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

Date: 7/9/21

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 7/9/21 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.

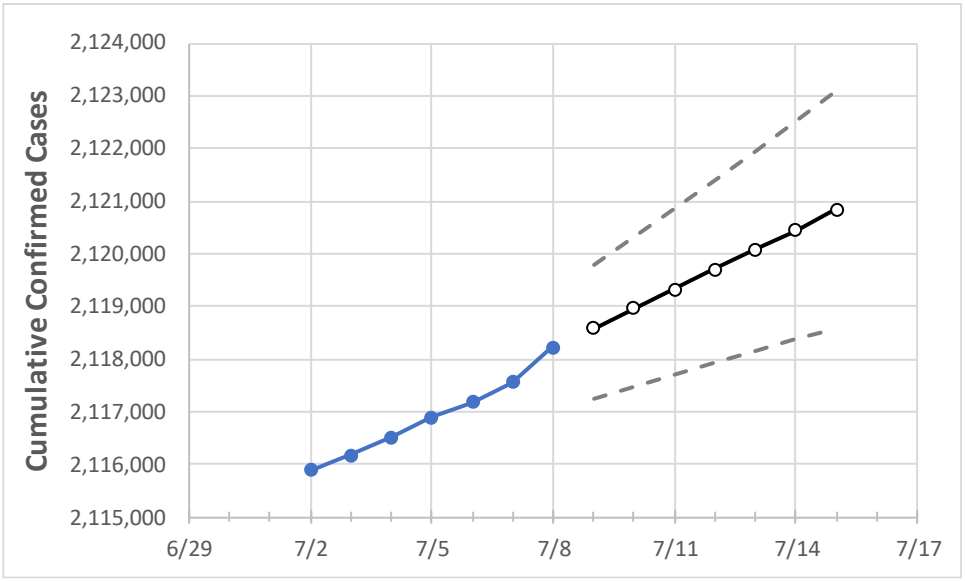
IEM's Modeling Lead

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:						
	7/5	7/6	7/7	7/8	7/9	7/10	7/11	7/12	7/13	7/14	7/15
New York	2,116,888	2,117,186	2,117,549	2,118,216	2,118,587	2,118,961	2,119,331	2,119,699	2,120,086	2,120,451	2,120,836

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:						
	7/5	7/6	7/7	7/8	7/9	7/10	7/11	7/12	7/13	7/14	7/15
Albany	24,740	24,740	24,743	24,746	24,747	24,748	24,749	24,750	24,751	24,752	24,753
Bronx	184,114	184,139	184,167	184,251	184,274	184,297	184,319	184,341	184,363	184,384	184,405
Dutchess	29,524	29,528	29,532	29,538	29,541	29,543	29,546	29,549	29,551	29,554	29,557
Erie	89,729	89,737	89,749	89,755	89,765	89,774	89,784	89,793	89,804	89,814	89,824
Kings	281,604	281,665	281,713	281,827	281,886	281,946	282,007	282,068	282,132	282,196	282,262
Monroe	69,233	69,240	69,259	69,273	69,283	69,293	69,303	69,312	69,322	69,331	69,341
Nassau	184,153	184,182	184,219	184,283	184,319	184,357	184,396	184,435	184,477	184,520	184,563
New York	139,000	139,022	139,069	139,160	139,218	139,277	139,338	139,400	139,466	139,533	139,603
Niagara	20,073	20,075	20,077	20,078	20,079	20,081	20,082	20,083	20,085	20,086	20,087
Onondaga	39,089	39,094	39,101	39,107	39,114	39,122	39,129	39,136	39,144	39,151	39,158
Orange	48,440	48,453	48,458	48,472	48,479	48,485	48,492	48,498	48,505	48,511	48,518
Putnam	10,634	10,635	10,635	10,635	10,636	10,637	10,637	10,638	10,639	10,640	10,640
Queens	278,222	278,266	278,317	278,442	278,500	278,560	278,621	278,683	278,744	278,807	278,871
Rensselaer	11,253	11,253	11,254	11,254	11,255	11,255	11,256	11,257	11,257	11,258	11,258
Richmond	75,510	75,533	75,548	75,584	75,614	75,645	75,675	75,706	75,737	75,768	75,800
Rockland	47,086	47,093	47,105	47,114	47,126	47,138	47,151	47,164	47,177	47,191	47,206
Saratoga	15,418	15,418	15,420	15,423	15,424	15,425	15,427	15,428	15,429	15,430	15,431
Schenectady	13,220	13,220	13,221	13,222	13,223	13,223	13,224	13,224	13,225	13,226	13,226
Suffolk	201,580	201,602	201,633	201,663	201,689	201,715	201,743	201,770	201,797	201,823	201,850
Sullivan	6,700	6,700	6,701	6,702	6,703	6,704	6,705	6,706	6,707	6,707	6,708
Tompkins	4,364	4,365	4,365	4,365	4,366	4,367	4,368	4,369	4,370	4,371	4,372
Ulster	13,936	13,937	13,939	13,948	13,950	13,952	13,954	13,957	13,959	13,961	13,963
Westchester	129,938	129,947	129,962	129,982	129,995	130,009	130,023	130,037	130,050	130,064	130,077

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:		
	7/5	7/6	7/7	7/8	7/10	7/12	7/14
Albany	24,740	24,740	24,743	24,746	24,748 (4,950) [1,188] {594}	24,750 (4,950) [1,188] {594}	24,752 (4,950) [1,188] {594}
Bronx	184,114	184,139	184,167	184,251	184,297 (36,859) [8,846] {4,423}	184,341 (36,868) [8,848] {4,424}	184,384 (36,877) [8,850] {4,425}
Dutchess	29,524	29,528	29,532	29,538	29,543 (5,909) [1,418] {709}	29,549 (5,910) [1,418] {709}	29,554 (5,911) [1,419] {709}
Erie	89,729	89,737	89,749	89,755	89,774 (17,955) [4,309] {2,155}	89,793 (17,959) [4,310] {2,155}	89,814 (17,963) [4,311] {2,156}
Kings	281,604	281,665	281,713	281,827	281,946 (56,389) [13,533] {6,767}	282,068 (56,414) [13,539] {6,770}	282,196 (56,439) [13,545] {6,773}
Monroe	69,233	69,240	69,259	69,273	69,293 (13,859) [3,326] {1,663}	69,312 (13,862) [3,327] {1,663}	69,331 (13,866) [3,328] {1,664}
Nassau	184,153	184,182	184,219	184,283	184,357 (36,871) [8,849] {4,425}	184,435 (36,887) [8,853] {4,426}	184,520 (36,904) [8,857] {4,428}
New York	139,000	139,022	139,069	139,160	139,277 (27,855) [6,685] {3,343}	139,400 (27,880) [6,691] {3,346}	139,533 (27,907) [6,698] {3,349}
Niagara	20,073	20,075	20,077	20,078	20,081 (4,016) [964] {482}	20,083 (4,017) [964] {482}	20,086 (4,017) [964] {482}
Onondaga	39,089	39,094	39,101	39,107	39,122 (7,824) [1,878] {939}	39,136 (7,827) [1,879] {939}	39,151 (7,830) [1,879] {940}
Orange	48,440	48,453	48,458	48,472	48,485 (9,697) [2,327] {1,164}	48,498 (9,700) [2,328] {1,164}	48,511 (9,702) [2,329] {1,164}
Putnam	10,634	10,635	10,635	10,635	10,637 (2,127) [511] {255}	10,638 (2,128) [511] {255}	10,640 (2,128) [511] {255}
Queens	278,222	278,266	278,317	278,442	278,560 (55,712) [13,371] {6,685}	278,683 (55,737) [13,377] {6,688}	278,807 (55,761) [13,383] {6,691}
Rensselaer	11,253	11,253	11,254	11,254	11,255 (2,251) [540] {270}	11,257 (2,251) [540] {270}	11,258 (2,252) [540] {270}
Richmond	75,510	75,533	75,548	75,584	75,645 (15,129) [3,631] {1,815}	75,706 (15,141) [3,634] {1,817}	75,768 (15,154) [3,637] {1,818}
Rockland	47,086	47,093	47,105	47,114	47,138 (9,428) [2,263] {1,131}	47,164 (9,433) [2,264] {1,132}	47,191 (9,438) [2,265] {1,133}
Saratoga	15,418	15,418	15,420	15,423	15,425 (3,085) [740] {370}	15,428 (3,086) [741] {370}	15,430 (3,086) [741] {370}
Schenectady	13,220	13,220	13,221	13,222	13,223 (2,645) [635] {317}	13,224 (2,645) [635] {317}	13,226 (2,645) [635] {317}
Suffolk	201,580	201,602	201,633	201,663	201,715 (40,343) [9,682] {4,841}	201,770 (40,354) [9,685] {4,842}	201,823 (40,365) [9,688] {4,844}
Sullivan	6,700	6,700	6,701	6,702	6,704 (1,341) [322] {161}	6,706 (1,341) [322] {161}	6,707 (1,341) [322] {161}
Tompkins	4,364	4,365	4,365	4,365	4,367 (873) [210] {105}	4,369 (874) [210] {105}	4,371 (874) [210] {105}
Ulster	13,936	13,937	13,939	13,948	13,952 (2,790) [670] {335}	13,957 (2,791) [670] {335}	13,961 (2,792) [670] {335}
Westchester	129,938	129,947	129,962	129,982	130,009 (26,002) [6,240] {3,120}	130,037 (26,007) [6,242] {3,121}	130,064 (26,013) [6,243] {3,122}

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.