IEM's AI Modeling: Short-term COVID-19 Projections
Date: 4/30/21

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 4/30/21 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
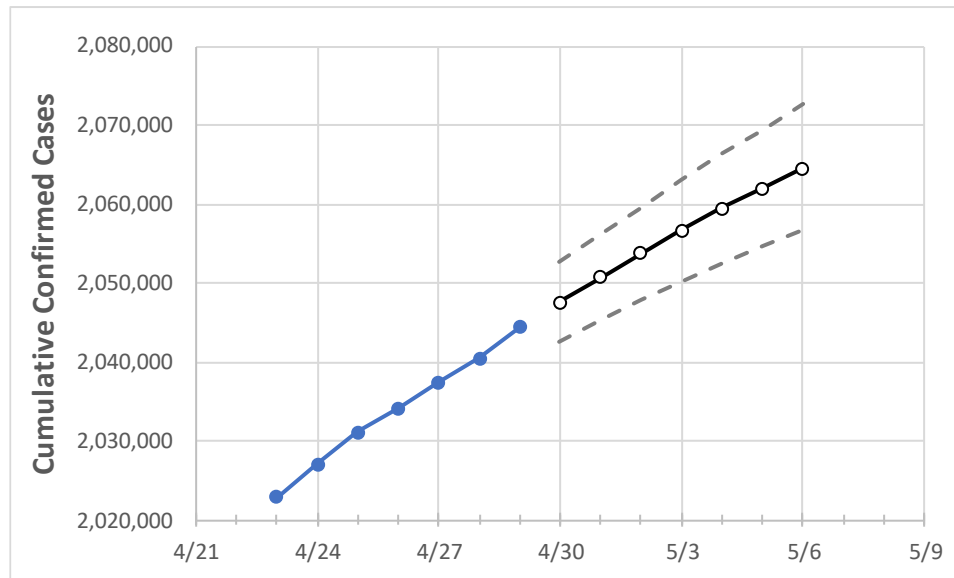
	Actual Confirmed Cases On:				Projected Cases For:						
	4/26	4/27	4/28	4/29	4/30	5/1	5/2	5/3	5/4	5/5	5/6
New York	2,034,102	2,037,414	2,040,448	2,044,345	2,047,601	2,050,731	2,053,744	2,056,652	2,059,401	2,061,990	2,064,509

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:						
	4/26	4/27	4/28	4/29	4/30	5/1	5/2	5/3	5/4	5/5	5/6
Albany	24,009	24,038	24,056	24,102	24,136	24,169	24,200	24,231	24,261	24,289	24,316
Bronx	177,686	178,009	178,170	178,411	178,665	178,909	179,147	179,369	179,583	179,790	179,988
Dutchess	28,441	28,480	28,533	28,587	28,630	28,672	28,713	28,751	28,788	28,824	28,858
Erie	85,081	85,314	85,537	85,879	86,140	86,394	86,634	86,868	87,096	87,313	87,524
Kings	270,349	270,965	271,368	271,836	272,355	272,861	273,354	273,822	274,274	274,708	275,130
Monroe	62,911	63,052	63,253	63,563	63,781	64,001	64,220	64,433	64,654	64,870	65,087
Nassau	179,572	179,724	179,895	180,144	180,333	180,511	180,679	180,834	180,979	181,120	181,251
New York	134,200	134,360	134,541	134,751	134,938	135,107	135,271	135,435	135,591	135,735	135,876
Niagara	18,816	18,870	18,926	18,995	19,049	19,103	19,155	19,206	19,255	19,304	19,350
Onondaga	36,689	36,760	36,853	36,982	37,067	37,153	37,238	37,323	37,407	37,490	37,574
Orange	46,892	46,944	47,038	47,121	47,194	47,266	47,334	47,399	47,463	47,525	47,584
Putnam	10,374	10,379	10,389	10,404	10,418	10,431	10,444	10,456	10,467	10,478	10,488
Queens	268,351	268,912	269,261	269,646	270,076	270,491	270,894	271,270	271,634	271,980	272,314
Rensselaer	10,846	10,857	10,867	10,890	10,906	10,920	10,935	10,949	10,962	10,974	10,986
Richmond	72,269	72,408	72,506	72,630	72,763	72,889	73,012	73,130	73,242	73,349	73,453
Rockland	46,113	46,149	46,181	46,231	46,266	46,299	46,331	46,360	46,388	46,413	46,438
Saratoga	14,657	14,680	14,704	14,735	14,757	14,779	14,799	14,819	14,838	14,855	14,872
Schenectady	12,598	12,622	12,646	12,670	12,690	12,709	12,728	12,746	12,765	12,783	12,800
Suffolk	196,101	196,305	196,535	196,806	197,024	197,233	197,432	197,619	197,797	197,962	198,119
Sullivan	6,332	6,347	6,366	6,374	6,390	6,406	6,421	6,436	6,450	6,464	6,478
Tompkins	4,115	4,116	4,123	4,135	4,141	4,147	4,153	4,159	4,165	4,171	4,176
Ulster	13,359	13,387	13,412	13,446	13,479	13,511	13,542	13,572	13,601	13,630	13,658
Westchester	127,179	127,273	127,393	127,521	127,649	127,771	127,888	127,996	128,100	128,201	128,296

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:		
	4/26	4/27	4/28	4/29	5/1	5/3	5/5
Albany	24,009	24,038	24,056	24,102	24,169 (4,834) [1,160] {580}	24,231 (4,846) [1,163] {582}	24,289 (4,858) [1,166] {583}
Bronx	177,686	178,009	178,170	178,411	178,909 (35,782) [8,588] {4,294}	179,369 (35,874) [8,610] {4,305}	179,790 (35,958) [8,630] {4,315}
Dutchess	28,441	28,480	28,533	28,587	28,672 (5,734) [1,376] {688}	28,751 (5,750) [1,380] {690}	28,824 (5,765) [1,384] {692}
Erie	85,081	85,314	85,537	85,879	86,394 (17,279) [4,147] {2,073}	86,868 (17,374) [4,170] {2,085}	87,313 (17,463) [4,191] {2,096}
Kings	270,349	270,965	271,368	271,836	272,861 (54,572) [13,097] {6,549}	273,822 (54,764) [13,143] {6,572}	274,708 (54,942) [13,186] {6,593}
Monroe	62,911	63,052	63,253	63,563	64,001 (12,800) [3,072] {1,536}	64,433 (12,887) [3,093] {1,546}	64,870 (12,974) [3,114] {1,557}
Nassau	179,572	179,724	179,895	180,144	180,511 (36,102) [8,665] {4,332}	180,834 (36,167) [8,680] {4,340}	181,120 (36,224) [8,694] {4,347}
New York	134,200	134,360	134,541	134,751	135,107 (27,021) [6,485] {3,243}	135,435 (27,087) [6,501] {3,250}	135,735 (27,147) [6,515] {3,258}
Niagara	18,816	18,870	18,926	18,995	19,103 (3,821) [917] {458}	19,206 (3,841) [922] {461}	19,304 (3,861) [927] {463}
Onondaga	36,689	36,760	36,853	36,982	37,153 (7,431) [1,783] {892}	37,323 (7,465) [1,792] {896}	37,490 (7,498) [1,800] {900}
Orange	46,892	46,944	47,038	47,121	47,266 (9,453) [2,269] {1,134}	47,399 (9,480) [2,275] {1,138}	47,525 (9,505) [2,281] {1,141}
Putnam	10,374	10,379	10,389	10,404	10,431 (2,086) [501] {250}	10,456 (2,091) [502] {251}	10,478 (2,096) [503] {251}
Queens	268,351	268,912	269,261	269,646	270,491 (54,098) [12,984] {6,492}	271,270 (54,254) [13,021] {6,510}	271,980 (54,396) [13,055] {6,528}
Rensselaer	10,846	10,857	10,867	10,890	10,920 (2,184) [524] {262}	10,949 (2,190) [526] {263}	10,974 (2,195) [527] {263}
Richmond	72,269	72,408	72,506	72,630	72,889 (14,578) [3,499] {1,749}	73,130 (14,626) [3,510] {1,755}	73,349 (14,670) [3,521] {1,760}
Rockland	46,113	46,149	46,181	46,231	46,299 (9,260) [2,222] {1,111}	46,360 (9,272) [2,225] {1,113}	46,413 (9,283) [2,228] {1,114}
Saratoga	14,657	14,680	14,704	14,735	14,779 (2,956) [709] {355}	14,819 (2,964) [711] {356}	14,855 (2,971) [713] {357}
Schenectady	12,598	12,622	12,646	12,670	12,709 (2,542) [610] {305}	12,746 (2,549) [612] {306}	12,783 (2,557) [614] {307}
Suffolk	196,101	196,305	196,535	196,806	197,233 (39,447) [9,467] {4,734}	197,619 (39,524) [9,486] {4,743}	197,962 (39,592) [9,502] {4,751}
Sullivan	6,332	6,347	6,366	6,374	6,406 (1,281) [307] {154}	6,436 (1,287) [309] {154}	6,464 (1,293) [310] {155}
Tompkins	4,115	4,116	4,123	4,135	4,147 (829) [199] {100}	4,159 (832) [200] {100}	4,171 (834) [200] {100}
Ulster	13,359	13,387	13,412	13,446	13,511 (2,702) [649] {324}	13,572 (2,714) [651] {326}	13,630 (2,726) [654] {327}
Westchester	127,179	127,273	127,393	127,521	127,771 (25,554) [6,133] {3,067}	127,996 (25,599) [6,144] {3,072}	128,201 (25,640) [6,154] {3,077}

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.