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

Date: 5/21/21

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 5/21 /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.

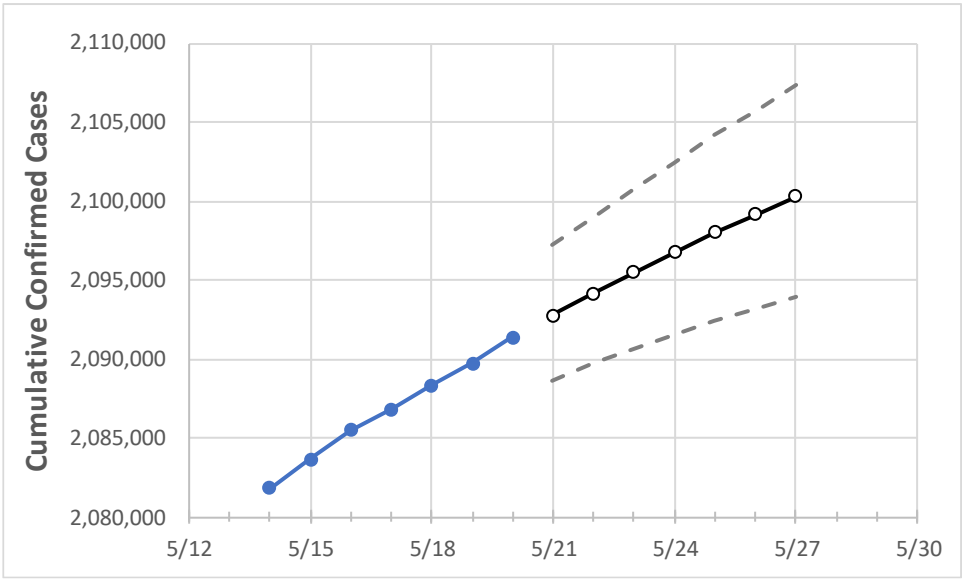
IEM's Modeling Lead

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:						
	5/17	5/18	5/19	5/20	5/21	5/22	5/23	5/24	5/25	5/26	5/27
New York	2,086,836	2,088,361	2,089,698	2,091,342	2,092,766	2,094,147	2,095,489	2,096,749	2,098,013	2,099,183	2,100,306

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:						
	5/17	5/18	5/19	5/20	5/21	5/22	5/23	5/24	5/25	5/26	5/27
Albany	24,455	24,466	24,480	24,493	24,507	24,520	24,534	24,546	24,559	24,571	24,583
Bronx	181,500	181,617	181,665	181,798	181,890	181,981	182,064	182,145	182,226	182,300	182,371
Dutchess	29,214	29,231	29,249	29,275	29,294	29,312	29,329	29,346	29,362	29,377	29,392
Erie	88,507	88,560	88,638	88,726	88,801	88,873	88,944	89,008	89,071	89,130	89,187
Kings	277,651	277,901	278,018	278,210	278,373	278,525	278,675	278,821	278,956	279,082	279,205
Monroe	66,986	67,103	67,230	67,409	67,554	67,697	67,835	67,969	68,105	68,235	68,362
Nassau	182,422	182,491	182,565	182,656	182,728	182,798	182,865	182,929	182,990	183,048	183,105
New York	136,977	137,019	137,079	137,171	137,236	137,299	137,359	137,414	137,469	137,520	137,570
Niagara	19,721	19,736	19,766	19,802	19,824	19,845	19,864	19,883	19,901	19,919	19,936
Onondaga	38,132	38,158	38,230	38,287	38,333	38,379	38,425	38,469	38,513	38,556	38,600
Orange	47,908	47,920	47,941	47,966	47,988	48,010	48,030	48,051	48,070	48,088	48,106
Putnam	10,542	10,544	10,548	10,553	10,556	10,559	10,562	10,565	10,567	10,569	10,571
Queens	274,493	274,913	275,028	275,195	275,361	275,523	275,677	275,824	275,968	276,104	276,237
Rensselaer	11,123	11,133	11,139	11,148	11,158	11,168	11,177	11,186	11,196	11,205	11,213
Richmond	74,109	74,179	74,217	74,267	74,312	74,356	74,397	74,436	74,475	74,512	74,548
Rockland	46,697	46,704	46,715	46,731	46,743	46,754	46,765	46,776	46,785	46,795	46,804
Saratoga	15,136	15,147	15,165	15,187	15,204	15,221	15,237	15,253	15,269	15,284	15,299
Schenectady	13,009	13,018	13,029	13,041	13,053	13,065	13,076	13,087	13,097	13,108	13,117
Suffolk	199,592	199,660	199,739	199,824	199,901	199,975	200,045	200,113	200,177	200,235	200,293
Sullivan	6,558	6,560	6,564	6,574	6,579	6,585	6,590	6,595	6,599	6,604	6,608
Tompkins	4,256	4,265	4,274	4,283	4,291	4,299	4,306	4,315	4,323	4,331	4,340
Ulster	13,788	13,795	13,801	13,813	13,822	13,831	13,839	13,847	13,854	13,861	13,868
Westchester	128,897	128,921	128,967	129,018	129,054	129,088	129,121	129,152	129,182	129,210	129,237

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:		
	5/17	5/18	5/19	5/20	5/22	5/24	5/26
Albany	24,455	24,466	24,480	24,493	24,520 (4,904) [1,177] {588}	24,546 (4,909) [1,178] {589}	24,571 (4,914) [1,179] {590}
Bronx	181,500	181,617	181,665	181,798	181,981 (36,396) [8,735] {4,368}	182,145 (36,429) [8,743] {4,371}	182,300 (36,460) [8,750] {4,375}
Dutchess	29,214	29,231	29,249	29,275	29,312 (5,862) [1,407] {703}	29,346 (5,869) [1,409] {704}	29,377 (5,875) [1,410] {705}
Erie	88,507	88,560	88,638	88,726	88,873 (17,775) [4,266] {2,133}	89,008 (17,802) [4,272] {2,136}	89,130 (17,826) [4,278] {2,139}
Kings	277,651	277,901	278,018	278,210	278,525 (55,705) [13,369] {6,685}	278,821 (55,764) [13,383] {6,692}	279,082 (55,816) [13,396] {6,698}
Monroe	66,986	67,103	67,230	67,409	67,697 (13,539) [3,249] {1,625}	67,969 (13,594) [3,263] {1,631}	68,235 (13,647) [3,275] {1,638}
Nassau	182,422	182,491	182,565	182,656	182,798 (36,560) [8,774] {4,387}	182,929 (36,586) [8,781] {4,390}	183,048 (36,610) [8,786] {4,393}
New York	136,977	137,019	137,079	137,171	137,299 (27,460) [6,590] {3,295}	137,414 (27,483) [6,596] {3,298}	137,520 (27,504) [6,601] {3,300}
Niagara	19,721	19,736	19,766	19,802	19,845 (3,969) [953] {476}	19,883 (3,977) [954] {477}	19,919 (3,984) [956] {478}
Onondaga	38,132	38,158	38,230	38,287	38,379 (7,676) [1,842] {921}	38,469 (7,694) [1,847] {923}	38,556 (7,711) [1,851] {925}
Orange	47,908	47,920	47,941	47,966	48,010 (9,602) [2,304] {1,152}	48,051 (9,610) [2,306] {1,153}	48,088 (9,618) [2,308] {1,154}
Putnam	10,542	10,544	10,548	10,553	10,559 (2,112) [507] {253}	10,565 (2,113) [507] {254}	10,569 (2,114) [507] {254}
Queens	274,493	274,913	275,028	275,195	275,523 (55,105) [13,225] {6,613}	275,824 (55,165) [13,240] {6,620}	276,104 (55,221) [13,253] {6,626}
Rensselaer	11,123	11,133	11,139	11,148	11,168 (2,234) [536] {268}	11,186 (2,237) [537] {268}	11,205 (2,241) [538] {269}
Richmond	74,109	74,179	74,217	74,267	74,356 (14,871) [3,569] {1,785}	74,436 (14,887) [3,573] {1,786}	74,512 (14,902) [3,577] {1,788}
Rockland	46,697	46,704	46,715	46,731	46,754 (9,351) [2,244] {1,122}	46,776 (9,355) [2,245] {1,123}	46,795 (9,359) [2,246] {1,123}
Saratoga	15,136	15,147	15,165	15,187	15,221 (3,044) [731] {365}	15,253 (3,051) [732] {366}	15,284 (3,057) [734] {367}
Schenectady	13,009	13,018	13,029	13,041	13,065 (2,613) [627] {314}	13,087 (2,617) [628] {314}	13,108 (2,622) [629] {315}
Suffolk	199,592	199,660	199,739	199,824	199,975 (39,995) [9,599] {4,799}	200,113 (40,023) [9,605] {4,803}	200,235 (40,047) [9,611] {4,806}
Sullivan	6,558	6,560	6,564	6,574	6,585 (1,317) [316] {158}	6,595 (1,319) [317] {158}	6,604 (1,321) [317] {158}
Tompkins	4,256	4,265	4,274	4,283	4,299 (860) [206] {103}	4,315 (863) [207] {104}	4,331 (866) [208] {104}
Ulster	13,788	13,795	13,801	13,813	13,831 (2,766) [664] {332}	13,847 (2,769) [665] {332}	13,861 (2,772) [665] {333}
Westchester	128,897	128,921	128,967	129,018	129,088 (25,818) [6,196] {3,098}	129,152 (25,830) [6,199] {3,100}	129,210 (25,842) [6,202] {3,101}

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.