

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

Date: 12/8/20

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 12/8/20 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.**

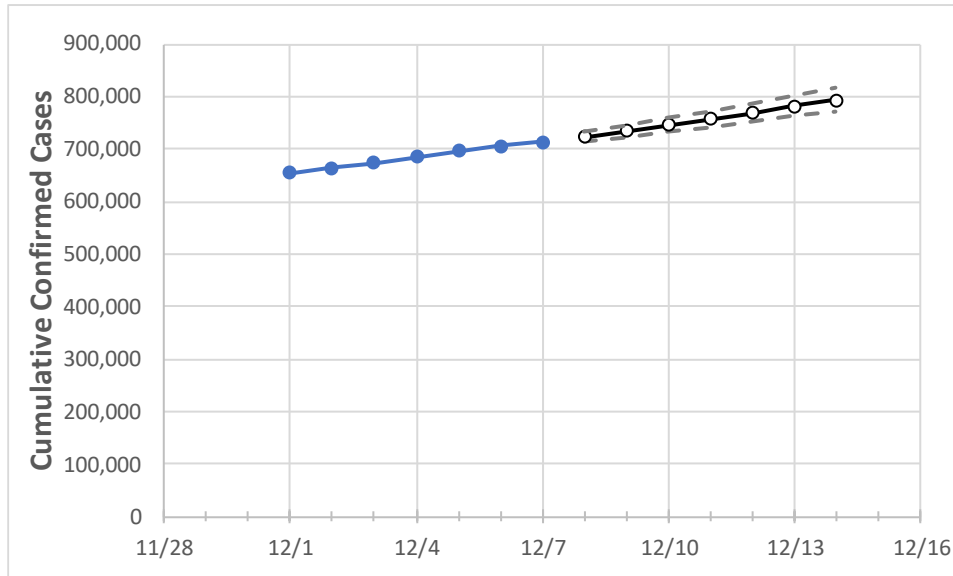
### IEM's Modeling Lead

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:						
	12/4	12/5	12/6	12/7	12/8	12/9	12/10	12/11	12/12	12/13	12/14
New York	685,364	696,125	705,827	713,129	723,368	734,005	745,054	756,530	768,450	780,828	793,683

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 20%, and are often within 10%, of actual confirmed cases.

## New York Counties

	Actual Confirmed Cases On:				Projected Cases For:							
	12/4	12/5	12/6	12/7	12/8	12/9	12/10	12/11	12/12	12/13	12/14	
Albany	6,406	6,571	6,711	6,818	6,976	7,140	7,312	7,491	7,679	7,874	8,078	
Bronx	66,128	66,682	67,257	67,754	68,358	68,986	69,639	70,318	71,023	71,757	72,519	
Dutchess	7,798	7,955	8,099	8,192	8,325	8,465	8,610	8,761	8,920	9,085	9,257	
Erie	27,903	28,681	29,337	29,720	30,398	31,093	31,805	32,534	33,281	34,045	34,828	
Kings	92,595	93,508	94,312	95,047	95,930	96,846	97,795	98,778	99,796	100,851	101,944	
Monroe	17,910	18,453	19,074	19,518	20,159	20,829	21,528	22,259	23,022	23,819	24,651	
Nassau	63,661	64,359	65,098	65,632	66,402	67,202	68,031	68,891	69,783	70,709	71,668	
New York	47,451	47,994	48,521	48,962	49,508	50,071	50,649	51,244	51,857	52,487	53,135	
Niagara	4,479	4,678	4,813	4,952	5,132	5,324	5,527	5,743	5,971	6,214	6,471	
Onondaga	11,933	12,358	12,662	12,941	13,239	13,547	13,864	14,191	14,527	14,874	15,232	
Orange	17,716	18,018	18,219	18,349	18,545	18,748	18,957	19,174	19,398	19,629	19,869	
Putnam	3,107	3,233	3,331	3,368	3,458	3,553	3,655	3,763	3,879	4,001	4,132	
Queens	93,723	94,584	95,446	96,267	97,183	98,135	99,125	100,154	101,225	102,337	103,494	
Rensselaer	1,968	2,034	2,100	2,145	2,207	2,272	2,341	2,414	2,492	2,574	2,660	
Richmond	24,753	25,111	25,470	25,741	26,152	26,580	27,025	27,489	27,972	28,474	28,997	
Rockland	22,421	22,633	22,800	22,897	23,068	23,243	23,421	23,602	23,788	23,977	24,170	
Saratoga	2,581	2,672	2,734	2,787	2,870	2,957	3,049	3,146	3,249	3,357	3,472	
Schenectady	2,819	2,957	3,032	3,081	3,177	3,281	3,391	3,508	3,633	3,767	3,910	
Suffolk	64,929	65,993	67,112	67,860	68,927	70,047	71,223	72,457	73,752	75,110	76,534	
Sullivan	2,261	2,288	2,302	2,315	2,332	2,350	2,368	2,386	2,405	2,424	2,444	
Tompkins	1,241	1,279	1,306	1,336	1,374	1,414	1,457	1,502	1,549	1,599	1,652	
Ulster	3,697	3,773	3,858	3,897	3,980	4,068	4,162	4,261	4,365	4,476	4,594	
Westchester	53,186	53,944	54,671	55,187	55,911	56,663	57,444	58,255	59,097	59,972	60,880	

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:											
	12/4	12/5	12/6	12/7	12/9			12/11			12/13					
Albany	6,406	6,571	6,711	6,818	7,140	(1,428)	[343]	{171}	7,491	(1,498)	[360]	{180}	7,874	(1,575)	[378]	{189}
Bronx	66,128	66,682	67,257	67,754	68,986	(13,797)	[3,311]	{1,656}	70,318	(14,064)	[3,375]	{1,688}	71,757	(14,351)	[3,444]	{1,722}
Dutchess	7,798	7,955	8,099	8,192	8,465	(1,693)	[406]	{203}	8,761	(1,752)	[421]	{210}	9,085	(1,817)	[436]	{218}
Erie	27,903	28,681	29,337	29,720	31,093	(6,219)	[1,492]	{746}	32,534	(6,507)	[1,562]	{781}	34,045	(6,809)	[1,634]	{817}
Kings	92,595	93,508	94,312	95,047	96,846	(19,369)	[4,649]	{2,324}	98,778	(19,756)	[4,741]	{2,371}	100,851	(20,170)	[4,841]	{2,420}
Monroe	17,910	18,453	19,074	19,518	20,829	(4,166)	[1,000]	{500}	22,259	(4,452)	[1,068]	{534}	23,819	(4,764)	[1,143]	{572}
Nassau	63,661	64,359	65,098	65,632	67,202	(13,440)	[3,226]	{1,613}	68,891	(13,778)	[3,307]	{1,653}	70,709	(14,142)	[3,394]	{1,697}
New York	47,451	47,994	48,521	48,962	50,071	(10,014)	[2,403]	{1,202}	51,244	(10,249)	[2,460]	{1,230}	52,487	(10,497)	[2,519]	{1,260}
Niagara	4,479	4,678	4,813	4,952	5,324	(1,065)	[256]	{128}	5,743	(1,149)	[276]	{138}	6,214	(1,243)	[298]	{149}
Onondaga	11,933	12,358	12,662	12,941	13,547	(2,709)	[650]	{325}	14,191	(2,838)	[681]	{341}	14,874	(2,975)	[714]	{357}
Orange	17,716	18,018	18,219	18,349	18,748	(3,750)	[900]	{450}	19,174	(3,835)	[920]	{460}	19,629	(3,926)	[942]	{471}
Putnam	3,107	3,233	3,331	3,368	3,553	(711)	[171]	{85}	3,763	(753)	[181]	{90}	4,001	(800)	[192]	{96}
Queens	93,723	94,584	95,446	96,267	98,135	(19,627)	[4,710]	{2,355}	100,154	(20,031)	[4,807]	{2,404}	102,337	(20,467)	[4,912]	{2,456}
Rensselaer	1,968	2,034	2,100	2,145	2,272	(454)	[109]	{55}	2,414	(483)	[116]	{58}	2,574	(515)	[124]	{62}
Richmond	24,753	25,111	25,470	25,741	26,580	(5,316)	[1,276]	{638}	27,489	(5,498)	[1,319]	{660}	28,474	(5,695)	[1,367]	{683}
Rockland	22,421	22,633	22,800	22,897	23,243	(4,649)	[1,116]	{558}	23,602	(4,720)	[1,133]	{566}	23,977	(4,795)	[1,151]	{575}
Saratoga	2,581	2,672	2,734	2,787	2,957	(591)	[142]	{71}	3,146	(629)	[151]	{76}	3,357	(671)	[161]	{81}
Schenectady	2,819	2,957	3,032	3,081	3,281	(656)	[157]	{79}	3,508	(702)	[168]	{84}	3,767	(753)	[181]	{90}
Suffolk	64,929	65,993	67,112	67,860	70,047	(14,009)	[3,362]	{1,681}	72,457	(14,491)	[3,478]	{1,739}	75,110	(15,022)	[3,605]	{1,803}
Sullivan	2,261	2,288	2,302	2,315	2,350	(470)	[113]	{56}	2,386	(477)	[115]	{57}	2,424	(485)	[116]	{58}
Tompkins	1,241	1,279	1,306	1,336	1,414	(283)	[68]	{34}	1,502	(300)	[72]	{36}	1,599	(320)	[77]	{38}
Ulster	3,697	3,773	3,858	3,897	4,068	(814)	[195]	{98}	4,261	(852)	[205]	{102}	4,476	(895)	[215]	{107}
Westchester	53,186	53,944	54,671	55,187	56,663	(11,333)	[2,720]	{1,360}	58,255	(11,651)	[2,796]	{1,398}	59,972	(11,994)	[2,879]	{1,439}

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.