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

Date: 1/28/21

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 1/28/21 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.

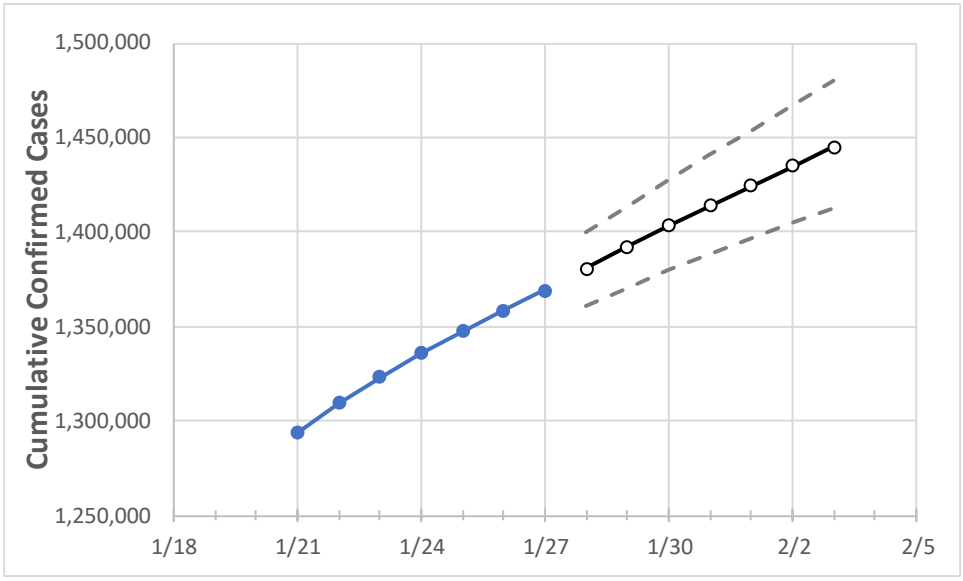
IEM's Modeling Lead

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:						
	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31	2/1	2/2	2/3
New York	1,335,695	1,347,667	1,358,707	1,369,072	1,380,561	1,392,048	1,403,161	1,413,986	1,424,512	1,435,036	1,445,137

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:						
	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31	2/1	2/2	2/3
Albany	17,485	17,620	17,798	17,977	18,160	18,335	18,509	18,678	18,847	19,010	19,174
Bronx	111,672	112,912	114,006	114,800	115,876	116,945	118,024	119,095	120,167	121,237	122,312
Dutchess	17,813	18,004	18,235	18,377	18,563	18,744	18,925	19,100	19,271	19,438	19,603
Erie	54,502	54,873	55,184	55,593	55,969	56,346	56,715	57,076	57,430	57,774	58,113
Kings	163,707	165,264	166,634	167,948	169,484	170,993	172,454	173,938	175,426	176,856	178,296
Monroe	46,064	46,265	46,476	46,841	47,092	47,329	47,556	47,781	47,992	48,192	48,380
Nassau	121,002	122,200	123,142	124,119	125,149	126,148	127,117	128,080	129,019	129,928	130,825
New York	79,916	80,797	81,511	82,127	82,882	83,636	84,380	85,134	85,890	86,653	87,390
Niagara	12,843	12,933	13,056	13,195	13,316	13,429	13,540	13,646	13,755	13,859	13,959
Onondaga	29,039	29,147	29,264	29,433	29,622	29,798	29,967	30,136	30,294	30,450	30,597
Orange	30,288	30,545	30,909	31,137	31,408	31,673	31,941	32,206	32,465	32,726	32,981
Putnam	6,927	7,004	7,071	7,112	7,178	7,243	7,310	7,373	7,436	7,498	7,559
Queens	166,808	168,404	169,941	171,214	172,718	174,217	175,705	177,186	178,609	180,066	181,504
Rensselaer	7,450	7,502	7,574	7,642	7,723	7,800	7,876	7,950	8,021	8,087	8,153
Richmond	47,253	47,641	47,981	48,264	48,612	48,953	49,288	49,605	49,922	50,231	50,525
Rockland	33,124	33,327	33,532	33,769	33,990	34,213	34,434	34,654	34,875	35,092	35,311
Saratoga	9,951	10,020	10,109	10,198	10,298	10,394	10,486	10,577	10,661	10,741	10,821
Schenectady	9,231	9,299	9,373	9,453	9,537	9,620	9,702	9,776	9,853	9,926	9,995
Suffolk	135,174	136,593	137,728	138,812	139,945	141,050	142,109	143,158	144,166	145,158	146,103
Sullivan	4,015	4,038	4,068	4,094	4,121	4,148	4,175	4,200	4,226	4,250	4,274
Tompkins	2,831	2,845	2,864	2,890	2,916	2,943	2,969	2,995	3,019	3,045	3,069
Ulster	8,227	8,301	8,388	8,442	8,527	8,610	8,694	8,777	8,858	8,938	9,016
Westchester	89,225	90,029	90,665	91,223	91,950	92,678	93,400	94,108	94,808	95,507	96,202

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:		
	1/24	1/25	1/26	1/27	1/29	1/31	2/2
Albany	17,485	17,620	17,798	17,977	18,335 (3,667) [880] {440}	18,678 (3,736) [897] {448}	19,010 (3,802) [912] {456}
Bronx	111,672	112,912	114,006	114,800	116,945 (23,389) [5,613] {2,807}	119,095 (23,819) [5,717] {2,858}	121,237 (24,247) [5,819] {2,910}
Dutchess	17,813	18,004	18,235	18,377	18,744 (3,749) [900] {450}	19,100 (3,820) [917] {458}	19,438 (3,888) [933] {467}
Erie	54,502	54,873	55,184	55,593	56,346 (11,269) [2,705] {1,352}	57,076 (11,415) [2,740] {1,370}	57,774 (11,555) [2,773] {1,387}
Kings	163,707	165,264	166,634	167,948	170,993 (34,199) [8,208] {4,104}	173,938 (34,788) [8,349] {4,175}	176,856 (35,371) [8,489] {4,245}
Monroe	46,064	46,265	46,476	46,841	47,329 (9,466) [2,272] {1,136}	47,781 (9,556) [2,293] {1,147}	48,192 (9,638) [2,313] {1,157}
Nassau	121,002	122,200	123,142	124,119	126,148 (25,230) [6,055] {3,028}	128,080 (25,616) [6,148] {3,074}	129,928 (25,986) [6,237] {3,118}
New York	79,916	80,797	81,511	82,127	83,636 (16,727) [4,015] {2,007}	85,134 (17,027) [4,086] {2,043}	86,653 (17,331) [4,159] {2,080}
Niagara	12,843	12,933	13,056	13,195	13,429 (2,686) [645] {322}	13,646 (2,729) [655] {328}	13,859 (2,772) [665] {333}
Onondaga	29,039	29,147	29,264	29,433	29,798 (5,960) [1,430] {715}	30,136 (6,027) [1,447] {723}	30,450 (6,090) [1,462] {731}
Orange	30,288	30,545	30,909	31,137	31,673 (6,335) [1,520] {760}	32,206 (6,441) [1,546] {773}	32,726 (6,545) [1,571] {785}
Putnam	6,927	7,004	7,071	7,112	7,243 (1,449) [348] {174}	7,373 (1,475) [354] {177}	7,498 (1,500) [360] {180}
Queens	166,808	168,404	169,941	171,214	174,217 (34,843) [8,362] {4,181}	177,186 (35,437) [8,505] {4,252}	180,066 (36,013) [8,643] {4,322}
Rensselaer	7,450	7,502	7,574	7,642	7,800 (1,560) [374] {187}	7,950 (1,590) [382] {191}	8,087 (1,617) [388] {194}
Richmond	47,253	47,641	47,981	48,264	48,953 (9,791) [2,350] {1,175}	49,605 (9,921) [2,381] {1,191}	50,231 (10,046) [2,411] {1,206}
Rockland	33,124	33,327	33,532	33,769	34,213 (6,843) [1,642] {821}	34,654 (6,931) [1,663] {832}	35,092 (7,018) [1,684] {842}
Saratoga	9,951	10,020	10,109	10,198	10,394 (2,079) [499] {249}	10,577 (2,115) [508] {254}	10,741 (2,148) [516] {258}
Schenectady	9,231	9,299	9,373	9,453	9,620 (1,924) [462] {231}	9,776 (1,955) [469] {235}	9,926 (1,985) [476] {238}
Suffolk	135,174	136,593	137,728	138,812	141,050 (28,210) [6,770] {3,385}	143,158 (28,632) [6,872] {3,436}	145,158 (29,032) [6,968] {3,484}
Sullivan	4,015	4,038	4,068	4,094	4,148 (830) [199] {100}	4,200 (840) [202] {101}	4,250 (850) [204] {102}
Tompkins	2,831	2,845	2,864	2,890	2,943 (589) [141] {71}	2,995 (599) [144] {72}	3,045 (609) [146] {73}
Ulster	8,227	8,301	8,388	8,442	8,610 (1,722) [413] {207}	8,777 (1,755) [421] {211}	8,938 (1,788) [429] {215}
Westchester	89,225	90,029	90,665	91,223	92,678 (18,536) [4,449] {2,224}	94,108 (18,822) [4,517] {2,259}	95,507 (19,101) [4,584] {2,292}

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.