

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

**Date: 12/27/21**

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 12/27/21 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.**

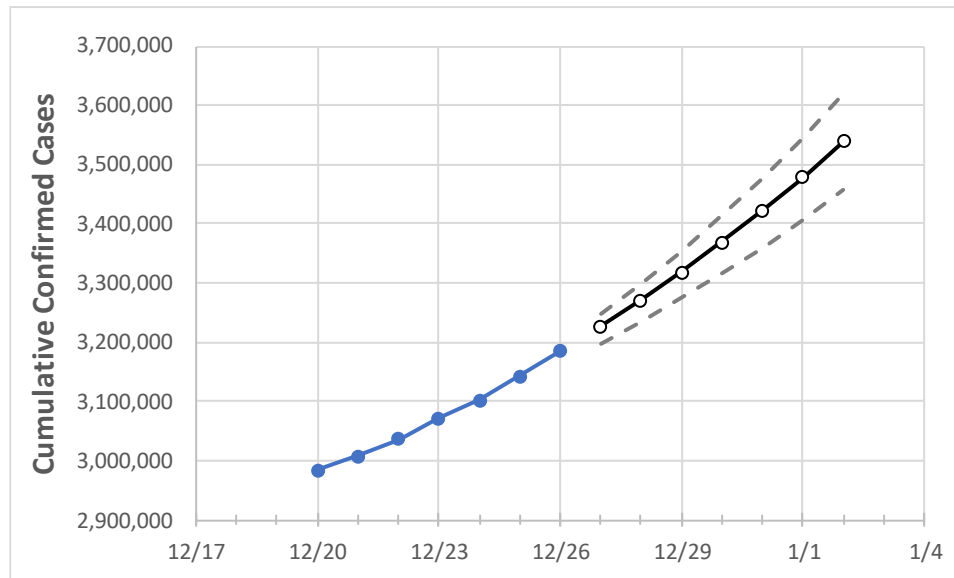
### **IEM's Modeling Lead**

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:						
	12/23	12/24	12/25	12/26	12/27	12/28	12/29	12/30	12/31	1/1	1/2
New York	3,070,884	3,102,022	3,143,197	3,184,372	3,226,045	3,270,720	3,318,796	3,369,165	3,422,616	3,479,019	3,538,803

*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:						
	12/23	12/24	12/25	12/26	12/27	12/28	12/29	12/30	12/31	1/1	1/2
Albany	38,391	38,669	38,914	39,158	39,401	39,652	39,907	40,170	40,439	40,719	40,999
Bronx	230,274	232,039	233,803	235,568	237,872	240,309	242,929	245,754	248,787	252,044	255,561
Dutchess	42,039	42,431	42,715	42,998	43,307	43,634	43,970	44,318	44,677	45,050	45,430
Erie	139,128	139,793	140,686	141,578	142,480	143,441	144,448	145,527	146,653	147,827	149,071
Kings	394,767	398,727	406,768	414,808	422,618	431,101	440,233	450,064	460,799	472,526	485,109
Monroe	108,043	108,554	108,996	109,437	109,836	110,256	110,656	111,065	111,466	111,875	112,277
Nassau	255,844	260,301	264,362	268,422	272,491	276,901	281,542	286,493	291,798	297,369	303,381
New York	220,457	227,858	234,342	240,826	248,839	257,549	266,907	277,073	288,227	300,305	313,437
Niagara	32,566	32,689	32,853	33,017	33,156	33,295	33,435	33,572	33,708	33,846	33,980
Onondaga	66,615	67,046	67,423	67,800	68,179	68,551	68,941	69,339	69,746	70,154	70,554
Orange	69,283	69,512	70,061	70,609	71,130	71,669	72,233	72,812	73,416	74,046	74,688
Putnam	14,811	15,020	15,057	15,093	15,221	15,357	15,496	15,643	15,797	15,954	16,122
Queens	359,276	360,959	367,614	374,268	379,526	385,287	391,392	398,099	405,333	413,148	421,561
Rensselaer	19,880	20,014	20,131	20,247	20,359	20,466	20,577	20,690	20,803	20,917	21,030
Richmond	102,068	103,271	104,953	106,635	108,076	109,629	111,263	113,061	114,939	116,950	119,108
Rockland	59,723	60,364	60,932	61,500	62,077	62,698	63,371	64,072	64,838	65,658	66,521
Saratoga	28,679	28,897	29,097	29,297	29,487	29,676	29,861	30,059	30,254	30,458	30,655
Schenectady	21,411	21,520	21,555	21,589	21,661	21,732	21,802	21,871	21,942	22,011	22,075
Suffolk	286,880	290,639	294,535	298,430	302,058	305,834	309,846	314,031	318,594	323,310	328,115
Sullivan	11,048	11,176	11,264	11,352	11,440	11,530	11,618	11,712	11,807	11,906	12,004
Tompkins	10,694	10,812	10,905	10,997	11,210	11,447	11,690	11,928	12,166	12,439	12,699
Ulster	21,150	21,275	21,385	21,494	21,605	21,716	21,828	21,943	22,063	22,181	22,303
Westchester	162,233	164,596	166,961	169,325	171,621	174,078	176,717	179,563	182,596	185,931	189,442

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:											
	12/23	12/24	12/25	12/26	12/28				12/30				1/1			
Albany	38,391	38,669	38,914	39,158	39,652	(7,930)	[1,903]	{952}	40,170	(8,034)	[1,928]	{964}	40,719	(8,144)	[1,955]	{977}
Bronx	230,274	232,039	233,803	235,568	240,309	(48,062)	[11,535]	{5,767}	245,754	(49,151)	[11,796]	{5,898}	252,044	(50,409)	[12,098]	{6,049}
Dutchess	42,039	42,431	42,715	42,998	43,634	(8,727)	[2,094]	{1,047}	44,318	(8,864)	[2,127]	{1,064}	45,050	(9,010)	[2,162]	{1,081}
Erie	139,128	139,793	140,686	141,578	143,441	(28,688)	[6,885]	{3,443}	145,527	(29,105)	[6,985]	{3,493}	147,827	(29,565)	[7,096]	{3,548}
Kings	394,767	398,727	406,768	414,808	431,101	(86,220)	[20,693]	{10,346}	450,064	(90,013)	[21,603]	{10,802}	472,526	(94,505)	[22,681]	{11,341}
Monroe	108,043	108,554	108,996	109,437	110,256	(22,051)	[5,292]	{2,646}	111,065	(22,213)	[5,331]	{2,666}	111,875	(22,375)	[5,370]	{2,685}
Nassau	255,844	260,301	264,362	268,422	276,901	(55,380)	[13,291]	{6,646}	286,493	(57,299)	[13,752]	{6,876}	297,369	(59,474)	[14,274]	{7,137}
New York	220,457	227,858	234,342	240,826	257,549	(51,510)	[12,362]	{6,181}	277,073	(55,415)	[13,300]	{6,650}	300,305	(60,061)	[14,415]	{7,207}
Niagara	32,566	32,689	32,853	33,017	33,295	(6,659)	[1,598]	{799}	33,572	(6,714)	[1,611]	{806}	33,846	(6,769)	[1,625]	{812}
Onondaga	66,615	67,046	67,423	67,800	68,551	(13,710)	[3,290]	{1,645}	69,339	(13,868)	[3,328]	{1,664}	70,154	(14,031)	[3,367]	{1,684}
Orange	69,283	69,512	70,061	70,609	71,669	(14,334)	[3,440]	{1,720}	72,812	(14,562)	[3,495]	{1,747}	74,046	(14,809)	[3,554]	{1,777}
Putnam	14,811	15,020	15,057	15,093	15,357	(3,071)	[737]	{369}	15,643	(3,129)	[751]	{375}	15,954	(3,191)	[766]	{383}
Queens	359,276	360,959	367,614	374,268	385,287	(77,057)	[18,494]	{9,247}	398,099	(79,620)	[19,109]	{9,554}	413,148	(82,630)	[19,831]	{9,916}
Rensselaer	19,880	20,014	20,131	20,247	20,466	(4,093)	[982]	{491}	20,690	(4,138)	[993]	{497}	20,917	(4,183)	[1,004]	{502}
Richmond	102,068	103,271	104,953	106,635	109,629	(21,926)	[5,262]	{2,631}	113,061	(22,612)	[5,427]	{2,713}	116,950	(23,390)	[5,614]	{2,807}
Rockland	59,723	60,364	60,932	61,500	62,698	(12,540)	[3,010]	{1,505}	64,072	(12,814)	[3,075]	{1,538}	65,658	(13,132)	[3,152]	{1,576}
Saratoga	28,679	28,897	29,097	29,297	29,676	(5,935)	[1,424]	{712}	30,059	(6,012)	[1,443]	{721}	30,458	(6,092)	[1,462]	{731}
Schenectady	21,411	21,520	21,555	21,589	21,732	(4,346)	[1,043]	{522}	21,871	(4,374)	[1,050]	{525}	22,011	(4,402)	[1,057]	{528}
Suffolk	286,880	290,639	294,535	298,430	305,834	(61,167)	[14,680]	{7,340}	314,031	(62,806)	[15,074]	{7,537}	323,310	(64,662)	[15,519]	{7,759}
Sullivan	11,048	11,176	11,264	11,352	11,530	(2,306)	[553]	{277}	11,712	(2,342)	[562]	{281}	11,906	(2,381)	[571]	{286}
Tompkins	10,694	10,812	10,905	10,997	11,447	(2,289)	[549]	{275}	11,928	(2,386)	[573]	{286}	12,439	(2,488)	[597]	{299}
Ulster	21,150	21,275	21,385	21,494	21,716	(4,343)	[1,042]	{521}	21,943	(4,389)	[1,053]	{527}	22,181	(4,436)	[1,065]	{532}
Westchester	162,233	164,596	166,961	169,325	174,078	(34,816)	[8,356]	{4,178}	179,563	(35,913)	[8,619]	{4,310}	185,931	(37,186)	[8,925]	{4,462}

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.