

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

Date: 1/7/22

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 1/7/22 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.**

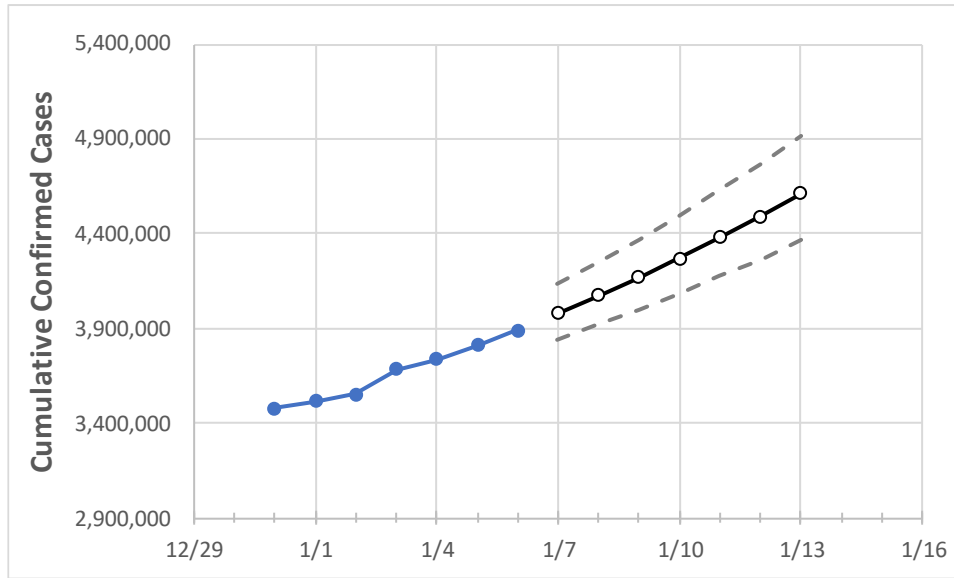
### IEM's Modeling Lead

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:							
	1/3	1/4	1/5	1/6	1/7	1/8	1/9	1/10	1/11	1/12	1/13	
New York	3,684,152	3,736,399	3,812,399	3,890,666	3,979,817	4,072,025	4,168,672	4,271,908	4,377,849	4,492,754	4,612,642	

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:						
	1/3	1/4	1/5	1/6	1/7	1/8	1/9	1/10	1/11	1/12	1/13
Albany	42,607	42,841	43,499	44,357	44,967	45,602	46,284	46,972	47,706	48,483	49,271
Bronx	295,914	302,120	309,787	316,241	326,256	336,717	347,794	359,692	372,029	385,011	398,642
Dutchess	47,719	48,429	49,214	50,003	50,865	51,754	52,704	53,721	54,778	55,873	57,023
Erie	154,817	156,851	159,282	161,690	164,194	166,890	169,677	172,691	175,754	179,119	182,541
Kings	504,248	512,207	524,070	535,325	551,036	567,302	584,371	602,462	621,177	641,264	662,402
Monroe	117,027	117,797	119,546	121,594	122,982	124,419	125,919	127,507	129,139	130,898	132,707
Nassau	313,601	317,907	323,887	330,870	338,494	346,410	354,701	363,325	372,417	381,861	391,652
New York	291,696	297,040	304,048	312,248	320,371	328,903	337,536	346,394	355,382	364,944	374,529
Niagara	35,656	36,113	36,636	37,272	37,787	38,336	38,915	39,509	40,128	40,784	41,460
Onondaga	73,874	74,960	76,730	78,104	79,374	80,745	82,212	83,677	85,292	87,003	88,755
Orange	80,058	81,122	82,989	84,287	86,046	87,829	89,716	91,744	93,867	96,091	98,414
Putnam	17,828	18,156	18,503	18,882	19,349	19,854	20,380	20,932	21,512	22,137	22,786
Queens	456,112	464,627	475,533	487,902	502,689	517,972	534,227	551,449	569,230	588,704	609,078
Rensselaer	21,915	22,025	22,423	22,852	23,141	23,445	23,758	24,080	24,421	24,772	25,135
Richmond	126,242	128,062	131,117	133,313	136,765	140,272	144,029	147,943	152,043	156,370	160,852
Rockland	69,935	71,182	72,914	74,264	75,950	77,785	79,696	81,740	83,891	86,205	88,630
Saratoga	32,202	32,415	33,075	33,850	34,374	34,904	35,461	36,035	36,639	37,276	37,919
Schenectady	23,418	23,552	24,044	24,442	24,795	25,138	25,505	25,886	26,304	26,726	27,179
Suffolk	337,149	340,955	347,300	354,277	361,106	368,205	375,630	383,303	391,332	399,810	408,597
Sullivan	12,906	13,080	13,435	13,722	14,014	14,325	14,653	14,987	15,343	15,717	16,112
Tompkins	11,932	11,963	12,168	12,531	12,658	12,781	12,903	13,022	13,158	13,278	13,398
Ulster	23,089	23,308	23,689	23,967	24,255	24,565	24,894	25,228	25,588	25,955	26,340
Westchester	192,288	194,964	198,900	203,075	207,397	211,882	216,640	221,648	226,878	232,385	238,219

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:											
	1/3	1/4	1/5	1/6	1/8			1/10			1/12					
Albany	42,607	42,841	43,499	44,357	45,602	(9,120)	[2,189]	{1,094}	46,972	(9,394)	[2,255]	{1,127}	48,483	(9,697)	[2,327]	{1,164}
Bronx	295,914	302,120	309,787	316,241	336,717	(67,343)	[16,162]	{8,081}	359,692	(71,938)	[17,265]	{8,633}	385,011	(77,002)	[18,481]	{9,240}
Dutchess	47,719	48,429	49,214	50,003	51,754	(10,351)	[2,484]	{1,242}	53,721	(10,744)	[2,579]	{1,289}	55,873	(11,175)	[2,682]	{1,341}
Erie	154,817	156,851	159,282	161,690	166,890	(33,378)	[8,011]	{4,005}	172,691	(34,538)	[8,289]	{4,145}	179,119	(35,824)	[8,598]	{4,299}
Kings	504,248	512,207	524,070	535,325	567,302	(113,460)	[27,230]	{13,615}	602,462	(120,492)	[28,918]	{14,459}	641,264	(128,253)	[30,781]	{15,390}
Monroe	117,027	117,797	119,546	121,594	124,419	(24,884)	[5,972]	{2,986}	127,507	(25,501)	[6,120]	{3,060}	130,898	(26,180)	[6,283]	{3,142}
Nassau	313,601	317,907	323,887	330,870	346,410	(69,282)	[16,628]	{8,314}	363,325	(72,665)	[17,440]	{8,720}	381,861	(76,372)	[18,329]	{9,165}
New York	291,696	297,040	304,048	312,248	328,903	(65,781)	[15,787]	{7,894}	346,394	(69,279)	[16,627]	{8,313}	364,944	(72,989)	[17,517]	{8,759}
Niagara	35,656	36,113	36,636	37,272	38,336	(7,667)	[1,840]	{920}	39,509	(7,902)	[1,896]	{948}	40,784	(8,157)	[1,958]	{979}
Onondaga	73,874	74,960	76,730	78,104	80,745	(16,149)	[3,876]	{1,938}	83,677	(16,735)	[4,017]	{2,008}	87,003	(17,401)	[4,176]	{2,088}
Orange	80,058	81,122	82,989	84,287	87,829	(17,566)	[4,216]	{2,108}	91,744	(18,349)	[4,404]	{2,202}	96,091	(19,218)	[4,612]	{2,306}
Putnam	17,828	18,156	18,503	18,882	19,854	(3,971)	[953]	{477}	20,932	(4,186)	[1,005]	{502}	22,137	(4,427)	[1,063]	{531}
Queens	456,112	464,627	475,533	487,902	517,972	(103,594)	[24,863]	{12,431}	551,449	(110,290)	[26,470]	{13,235}	588,704	(117,741)	[28,258]	{14,129}
Rensselaer	21,915	22,025	22,423	22,852	23,445	(4,689)	[1,125]	{563}	24,080	(4,816)	[1,156]	{578}	24,772	(4,954)	[1,189]	{595}
Richmond	126,242	128,062	131,117	133,313	140,272	(28,054)	[6,733]	{3,367}	147,943	(29,589)	[7,101]	{3,551}	156,370	(31,274)	[7,506]	{3,753}
Rockland	69,935	71,182	72,914	74,264	77,785	(15,557)	[3,734]	{1,867}	81,740	(16,348)	[3,924]	{1,962}	86,205	(17,241)	[4,138]	{2,069}
Saratoga	32,202	32,415	33,075	33,850	34,904	(6,981)	[1,675]	{838}	36,035	(7,207)	[1,730]	{865}	37,276	(7,455)	[1,789]	{895}
Schenectady	23,418	23,552	24,044	24,442	25,138	(5,028)	[1,207]	{603}	25,886	(5,177)	[1,243]	{621}	26,726	(5,345)	[1,283]	{641}
Suffolk	337,149	340,955	347,300	354,277	368,205	(73,641)	[17,674]	{8,837}	383,303	(76,661)	[18,399]	{9,199}	399,810	(79,962)	[19,191]	{9,595}
Sullivan	12,906	13,080	13,435	13,722	14,325	(2,865)	[688]	{344}	14,987	(2,997)	[719]	{360}	15,717	(3,143)	[754]	{377}
Tompkins	11,932	11,963	12,168	12,531	12,781	(2,556)	[613]	{307}	13,022	(2,604)	[625]	{313}	13,278	(2,656)	[637]	{319}
Ulster	23,089	23,308	23,689	23,967	24,565	(4,913)	[1,179]	{590}	25,228	(5,046)	[1,211]	{605}	25,955	(5,191)	[1,246]	{623}
Westchester	192,288	194,964	198,900	203,075	211,882	(42,376)	[10,170]	{5,085}	221,648	(44,330)	[10,639]	{5,320}	232,385	(46,477)	[11,154]	{5,577}

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.