

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

Date: 1/28/22

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 1/28/22 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.**

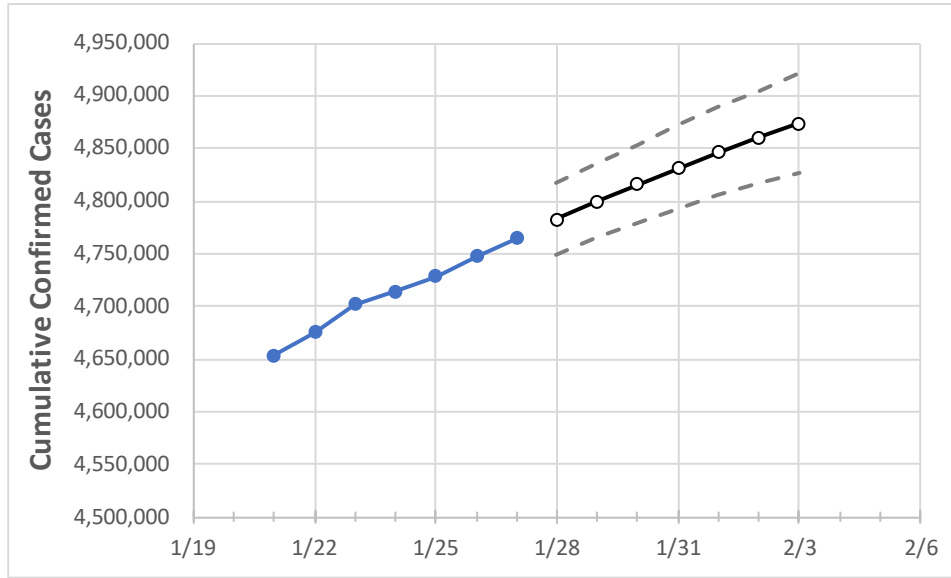
### IEM's Modeling Lead

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:						
	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31	2/1	2/2	2/3

New York 4,714,010 4,728,422 4,747,535 4,764,422 4,782,551 4,799,667 4,815,436 4,831,031 4,845,858 4,860,301 4,873,489

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	54,213	54,406	54,668	54,921	55,243	55,558	55,862	56,151	56,443	56,738	57,002
Bronx	393,347	395,379	395,965	396,841	398,513	400,039	401,569	402,798	404,176	405,656	406,814
Dutchess	60,300	60,535	60,725	61,028	61,307	61,579	61,843	62,085	62,334	62,583	62,798
Erie	194,842	196,101	196,975	197,793	198,818	199,800	200,741	201,681	202,560	203,448	204,279
Kings	660,505	662,458	664,549	666,653	669,455	671,994	674,560	677,036	679,399	681,772	683,718
Monroe	142,401	142,732	143,167	143,771	144,398	144,988	145,533	146,118	146,644	147,201	147,666
Nassau	386,031	386,676	387,829	388,880	389,888	390,806	391,676	392,564	393,316	394,101	394,785
New York	386,109	386,831	388,024	389,214	390,778	392,242	393,592	394,911	396,257	397,459	398,604
Niagara	44,689	44,940	45,157	45,369	45,612	45,843	46,080	46,296	46,520	46,728	46,933
Onondaga	98,669	99,337	99,999	100,596	101,299	101,980	102,638	103,267	103,887	104,539	105,125
Orange	101,198	101,414	104,729	104,729	105,396	105,910	106,533	107,019	107,595	108,147	108,736
Putnam	22,447	22,529	22,581	22,661	22,742	22,818	22,888	22,956	23,021	23,088	23,142
Queens	615,174	616,467	618,222	619,919	622,354	624,575	626,731	628,746	630,619	632,489	634,232
Rensselaer	28,468	28,589	28,771	28,966	29,152	29,338	29,510	29,681	29,843	30,006	30,173
Richmond	159,136	159,484	159,841	160,290	160,812	161,315	161,776	162,208	162,620	163,056	163,425
Rockland	88,325	88,469	88,879	89,063	89,420	89,785	90,097	90,415	90,705	91,028	91,291
Saratoga	41,787	41,996	42,192	42,479	42,723	42,971	43,205	43,438	43,655	43,877	44,087
Schenectady	30,207	30,336	30,445	30,629	30,828	31,029	31,212	31,391	31,570	31,749	31,917
Suffolk	409,795	410,532	411,909	413,080	414,184	415,264	416,247	417,138	418,039	418,893	419,709
Sullivan	17,172	17,235	17,330	17,424	17,521	17,611	17,695	17,778	17,859	17,935	18,008
Tompkins	15,629	15,715	15,847	15,981	16,103	16,218	16,331	16,447	16,562	16,669	16,780
Ulster	28,933	29,054	29,112	29,300	29,478	29,645	29,811	29,974	30,136	30,290	30,440
Westchester	238,825	239,276	239,846	240,514	241,208	241,871	242,486	243,122	243,673	244,227	244,759

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	54,213	54,406	54,668	54,921	55,558	(11,112)	[2,667]	{1,333}	56,151	(11,230)	[2,695]	{1,348}	56,738	(11,348)	[2,723]	{1,362}
Bronx	393,347	395,379	395,965	396,841	400,039	(80,008)	[19,202]	{9,601}	402,798	(80,560)	[19,334]	{9,667}	405,656	(81,131)	[19,471]	{9,736}
Dutchess	60,300	60,535	60,725	61,028	61,579	(12,316)	[2,956]	{1,478}	62,085	(12,417)	[2,980]	{1,490}	62,583	(12,517)	[3,004]	{1,502}
Erie	194,842	196,101	196,975	197,793	199,800	(39,960)	[9,590]	{4,795}	201,681	(40,336)	[9,681]	{4,840}	203,448	(40,690)	[9,765]	{4,883}
Kings	660,505	662,458	664,549	666,653	671,994	(134,399)	[32,256]	{16,128}	677,036	(135,407)	[32,498]	{16,249}	681,772	(136,354)	[32,725]	{16,363}
Monroe	142,401	142,732	143,167	143,771	144,988	(28,998)	[6,959]	{3,480}	146,118	(29,224)	[7,014]	{3,507}	147,201	(29,440)	[7,066]	{3,533}
Nassau	386,031	386,676	387,829	388,880	390,806	(78,161)	[18,759]	{9,379}	392,564	(78,513)	[18,843]	{9,422}	394,101	(78,820)	[18,917]	{9,458}
New York	386,109	386,831	388,024	389,214	392,242	(78,448)	[18,828]	{9,414}	394,911	(78,982)	[18,956]	{9,478}	397,459	(79,492)	[19,078]	{9,539}
Niagara	44,689	44,940	45,157	45,369	45,843	(9,169)	[2,200]	{1,100}	46,296	(9,259)	[2,222]	{1,111}	46,728	(9,346)	[2,243]	{1,121}
Onondaga	98,669	99,337	99,999	100,596	101,980	(20,396)	[4,895]	{2,448}	103,267	(20,653)	[4,957]	{2,478}	104,539	(20,908)	[5,018]	{2,509}
Orange	101,198	101,414	104,729	104,729	105,910	(21,182)	[5,084]	{2,542}	107,019	(21,404)	[5,137]	{2,568}	108,147	(21,629)	[5,191]	{2,596}
Putnam	22,447	22,529	22,581	22,661	22,818	(4,564)	[1,095]	{548}	22,956	(4,591)	[1,102]	{551}	23,088	(4,618)	[1,108]	{554}
Queens	615,174	616,467	618,222	619,919	624,575	(124,915)	[29,980]	{14,990}	628,746	(125,749)	[30,180]	{15,090}	632,489	(126,498)	[30,359]	{15,180}
Rensselaer	28,468	28,589	28,771	28,966	29,338	(5,868)	[1,408]	{704}	29,681	(5,936)	[1,425]	{712}	30,006	(6,001)	[1,440]	{720}
Richmond	159,136	159,484	159,841	160,290	161,315	(32,263)	[7,743]	{3,872}	162,208	(32,442)	[7,786]	{3,893}	163,056	(32,611)	[7,827]	{3,913}
Rockland	88,325	88,469	88,879	89,063	89,785	(17,957)	[4,310]	{2,155}	90,415	(18,083)	[4,340]	{2,170}	91,028	(18,206)	[4,369]	{2,185}
Saratoga	41,787	41,996	42,192	42,479	42,971	(8,594)	[2,063]	{1,031}	43,438	(8,688)	[2,085]	{1,043}	43,877	(8,775)	[2,106]	{1,053}
Schenectady	30,207	30,336	30,445	30,629	31,029	(6,206)	[1,489]	{745}	31,391	(6,278)	[1,507]	{753}	31,749	(6,350)	[1,524]	{762}
Suffolk	409,795	410,532	411,909	413,080	415,264	(83,053)	[19,933]	{9,966}	417,138	(83,428)	[20,023]	{10,011}	418,893	(83,779)	[20,107]	{10,053}
Sullivan	17,172	17,235	17,330	17,424	17,611	(3,522)	[845]	{423}	17,778	(3,556)	[853]	{427}	17,935	(3,587)	[861]	{430}
Tompkins	15,629	15,715	15,847	15,981	16,218	(3,244)	[778]	{389}	16,447	(3,289)	[789]	{395}	16,669	(3,334)	[800]	{400}
Ulster	28,933	29,054	29,112	29,300	29,645	(5,929)	[1,423]	{711}	29,974	(5,995)	[1,439]	{719}	30,290	(6,058)	[1,454]	{727}
Westchester	238,825	239,276	239,846	240,514	241,871	(48,374)	[11,610]	{5,805}	243,122	(48,624)	[11,670]	{5,835}	244,227	(48,845)	[11,723]	{5,861}

For additional information from IEM, please contact Bryan Koon, Vice President of Emergency Management and Homeland Security at [bryan.koon@iem.com](mailto:bryan.koon@iem.com) or 850-519-7966 or Stephanie Tennyson at [stephanie.tennyson@iem.com](mailto:stephanie.tennyson@iem.com) or 202-309-4257.