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

Date: 11/12/21

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 11/12/21 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.

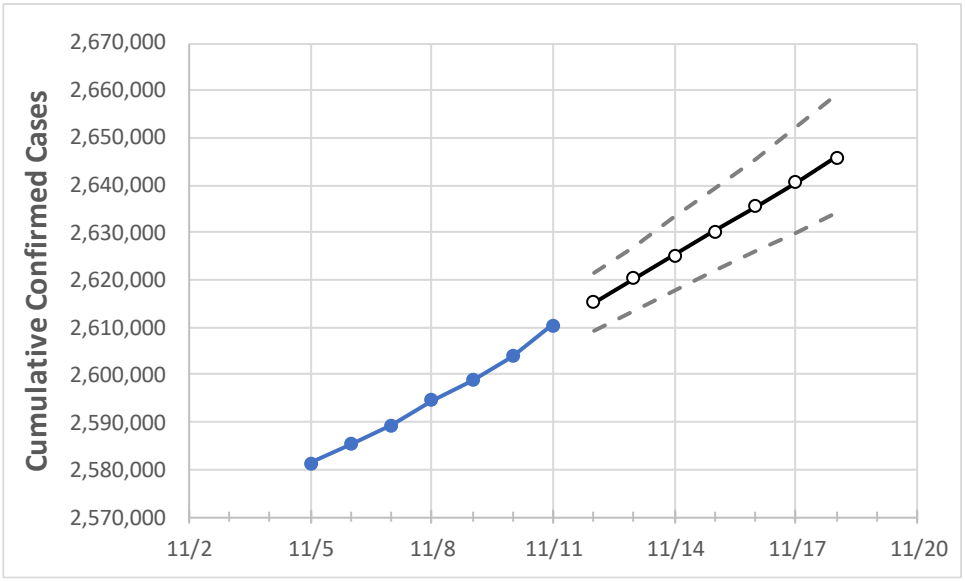
IEM's Modeling Lead

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:						
	11/8	11/9	11/10	11/11	11/12	11/13	11/14	11/15	11/16	11/17	11/18
New York	2,594,515	2,598,730	2,603,833	2,610,481	2,615,330	2,620,294	2,625,239	2,630,329	2,635,517	2,640,706	2,645,888

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:						
	11/8	11/9	11/10	11/11	11/12	11/13	11/14	11/15	11/16	11/17	11/18
Albany	32,205	32,292	32,391	32,516	32,602	32,688	32,775	32,861	32,953	33,040	33,126
Bronx	209,784	209,924	210,017	210,200	210,318	210,434	210,554	210,670	210,789	210,906	211,026
Dutchess	36,432	36,492	36,536	36,613	36,662	36,712	36,761	36,811	36,862	36,913	36,965
Erie	112,244	112,610	113,079	113,599	114,053	114,510	114,965	115,452	115,942	116,443	116,960
Kings	340,269	340,605	340,921	341,413	341,777	342,133	342,500	342,862	343,219	343,584	343,945
Monroe	88,777	89,030	89,421	89,894	90,250	90,606	90,972	91,342	91,722	92,124	92,511
Nassau	217,879	218,094	218,368	218,697	218,938	219,181	219,434	219,685	219,937	220,195	220,457
New York	171,016	171,173	171,394	171,653	171,850	172,051	172,254	172,455	172,666	172,872	173,086
Niagara	25,436	25,542	25,662	25,788	25,896	26,007	26,116	26,232	26,350	26,471	26,593
Onondaga	54,953	55,074	55,282	55,512	55,687	55,855	56,026	56,204	56,377	56,559	56,735
Orange	59,075	59,162	59,306	59,470	59,578	59,686	59,800	59,911	60,027	60,142	60,257
Putnam	12,726	12,734	12,747	12,764	12,774	12,785	12,795	12,805	12,815	12,825	12,834
Queens	319,055	319,313	319,536	319,832	320,086	320,346	320,609	320,872	321,146	321,418	321,696
Rensselaer	15,757	15,809	15,865	16,003	16,072	16,140	16,211	16,282	16,356	16,431	16,506
Richmond	90,316	90,380	90,466	90,580	90,649	90,719	90,787	90,855	90,925	90,992	91,057
Rockland	54,068	54,130	54,181	54,249	54,299	54,350	54,398	54,449	54,497	54,548	54,598
Saratoga	21,624	21,697	21,785	21,960	22,057	22,155	22,252	22,358	22,458	22,566	22,673
Schenectady	17,712	17,756	17,802	17,890	17,946	18,001	18,059	18,114	18,170	18,229	18,285
Suffolk	244,622	244,879	245,247	245,723	246,061	246,407	246,758	247,115	247,483	247,845	248,210
Sullivan	8,820	8,833	8,859	8,894	8,915	8,935	8,956	8,977	8,998	9,019	9,039
Tompkins	6,806	6,824	6,831	6,871	6,889	6,907	6,925	6,943	6,963	6,982	7,000
Ulster	17,785	17,809	17,853	17,928	17,964	18,000	18,037	18,075	18,113	18,153	18,191
Westchester	145,017	145,098	145,180	145,320	145,411	145,501	145,594	145,685	145,779	145,874	145,969

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:		
	11/8	11/9	11/10	11/11	11/13	11/15	11/17
Albany	32,205	32,292	32,391	32,516	32,688 (6,538) [1,569] {785}	32,861 (6,572) [1,577] {789}	33,040 (6,608) [1,586] {793}
Bronx	209,784	209,924	210,017	210,200	210,434 (42,087) [10,101] {5,050}	210,670 (42,134) [10,112] {5,056}	210,906 (42,181) [10,123] {5,062}
Dutchess	36,432	36,492	36,536	36,613	36,712 (7,342) [1,762] {881}	36,811 (7,362) [1,767] {883}	36,913 (7,383) [1,772] {886}
Erie	112,244	112,610	113,079	113,599	114,510 (22,902) [5,496] {2,748}	115,452 (23,090) [5,542] {2,771}	116,443 (23,289) [5,589] {2,795}
Kings	340,269	340,605	340,921	341,413	342,133 (68,427) [16,422] {8,211}	342,862 (68,572) [16,457] {8,229}	343,584 (68,717) [16,492] {8,246}
Monroe	88,777	89,030	89,421	89,894	90,606 (18,121) [4,349] {2,175}	91,342 (18,268) [4,384] {2,192}	92,124 (18,425) [4,422] {2,211}
Nassau	217,879	218,094	218,368	218,697	219,181 (43,836) [10,521] {5,260}	219,685 (43,937) [10,545] {5,272}	220,195 (44,039) [10,569] {5,285}
New York	171,016	171,173	171,394	171,653	172,051 (34,410) [8,258] {4,129}	172,455 (34,491) [8,278] {4,139}	172,872 (34,574) [8,298] {4,149}
Niagara	25,436	25,542	25,662	25,788	26,007 (5,201) [1,248] {624}	26,232 (5,246) [1,259] {630}	26,471 (5,294) [1,271] {635}
Onondaga	54,953	55,074	55,282	55,512	55,855 (11,171) [2,681] {1,341}	56,204 (11,241) [2,698] {1,349}	56,559 (11,312) [2,715] {1,357}
Orange	59,075	59,162	59,306	59,470	59,686 (11,937) [2,865] {1,432}	59,911 (11,982) [2,876] {1,438}	60,142 (12,028) [2,887] {1,443}
Putnam	12,726	12,734	12,747	12,764	12,785 (2,557) [614] {307}	12,805 (2,561) [615] {307}	12,825 (2,565) [616] {308}
Queens	319,055	319,313	319,536	319,832	320,346 (64,069) [15,377] {7,688}	320,872 (64,174) [15,402] {7,701}	321,418 (64,284) [15,428] {7,714}
Rensselaer	15,757	15,809	15,865	16,003	16,140 (3,228) [775] {387}	16,282 (3,256) [782] {391}	16,431 (3,286) [789] {394}
Richmond	90,316	90,380	90,466	90,580	90,719 (18,144) [4,355] {2,177}	90,855 (18,171) [4,361] {2,181}	90,992 (18,198) [4,368] {2,184}
Rockland	54,068	54,130	54,181	54,249	54,350 (10,870) [2,609] {1,304}	54,449 (10,890) [2,614] {1,307}	54,548 (10,910) [2,618] {1,309}
Saratoga	21,624	21,697	21,785	21,960	22,155 (4,431) [1,063] {532}	22,358 (4,472) [1,073] {537}	22,566 (4,513) [1,083] {542}
Schenectady	17,712	17,756	17,802	17,890	18,001 (3,600) [864] {432}	18,114 (3,623) [869] {435}	18,229 (3,646) [875] {437}
Suffolk	244,622	244,879	245,247	245,723	246,407 (49,281) [11,828] {5,914}	247,115 (49,423) [11,862] {5,931}	247,845 (49,569) [11,897] {5,948}
Sullivan	8,820	8,833	8,859	8,894	8,935 (1,787) [429] {214}	8,977 (1,795) [431] {215}	9,019 (1,804) [433] {216}
Tompkins	6,806	6,824	6,831	6,871	6,907 (1,381) [332] {166}	6,943 (1,389) [333] {167}	6,982 (1,396) [335] {168}
Ulster	17,785	17,809	17,853	17,928	18,000 (3,600) [864] {432}	18,075 (3,615) [868] {434}	18,153 (3,631) [871] {436}
Westchester	145,017	145,098	145,180	145,320	145,501 (29,100) [6,984] {3,492}	145,685 (29,137) [6,993] {3,496}	145,874 (29,175) [7,002] {3,501}

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.