275

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:		
	4/25	4/26	4/27	4/28	4/30	5/2	5/4
Albany	23,976	24,009	24,038	24,056	24,124 (4,825) [1,158] {579}	24,188 (4,838) [1,161] {581}	24,248 (4,850) [1,164] {582}
Bronx	177,489	177,686	178,009	178,170	178,722 (35,744) [8,579] {4,289}	179,242 (35,848) [8,604] {4,302}	179,727 (35,945) [8,627] {4,313}
Dutchess	28,392	28,441	28,480	28,533	28,621 (5,724) [1,374] {687}	28,700 (5,740) [1,378] {689}	28,772 (5,754) [1,381] {691}
Erie	84,866	85,081	85,314	85,537	86,047 (17,209) [4,130] {2,065}	86,537 (17,307) [4,154] {2,077}	86,985 (17,397) [4,175] {2,088}
Kings	269,887	270,349	270,965	271,368	272,415 (54,483) [13,076] {6,538}	273,375 (54,675) [13,122] {6,561}	274,260 (54,852) [13,164] {6,582}
Monroe	62,728	62,911	63,052	63,253	63,675 (12,735) [3,056] {1,528}	64,089 (12,818) [3,076] {1,538}	64,492 (12,898) [3,096] {1,548}
Nassau	179,350	179,572	179,724	179,895	180,280 (36,056) [8,653] {4,327}	180,633 (36,127) [8,670] {4,335}	180,951 (36,190) [8,686] {4,343}
New York	134,070	134,200	134,360	134,541	134,923 (26,985) [6,476] {3,238}	135,269 (27,054) [6,493] {3,246}	135,584 (27,117) [6,508] {3,254}
Niagara	18,770	18,816	18,870	18,926	19,035 (3,807) [914] {457}	19,137 (3,827) [919] {459}	19,234 (3,847) [923] {462}
Onondaga	36,643	36,689	36,760	36,853	37,014 (7,403) [1,777] {888}	37,174 (7,435) [1,784] {892}	37,331 (7,466) [1,792] {896}
Orange	46,818	46,892	46,944	47,038	47,185 (9,437) [2,265] {1,132}	47,321 (9,464) [2,271] {1,136}	47,450 (9,490) [2,278] {1,139}
Putnam	10,362	10,374	10,379	10,389	10,418 (2,084) [500] {250}	10,445 (2,089) [501] {251}	10,469 (2,094) [503] {251}
Queens	267,966	268,351	268,912	269,261	270,172 (54,034) [12,968] {6,484}	271,014 (54,203) [13,009] {6,504}	271,795 (54,359) [13,046] {6,523}
Rensselaer	10,823	10,846	10,857	10,867	10,899 (2,180) [523] {262}	10,928 (2,186) [525] {262}	10,955 (2,191) [526] {263}
Richmond	72,136	72,269	72,408	72,506	72,784 (14,557) [3,494] {1,747}	73,039 (14,608) [3,506] {1,753}	73,275 (14,655) [3,517] {1,759}
Rockland	46,083	46,113	46,149	46,181	46,251 (9,250) [2,220] {1,110}	46,313 (9,263) [2,223] {1,112}	46,368 (9,274) [2,226] {1,113}
Saratoga	14,635	14,657	14,680	14,704	14,746 (2,949) [708] {354}	14,787 (2,957) [710] {355}	14,821 (2,964) [711] {356}
Schenectady	12,575	12,598	12,622	12,646	12,685 (2,537) [609] {304}	12,721 (2,544) [611] {305}	12,756 (2,551) [612] {306}
Suffolk	195,864	196,101	196,305	196,535	196,977 (39,395) [9,455] {4,727}	197,371 (39,474) [9,474] {4,737}	197,718 (39,544) [9,490] {4,745}
Sullivan	6,320	6,332	6,347	6,366	6,402 (1,280) [307] {154}	6,436 (1,287) [309] {154}	6,468 (1,294) [310] {155}
Tompkins	4,113	4,115	4,116	4,123	4,134 (827) [198] {99}	4,145 (829) [199] {99}	4,155 (831) [199] {100}
Ulster	13,323	13,359	13,387	13,412	13,479 (2,696) [647] {324}	13,543 (2,709) [650] {325}	13,602 (2,720) [653] {326}
Westchester	127,046	127,179	127,273	127,393	127,675 (25,535) [6,128] {3,064}	127,933 (25,587) [6,141] {3,070}	128,167 (25,633) [6,152] {3,076}

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.