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

Date: 7/7/21

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 7/7/21 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.

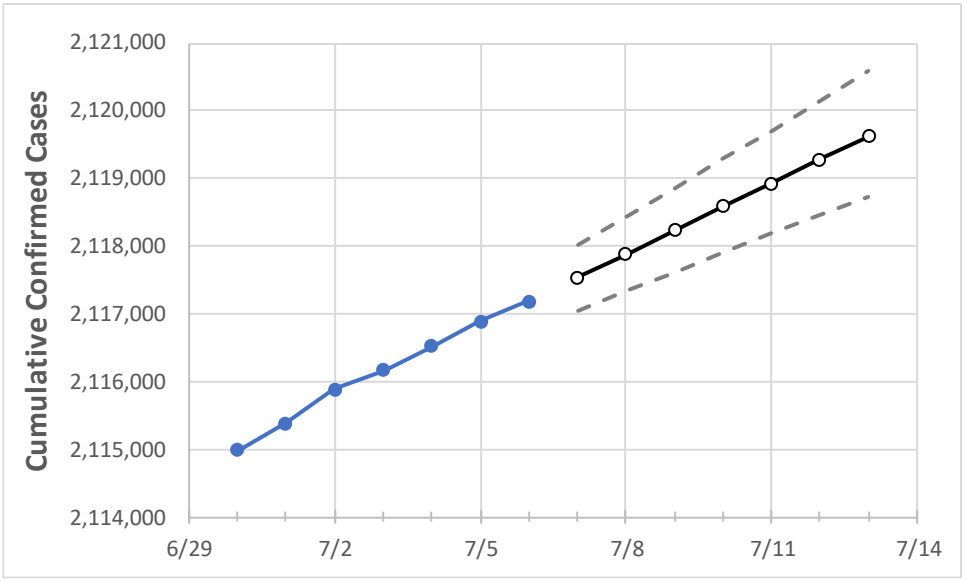
IEM's Modeling Lead

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:						
	7/3	7/4	7/5	7/6	7/7	7/8	7/9	7/10	7/11	7/12	7/13
New York	2,116,166	2,116,516	2,116,888	2,117,186	2,117,536	2,117,887	2,118,237	2,118,582	2,118,929	2,119,280	2,119,627

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:						
	7/3	7/4	7/5	7/6	7/7	7/8	7/9	7/10	7/11	7/12	7/13
Albany	24,737	24,739	24,740	24,740	24,741	24,742	24,743	24,744	24,744	24,745	24,746
Bronx	184,069	184,089	184,114	184,139	184,162	184,184	184,207	184,228	184,249	184,270	184,291
Dutchess	29,520	29,522	29,524	29,528	29,530	29,532	29,534	29,537	29,539	29,541	29,543
Erie	89,704	89,717	89,729	89,737	89,746	89,756	89,765	89,775	89,785	89,795	89,805
Kings	281,496	281,532	281,604	281,665	281,717	281,769	281,821	281,872	281,925	281,978	282,031
Monroe	69,206	69,222	69,233	69,240	69,249	69,258	69,267	69,276	69,284	69,292	69,300
Nassau	184,084	184,122	184,153	184,182	184,213	184,245	184,277	184,310	184,343	184,378	184,414
New York	138,875	138,946	139,000	139,022	139,068	139,115	139,163	139,213	139,264	139,316	139,368
Niagara	20,069	20,072	20,073	20,073	20,074	20,076	20,077	20,078	20,079	20,081	20,082
Onondaga	39,074	39,084	39,089	39,094	39,102	39,109	39,117	39,124	39,132	39,139	39,147
Orange	48,432	48,439	48,440	48,453	48,459	48,464	48,469	48,475	48,480	48,485	48,491
Putnam	10,632	10,633	10,634	10,634	10,635	10,636	10,636	10,637	10,638	10,639	10,639
Queens	278,130	278,163	278,222	278,266	278,312	278,357	278,402	278,449	278,496	278,541	278,586
Rensselaer	11,252	11,253	11,253	11,253	11,254	11,254	11,255	11,256	11,256	11,257	11,258
Richmond	75,462	75,490	75,510	75,533	75,565	75,599	75,632	75,666	75,700	75,736	75,771
Rockland	47,076	47,081	47,086	47,093	47,104	47,115	47,127	47,139	47,152	47,165	47,178
Saratoga	15,416	15,417	15,418	15,418	15,419	15,420	15,421	15,422	15,423	15,424	15,425
Schenectady	13,219	13,220	13,220	13,220	13,221	13,221	13,222	13,222	13,222	13,223	13,223
Suffolk	201,530	201,555	201,580	201,602	201,628	201,653	201,679	201,704	201,730	201,754	201,780
Sullivan	6,696	6,699	6,699	6,699	6,700	6,701	6,702	6,703	6,704	6,705	6,706
Tompkins	4,361	4,363	4,364	4,365	4,366	4,367	4,367	4,368	4,369	4,369	4,370
Ulster	13,933	13,933	13,936	13,937	13,938	13,939	13,940	13,941	13,942	13,943	13,944
Westchester	129,912	129,927	129,938	129,947	129,960	129,973	129,986	129,999	130,012	130,024	130,036

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:		
	7/3	7/4	7/5	7/6	7/8	7/10	7/12
Albany	24,737	24,739	24,740	24,740	24,742 (4,948) [1,188] {594}	24,744 (4,949) [1,188] {594}	24,745 (4,949) [1,188] {594}
Bronx	184,069	184,089	184,114	184,139	184,184 (36,837) [8,841] {4,420}	184,228 (36,846) [8,843] {4,421}	184,270 (36,854) [8,845] {4,422}
Dutchess	29,520	29,522	29,524	29,528	29,532 (5,906) [1,418] {709}	29,537 (5,907) [1,418] {709}	29,541 (5,908) [1,418] {709}
Erie	89,704	89,717	89,729	89,737	89,756 (17,951) [4,308] {2,154}	89,775 (17,955) [4,309] {2,155}	89,795 (17,959) [4,310] {2,155}
Kings	281,496	281,532	281,604	281,665	281,769 (56,354) [13,525] {6,762}	281,872 (56,374) [13,530] {6,765}	281,978 (56,396) [13,535] {6,767}
Monroe	69,206	69,222	69,233	69,240	69,258 (13,852) [3,324] {1,662}	69,276 (13,855) [3,325] {1,663}	69,292 (13,858) [3,326] {1,663}
Nassau	184,084	184,122	184,153	184,182	184,245 (36,849) [8,844] {4,422}	184,310 (36,862) [8,847] {4,423}	184,378 (36,876) [8,850] {4,425}
New York	138,875	138,946	139,000	139,022	139,115 (27,823) [6,678] {3,339}	139,213 (27,843) [6,682] {3,341}	139,316 (27,863) [6,687] {3,344}
Niagara	20,069	20,072	20,073	20,073	20,076 (4,015) [964] {482}	20,078 (4,016) [964] {482}	20,081 (4,016) [964] {482}
Onondaga	39,074	39,084	39,089	39,094	39,109 (7,822) [1,877] {939}	39,124 (7,825) [1,878] {939}	39,139 (7,828) [1,879] {939}
Orange	48,432	48,439	48,440	48,453	48,464 (9,693) [2,326] {1,163}	48,475 (9,695) [2,327] {1,163}	48,485 (9,697) [2,327] {1,164}
Putnam	10,632	10,633	10,634	10,634	10,636 (2,127) [511] {255}	10,637 (2,127) [511] {255}	10,639 (2,128) [511] {255}
Queens	278,130	278,163	278,222	278,266	278,357 (55,671) [13,361] {6,681}	278,449 (55,690) [13,366] {6,683}	278,541 (55,708) [13,370] {6,685}
Rensselaer	11,252	11,253	11,253	11,253	11,254 (2,251) [540] {270}	11,256 (2,251) [540] {270}	11,257 (2,251) [540] {270}
Richmond	75,462	75,490	75,510	75,533	75,599 (15,120) [3,629] {1,814}	75,666 (15,133) [3,632] {1,816}	75,736 (15,147) [3,635] {1,818}
Rockland	47,076	47,081	47,086	47,093	47,115 (9,423) [2,261] {1,131}	47,139 (9,428) [2,263] {1,131}	47,165 (9,433) [2,264] {1,132}
Saratoga	15,416	15,417	15,418	15,418	15,420 (3,084) [740] {370}	15,422 (3,084) [740] {370}	15,424 (3,085) [740] {370}
Schenectady	13,219	13,220	13,220	13,220	13,221 (2,644) [635] {317}	13,222 (2,644) [635] {317}	13,223 (2,645) [635] {317}
Suffolk	201,530	201,555	201,580	201,602	201,653 (40,331) [9,679] {4,840}	201,704 (40,341) [9,682] {4,841}	201,754 (40,351) [9,684] {4,842}
Sullivan	6,696	6,699	6,699	6,699	6,701 (1,340) [322] {161}	6,703 (1,341) [322] {161}	6,705 (1,341) [322] {161}
Tompkins	4,361	4,363	4,364	4,365	4,367 (873) [210] {105}	4,368 (874) [210] {105}	4,369 (874) [210] {105}
Ulster	13,933	13,933	13,936	13,937	13,939 (2,788) [669] {335}	13,941 (2,788) [669] {335}	13,943 (2,789) [669] {335}
Westchester	129,912	129,927	129,938	129,947	129,973 (25,995) [6,239] {3,119}	129,999 (26,000) [6,240] {3,120}	130,024 (26,005) [6,241] {3,121}

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.