

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

Date: 1/8/21

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 1/8/21 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.**

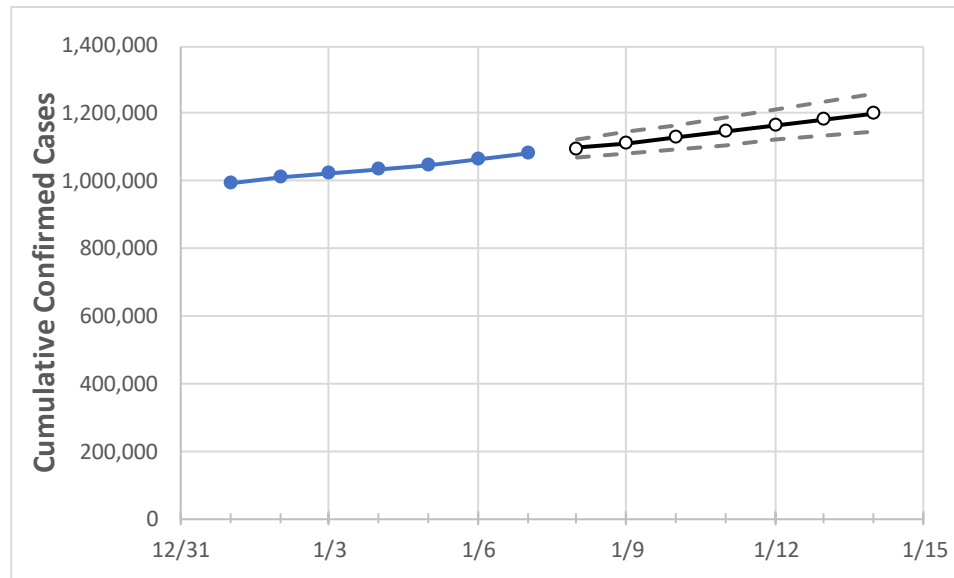
### IEM's Modeling Lead

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:							
	1/4	1/5	1/6	1/7	1/8	1/9	1/10	1/11	1/12	1/13	1/14	
New York	1,035,139	1,048,281	1,064,297	1,081,885	1,097,657	1,113,861	1,130,433	1,147,429	1,165,072	1,183,093	1,201,626	

*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:						
	1/4	1/5	1/6	1/7	1/8	1/9	1/10	1/11	1/12	1/13	1/14
Albany	12,593	12,852	13,112	13,410	13,684	13,969	14,256	14,542	14,843	15,141	15,451
Bronx	89,197	90,121	90,958	92,156	93,150	94,182	95,267	96,396	97,544	98,705	99,923
Dutchess	13,020	13,190	13,379	13,642	13,879	14,124	14,371	14,628	14,888	15,156	15,433
Erie	43,442	43,816	44,616	45,077	45,615	46,145	46,689	47,243	47,790	48,345	48,898
Kings	129,252	130,653	132,075	133,865	135,332	136,846	138,377	139,927	141,507	143,119	144,790
Monroe	36,258	36,705	37,330	38,053	38,662	39,282	39,912	40,525	41,161	41,799	42,448
Nassau	93,106	94,379	96,112	97,746	99,342	101,009	102,708	104,508	106,354	108,225	110,142
New York	63,434	64,189	64,781	65,687	66,353	67,042	67,729	68,422	69,133	69,861	70,610
Niagara	9,259	9,393	9,681	9,806	10,004	10,204	10,413	10,626	10,844	11,067	11,296
Onondaga	22,697	22,880	23,347	23,764	24,140	24,525	24,905	25,286	25,677	26,075	26,476
Orange	24,370	24,579	24,853	25,254	25,558	25,868	26,187	26,514	26,850	27,199	27,557
Putnam	5,162	5,235	5,320	5,436	5,533	5,633	5,737	5,845	5,956	6,070	6,187
Queens	131,464	133,083	134,670	136,465	138,096	139,811	141,558	143,305	145,164	147,057	149,040
Rensselaer	4,796	4,933	5,067	5,249	5,404	5,565	5,734	5,907	6,083	6,265	6,452
Richmond	37,042	37,680	38,243	38,891	39,471	40,080	40,715	41,368	42,031	42,723	43,441
Rockland	28,335	28,568	28,861	29,202	29,481	29,766	30,060	30,359	30,669	30,987	31,314
Saratoga	6,360	6,543	6,753	7,027	7,262	7,509	7,762	8,030	8,317	8,610	8,912
Schenectady	6,501	6,619	6,800	6,952	7,111	7,273	7,436	7,606	7,774	7,945	8,119
Suffolk	102,465	104,019	106,061	108,255	110,249	112,297	114,429	116,666	118,954	121,322	123,795
Sullivan	3,249	3,276	3,328	3,370	3,409	3,448	3,489	3,528	3,568	3,609	3,649
Tompkins	2,152	2,166	2,225	2,278	2,303	2,329	2,353	2,379	2,404	2,428	2,454
Ulster	6,089	6,186	6,304	6,417	6,529	6,645	6,763	6,885	7,008	7,139	7,271
Westchester	72,762	73,381	74,157	75,176	76,032	76,912	77,830	78,760	79,706	80,686	81,695

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:											
	1/4	1/5	1/6	1/7	1/9				1/11				1/13			
Albany	12,593	12,852	13,112	13,410	13,969	(2,794)	[671]	{335}	14,542	(2,908)	[698]	{349}	15,141	(3,028)	[727]	{363}
Bronx	89,197	90,121	90,958	92,156	94,182	(18,836)	[4,521]	{2,260}	96,396	(19,279)	[4,627]	{2,314}	98,705	(19,741)	[4,738]	{2,369}
Dutchess	13,020	13,190	13,379	13,642	14,124	(2,825)	[678]	{339}	14,628	(2,926)	[702]	{351}	15,156	(3,031)	[727]	{364}
Erie	43,442	43,816	44,616	45,077	46,145	(9,229)	[2,215]	{1,107}	47,243	(9,449)	[2,268]	{1,134}	48,345	(9,669)	[2,321]	{1,160}
Kings	129,252	130,653	132,075	133,865	136,846	(27,369)	[6,569]	{3,284}	139,927	(27,985)	[6,717]	{3,358}	143,119	(28,624)	[6,870]	{3,435}
Monroe	36,258	36,705	37,330	38,053	39,282	(7,856)	[1,886]	{943}	40,525	(8,105)	[1,945]	{973}	41,799	(8,360)	[2,006]	{1,003}
Nassau	93,106	94,379	96,112	97,746	101,009	(20,202)	[4,848]	{2,424}	104,508	(20,902)	[5,016]	{2,508}	108,225	(21,645)	[5,195]	{2,597}
New York	63,434	64,189	64,781	65,687	67,042	(13,408)	[3,218]	{1,609}	68,422	(13,684)	[3,284]	{1,642}	69,861	(13,972)	[3,353]	{1,677}
Niagara	9,259	9,393	9,681	9,806	10,204	(2,041)	[490]	{245}	10,626	(2,125)	[510]	{255}	11,067	(2,213)	[531]	{266}
Onondaga	22,697	22,880	23,347	23,764	24,525	(4,905)	[1,177]	{589}	25,286	(5,057)	[1,214]	{607}	26,075	(5,215)	[1,252]	{626}
Orange	24,370	24,579	24,853	25,254	25,868	(5,174)	[1,242]	{621}	26,514	(5,303)	[1,273]	{636}	27,199	(5,440)	[1,306]	{653}
Putnam	5,162	5,235	5,320	5,436	5,633	(1,127)	[270]	{135}	5,845	(1,169)	[281]	{140}	6,070	(1,214)	[291]	{146}
Queens	131,464	133,083	134,670	136,465	139,811	(27,962)	[6,711]	{3,355}	143,305	(28,661)	[6,879]	{3,439}	147,057	(29,411)	[7,059]	{3,529}
Rensselaer	4,796	4,933	5,067	5,249	5,565	(1,113)	[267]	{134}	5,907	(1,181)	[284]	{142}	6,265	(1,253)	[301]	{150}
Richmond	37,042	37,680	38,243	38,891	40,080	(8,016)	[1,924]	{962}	41,368	(8,274)	[1,986]	{993}	42,723	(8,545)	[2,051]	{1,025}
Rockland	28,335	28,568	28,861	29,202	29,766	(5,953)	[1,429]	{714}	30,359	(6,072)	[1,457]	{729}	30,987	(6,197)	[1,487]	{744}
Saratoga	6,360	6,543	6,753	7,027	7,509	(1,502)	[360]	{180}	8,030	(1,606)	[385]	{193}	8,610	(1,722)	[413]	{207}
Schenectady	6,501	6,619	6,800	6,952	7,273	(1,455)	[349]	{175}	7,606	(1,521)	[365]	{183}	7,945	(1,589)	[381]	{191}
Suffolk	102,465	104,019	106,061	108,255	112,297	(22,459)	[5,390]	{2,695}	116,666	(23,333)	[5,600]	{2,800}	121,322	(24,264)	[5,823]	{2,912}
Sullivan	3,249	3,276	3,328	3,370	3,448	(690)	[166]	{83}	3,528	(706)	[169]	{85}	3,609	(722)	[173]	{87}
Tompkins	2,152	2,166	2,225	2,278	2,329	(466)	[112]	{56}	2,379	(476)	[114]	{57}	2,428	(486)	[117]	{58}
Ulster	6,089	6,186	6,304	6,417	6,645	(1,329)	[319]	{159}	6,885	(1,377)	[330]	{165}	7,139	(1,428)	[343]	{171}
Westchester	72,762	73,381	74,157	75,176	76,912	(15,382)	[3,692]	{1,846}	78,760	(15,752)	[3,780]	{1,890}	80,686	(16,137)	[3,873]	{1,936}

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.