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

Date: 5/28/21

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 5/28/21 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.

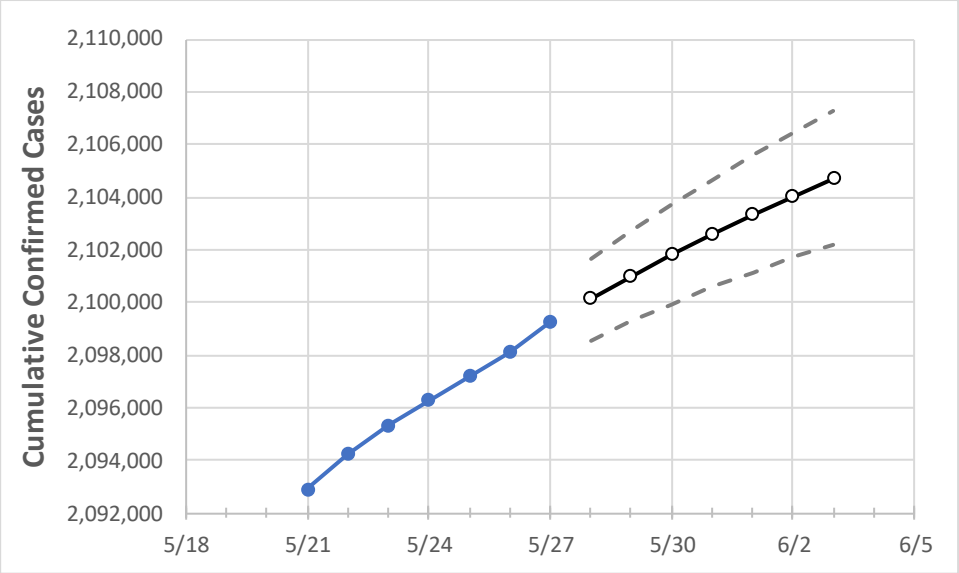
IEM's Modeling Lead

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:						
	5/24	5/25	5/26	5/27	5/28	5/29	5/30	5/31	6/1	6/2	6/3
New York	2,096,280	2,097,200	2,098,098	2,099,246	2,100,151	2,101,002	2,101,823	2,102,600	2,103,325	2,104,028	2,104,705

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:						
	5/24	5/25	5/26	5/27	5/28	5/29	5/30	5/31	6/1	6/2	6/3
Albany	24,566	24,583	24,593	24,603	24,616	24,628	24,641	24,653	24,664	24,676	24,687
Bronx	182,141	182,215	182,260	182,338	182,399	182,457	182,513	182,566	182,615	182,662	182,709
Dutchess	29,329	29,338	29,346	29,359	29,369	29,379	29,389	29,397	29,405	29,413	29,421
Erie	88,998	89,031	89,087	89,142	89,187	89,230	89,270	89,308	89,343	89,377	89,409
Kings	278,846	279,032	279,152	279,318	279,446	279,570	279,689	279,805	279,913	280,019	280,119
Monroe	67,892	67,967	68,059	68,161	68,255	68,347	68,433	68,516	68,593	68,670	68,744
Nassau	182,902	182,945	183,001	183,056	183,103	183,147	183,191	183,231	183,269	183,307	183,341
New York	137,424	137,451	137,496	137,561	137,603	137,643	137,682	137,718	137,752	137,786	137,818
Niagara	19,897	19,910	19,927	19,938	19,953	19,967	19,981	19,994	20,006	20,018	20,030
Onondaga	38,458	38,475	38,525	38,557	38,593	38,627	38,662	38,696	38,728	38,759	38,790
Orange	48,043	48,061	48,079	48,091	48,104	48,116	48,127	48,139	48,149	48,159	48,168
Putnam	10,561	10,564	10,566	10,567	10,568	10,570	10,571	10,572	10,573	10,574	10,575
Queens	275,707	275,827	275,904	276,048	276,166	276,281	276,389	276,490	276,589	276,686	276,782
Rensselaer	11,170	11,174	11,176	11,180	11,183	11,186	11,189	11,192	11,194	11,197	11,199
Richmond	74,427	74,462	74,483	74,547	74,581	74,614	74,644	74,675	74,703	74,729	74,756
Rockland	46,782	46,793	46,809	46,821	46,831	46,841	46,850	46,859	46,868	46,876	46,884
Saratoga	15,242	15,250	15,263	15,271	15,281	15,291	15,301	15,310	15,319	15,328	15,336
Schenectady	13,097	13,112	13,115	13,125	13,134	13,143	13,151	13,160	13,168	13,176	13,184
Suffolk	200,115	200,163	200,205	200,277	200,326	200,373	200,417	200,459	200,499	200,535	200,571
Sullivan	6,601	6,606	6,610	6,616	6,620	6,624	6,628	6,631	6,635	6,638	6,641
Tompkins	4,300	4,302	4,303	4,306	4,310	4,314	4,318	4,322	4,325	4,329	4,332
Ulster	13,844	13,851	13,852	13,854	13,859	13,863	13,867	13,871	13,874	13,878	13,881
Westchester	129,179	129,207	129,238	129,271	129,296	129,320	129,342	129,363	129,383	129,403	129,423

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:		
	5/24	5/25	5/26	5/27	5/29	5/31	6/2
Albany	24,566	24,583	24,593	24,603	24,628 (4,926) [1,182] {591}	24,653 (4,931) [1,183] {592}	24,676 (4,935) [1,184] {592}
Bronx	182,141	182,215	182,260	182,338	182,457 (36,491) [8,758] {4,379}	182,566 (36,513) [8,763] {4,382}	182,662 (36,532) [8,768] {4,384}
Dutchess	29,329	29,338	29,346	29,359	29,379 (5,876) [1,410] {705}	29,397 (5,879) [1,411] {706}	29,413 (5,883) [1,412] {706}
Erie	88,998	89,031	89,087	89,142	89,230 (17,846) [4,283] {2,142}	89,308 (17,862) [4,287] {2,143}	89,377 (17,875) [4,290] {2,145}
Kings	278,846	279,032	279,152	279,318	279,570 (55,914) [13,419] {6,710}	279,805 (55,961) [13,431] {6,715}	280,019 (56,004) [13,441] {6,720}
Monroe	67,892	67,967	68,059	68,161	68,347 (13,669) [3,281] {1,640}	68,516 (13,703) [3,289] {1,644}	68,670 (13,734) [3,296] {1,648}
Nassau	182,902	182,945	183,001	183,056	183,147 (36,629) [8,791] {4,396}	183,231 (36,646) [8,795] {4,398}	183,307 (36,661) [8,799] {4,399}
New York	137,424	137,451	137,496	137,561	137,643 (27,529) [6,607] {3,303}	137,718 (27,544) [6,610] {3,305}	137,786 (27,557) [6,614] {3,307}
Niagara	19,897	19,910	19,927	19,938	19,967 (3,993) [958] {479}	19,994 (3,999) [960] {480}	20,018 (4,004) [961] {480}
Onondaga	38,458	38,475	38,525	38,557	38,627 (7,725) [1,854] {927}	38,696 (7,739) [1,857] {929}	38,759 (7,752) [1,860] {930}
Orange	48,043	48,061	48,079	48,091	48,116 (9,623) [2,310] {1,155}	48,139 (9,628) [2,311] {1,155}	48,159 (9,632) [2,312] {1,156}
Putnam	10,561	10,564	10,566	10,567	10,570 (2,114) [507] {254}	10,572 (2,114) [507] {254}	10,574 (2,115) [508] {254}
Queens	275,707	275,827	275,904	276,048	276,281 (55,256) [13,262] {6,631}	276,490 (55,298) [13,272] {6,636}	276,686 (55,337) [13,281] {6,640}
Rensselaer	11,170	11,174	11,176	11,180	11,186 (2,237) [537] {268}	11,192 (2,238) [537] {269}	11,197 (2,239) [537] {269}
Richmond	74,427	74,462	74,483	74,547	74,614 (14,923) [3,581] {1,791}	74,675 (14,935) [3,584] {1,792}	74,729 (14,946) [3,587] {1,794}
Rockland	46,782	46,793	46,809	46,821	46,841 (9,368) [2,248] {1,124}	46,859 (9,372) [2,249] {1,125}	46,876 (9,375) [2,250] {1,125}
Saratoga	15,242	15,250	15,263	15,271	15,291 (3,058) [734] {367}	15,310 (3,062) [735] {367}	15,328 (3,066) [736] {368}
Schenectady	13,097	13,112	13,115	13,125	13,143 (2,629) [631] {315}	13,160 (2,632) [632] {316}	13,176 (2,635) [632] {316}
Suffolk	200,115	200,163	200,205	200,277	200,373 (40,075) [9,618] {4,809}	200,459 (40,092) [9,622] {4,811}	200,535 (40,107) [9,626] {4,813}
Sullivan	6,601	6,606	6,610	6,616	6,624 (1,325) [318] {159}	6,631 (1,326) [318] {159}	6,638 (1,328) [319] {159}
Tompkins	4,300	4,302	4,303	4,306	4,314 (863) [207] {104}	4,322 (864) [207] {104}	4,329 (866) [208] {104}
Ulster	13,844	13,851	13,852	13,854	13,863 (2,773) [665] {333}	13,871 (2,774) [666] {333}	13,878 (2,776) [666] {333}
Westchester	129,179	129,207	129,238	129,271	129,320 (25,864) [6,207] {3,104}	129,363 (25,873) [6,209] {3,105}	129,403 (25,881) [6,211] {3,106}

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.