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

Date: 1/31/22

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 1/31/22 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.

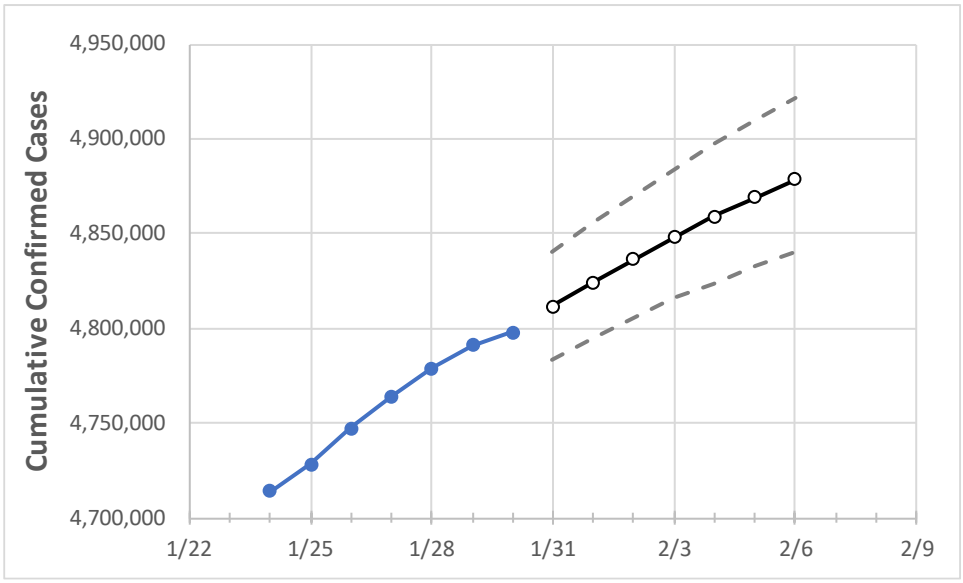
IEM's Modeling Lead

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:						
	1/27	1/28	1/29	1/30	1/31	2/1	2/2	2/3	2/4	2/5	2/6
New York	4,764,422	4,778,737	4,790,901	4,797,903	4,811,605	4,824,466	4,836,615	4,847,902	4,858,886	4,868,959	4,878,545

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:						
	1/27	1/28	1/29	1/30	1/31	2/1	2/2	2/3	2/4	2/5	2/6
Albany	54,921	55,128	55,361	55,524	55,749	55,968	56,177	56,378	56,578	56,773	56,953
Bronx	396,841	397,508	398,031	398,031	399,648	401,043	402,337	403,598	404,787	406,303	407,182
Dutchess	61,028	61,200	61,390	61,525	61,713	61,895	62,069	62,232	62,390	62,546	62,687
Erie	197,793	198,463	199,134	199,585	200,306	200,994	201,642	202,271	202,899	203,496	204,057
Kings	666,653	668,636	670,414	670,414	672,699	674,745	676,668	678,525	680,375	682,090	683,628
Monroe	143,771	144,233	144,720	145,121	145,593	146,045	146,456	146,867	147,276	147,680	148,041
Nassau	388,880	389,697	390,398	390,879	391,593	392,279	392,932	393,532	394,101	394,642	395,155
New York	389,214	390,185	391,062	391,664	392,872	393,947	394,971	395,995	396,894	397,816	398,686
Niagara	45,369	45,524	45,708	45,807	45,981	46,155	46,316	46,472	46,622	46,771	46,913
Onondaga	100,596	100,975	101,518	101,867	102,397	102,939	103,456	103,952	104,417	104,928	105,387
Orange	105,079	105,429	105,429	105,429	106,053	106,556	107,044	107,567	108,113	108,652	109,088
Putnam	22,661	22,726	22,781	22,817	22,873	22,927	22,979	23,027	23,073	23,118	23,157
Queens	619,919	621,181	622,237	623,117	624,612	625,986	627,266	628,520	629,641	630,749	631,714
Rensselaer	28,966	29,089	29,259	29,353	29,499	29,643	29,782	29,920	30,050	30,183	30,310
Richmond	160,290	160,651	160,937	160,937	161,361	161,732	162,061	162,419	162,738	163,070	163,343
Rockland	89,063	89,295	89,435	89,532	89,734	89,920	90,095	90,264	90,426	90,576	90,723
Saratoga	42,479	42,677	42,880	43,008	43,211	43,405	43,593	43,771	43,950	44,120	44,285
Schenectady	30,629	30,778	30,895	31,024	31,172	31,320	31,462	31,596	31,730	31,860	31,984
Suffolk	413,080	413,996	414,679	415,142	415,908	416,653	417,371	418,023	418,632	419,276	419,796
Sullivan	17,424	17,494	17,552	17,583	17,656	17,723	17,784	17,847	17,904	17,960	18,016
Tompkins	15,981	16,081	16,215	16,282	16,382	16,481	16,580	16,672	16,773	16,863	16,951
Ulster	29,300	29,413	29,531	29,620	29,750	29,877	29,992	30,112	30,224	30,334	30,440
Westchester	240,514	241,083	241,497	241,818	242,268	242,667	243,059	243,430	243,781	244,111	244,418

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:		
	1/27	1/28	1/29	1/30	2/1	2/3	2/5
Albany	54,921	55,128	55,361	55,524	55,968 (11,194) [2,686] {1,343}	56,378 (11,276) [2,706] {1,353}	56,773 (11,355) [2,725] {1,363}
Bronx	396,841	397,508	398,031	398,031	401,043 (80,209) [19,250] {9,625}	403,598 (80,720) [19,373] {9,686}	406,303 (81,261) [19,503] {9,751}
Dutchess	61,028	61,200	61,390	61,525	61,895 (12,379) [2,971] {1,485}	62,232 (12,446) [2,987] {1,494}	62,546 (12,509) [3,002] {1,501}
Erie	197,793	198,463	199,134	199,585	200,994 (40,199) [9,648] {4,824}	202,271 (40,454) [9,709] {4,854}	203,496 (40,699) [9,768] {4,884}
Kings	666,653	668,636	670,414	670,414	674,745 (134,949) [32,388] {16,194}	678,525 (135,705) [32,569] {16,285}	682,090 (136,418) [32,740] {16,370}
Monroe	143,771	144,233	144,720	145,121	146,045 (29,209) [7,010] {3,505}	146,867 (29,373) [7,050] {3,525}	147,680 (29,536) [7,089] {3,544}
Nassau	388,880	389,697	390,398	390,879	392,279 (78,456) [18,829] {9,415}	393,532 (78,706) [18,890] {9,445}	394,642 (78,928) [18,943] {9,471}
New York	389,214	390,185	391,062	391,664	393,947 (78,789) [18,909] {9,455}	395,995 (79,199) [19,008] {9,504}	397,816 (79,563) [19,095] {9,548}
Niagara	45,369	45,524	45,708	45,807	46,155 (9,231) [2,215] {1,108}	46,472 (9,294) [2,231] {1,115}	46,771 (9,354) [2,245] {1,123}
Onondaga	100,596	100,975	101,518	101,867	102,939 (20,588) [4,941] {2,471}	103,952 (20,790) [4,990] {2,495}	104,928 (20,986) [5,037] {2,518}
Orange	105,079	105,429	105,429	105,429	106,556 (21,311) [5,115] {2,557}	107,567 (21,513) [5,163] {2,582}	108,652 (21,730) [5,215] {2,608}
Putnam	22,661	22,726	22,781	22,817	22,927 (4,585) [1,100] {550}	23,027 (4,605) [1,105] {553}	23,118 (4,624) [1,110] {555}
Queens	619,919	621,181	622,237	623,117	625,986 (125,197) [30,047] {15,024}	628,520 (125,704) [30,169] {15,084}	630,749 (126,150) [30,276] {15,138}
Rensselaer	28,966	29,089	29,259	29,353	29,643 (5,929) [1,423] {711}	29,920 (5,984) [1,436] {718}	30,183 (6,037) [1,449] {724}
Richmond	160,290	160,651	160,937	160,937	161,732 (32,346) [7,763] {3,882}	162,419 (32,484) [7,796] {3,898}	163,070 (32,614) [7,827] {3,914}
Rockland	89,063	89,295	89,435	89,532	89,920 (17,984) [4,316] {2,158}	90,264 (18,053) [4,333] {2,166}	90,576 (18,115) [4,348] {2,174}
Saratoga	42,479	42,677	42,880	43,008	43,405 (8,681) [2,083] {1,042}	43,771 (8,754) [2,101] {1,051}	44,120 (8,824) [2,118] {1,059}
Schenectady	30,629	30,778	30,895	31,024	31,320 (6,264) [1,503] {752}	31,596 (6,319) [1,517] {758}	31,860 (6,372) [1,529] {765}
Suffolk	413,080	413,996	414,679	415,142	416,653 (83,331) [19,999] {10,000}	418,023 (83,605) [20,065] {10,033}	419,276 (83,855) [20,125] {10,063}
Sullivan	17,424	17,494	17,552	17,583	17,723 (3,545) [851] {425}	17,847 (3,569) [857] {428}	17,960 (3,592) [862] {431}
Tompkins	15,981	16,081	16,215	16,282	16,481 (3,296) [791] {396}	16,672 (3,334) [800] {400}	16,863 (3,373) [809] {405}
Ulster	29,300	29,413	29,531	29,620	29,877 (5,975) [1,434] {717}	30,112 (6,022) [1,445] {723}	30,334 (6,067) [1,456] {728}
Westchester	240,514	241,083	241,497	241,818	242,667 (48,533) [11,648] {5,824}	243,430 (48,686) [11,685] {5,842}	244,111 (48,822) [11,717] {5,859}

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.