

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

Date: 4/8/21

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 4/8/21 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.

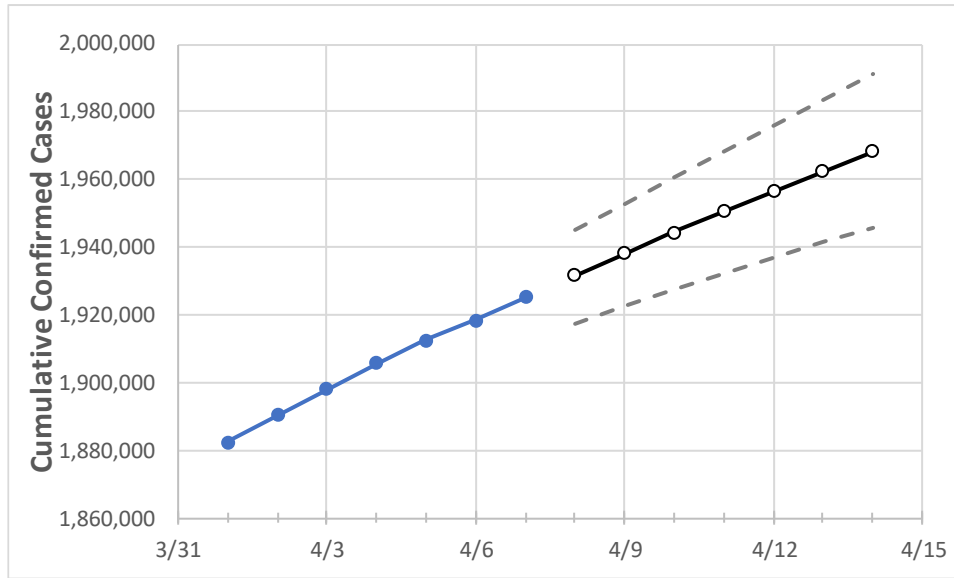
IEM's Modeling Lead

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:						
	4/4	4/5	4/6	4/7	4/8	4/9	4/10	4/11	4/12	4/13	4/14

New York 1,905,737 1,912,396 1,918,437 1,925,080 1,931,671 1,938,079 1,944,333 1,950,556 1,956,636 1,962,551 1,968,216

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:							
	4/4	4/5	4/6	4/7	4/8	4/9	4/10	4/11	4/12	4/13	4/14	
Albany	22,855	22,925	22,965	23,011	23,069	23,127	23,185	23,243	23,299	23,358	23,414	
Bronx	167,901	168,418	168,921	169,333	169,941	170,568	171,155	171,744	172,358	172,939	173,506	
Dutchess	26,573	26,680	26,776	26,899	27,015	27,130	27,244	27,359	27,470	27,580	27,690	
Erie	75,876	76,365	76,665	77,089	77,564	78,049	78,548	79,045	79,556	80,072	80,603	
Kings	251,097	252,049	253,120	254,022	254,971	255,899	256,798	257,668	258,526	259,367	260,184	
Monroe	57,538	57,780	57,911	58,139	58,353	58,572	58,795	59,019	59,253	59,486	59,721	
Nassau	170,179	170,680	171,185	171,738	172,301	172,859	173,406	173,950	174,480	175,017	175,541	
New York	125,851	126,316	126,686	127,213	127,698	128,177	128,639	129,084	129,522	129,954	130,372	
Niagara	16,900	17,014	17,076	17,156	17,259	17,368	17,484	17,605	17,733	17,868	18,007	
Onondaga	34,629	34,741	34,773	34,868	34,961	35,055	35,150	35,249	35,351	35,455	35,562	
Orange	44,048	44,185	44,370	44,565	44,753	44,942	45,127	45,311	45,491	45,668	45,846	
Putnam	9,729	9,757	9,786	9,835	9,882	9,928	9,976	10,023	10,071	10,120	10,168	
Queens	250,990	251,972	252,963	253,766	254,756	255,729	256,701	257,634	258,540	259,447	260,333	
Rensselaer	10,181	10,217	10,248	10,285	10,326	10,367	10,410	10,452	10,494	10,537	10,580	
Richmond	67,083	67,363	67,627	67,861	68,136	68,414	68,690	68,962	69,228	69,497	69,760	
Rockland	44,150	44,234	44,384	44,503	44,634	44,764	44,890	45,015	45,137	45,258	45,377	
Saratoga	13,668	13,713	13,752	13,826	13,891	13,956	14,023	14,091	14,160	14,230	14,300	
Schenectady	11,951	11,987	11,998	12,046	12,077	12,109	12,140	12,171	12,201	12,231	12,260	
Suffolk	185,345	185,911	186,487	187,149	187,816	188,477	189,131	189,781	190,425	191,059	191,688	
Sullivan	5,691	5,710	5,733	5,782	5,820	5,859	5,899	5,940	5,981	6,023	6,066	
Tompkins	3,944	3,951	3,956	3,965	3,974	3,983	3,991	3,999	4,007	4,015	4,022	
Ulster	12,271	12,322	12,378	12,437	12,500	12,562	12,623	12,684	12,745	12,803	12,861	
Westchester	121,507	121,803	122,066	122,412	122,836	123,263	123,689	124,112	124,540	124,967	125,402	

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:											
	4/4	4/5	4/6	4/7	4/9			4/11			4/13					
Albany	22,855	22,925	22,965	23,011	23,127	(4,625)	[1,110]	{555}	23,243	(4,649)	[1,116]	{558}	23,358	(4,672)	[1,121]	{561}
Bronx	167,901	168,418	168,921	169,333	170,568	(34,114)	[8,187]	{4,094}	171,744	(34,349)	[8,244]	{4,122}	172,939	(34,588)	[8,301]	{4,151}
Dutchess	26,573	26,680	26,776	26,899	27,130	(5,426)	[1,302]	{651}	27,359	(5,472)	[1,313]	{657}	27,580	(5,516)	[1,324]	{662}
Erie	75,876	76,365	76,665	77,089	78,049	(15,610)	[3,746]	{1,873}	79,045	(15,809)	[3,794]	{1,897}	80,072	(16,014)	[3,843]	{1,922}
Kings	251,097	252,049	253,120	254,022	255,899	(51,180)	[12,283]	{6,142}	257,668	(51,534)	[12,368]	{6,184}	259,367	(51,873)	[12,450]	{6,225}
Monroe	57,538	57,780	57,911	58,139	58,572	(11,714)	[2,811]	{1,406}	59,019	(11,804)	[2,833]	{1,416}	59,486	(11,897)	[2,855]	{1,428}
Nassau	170,179	170,680	171,185	171,738	172,859	(34,572)	[8,297]	{4,149}	173,950	(34,790)	[8,350]	{4,175}	175,017	(35,003)	[8,401]	{4,200}
New York	125,851	126,316	126,686	127,213	128,177	(25,635)	[6,153]	{3,076}	129,084	(25,817)	[6,196]	{3,098}	129,954	(25,991)	[6,238]	{3,119}
Niagara	16,900	17,014	17,076	17,156	17,368	(3,474)	[834]	{417}	17,605	(3,521)	[845]	{423}	17,868	(3,574)	[858]	{429}
Onondaga	34,629	34,741	34,773	34,868	35,055	(7,011)	[1,683]	{841}	35,249	(7,050)	[1,692]	{846}	35,455	(7,091)	[1,702]	{851}
Orange	44,048	44,185	44,370	44,565	44,942	(8,988)	[2,157]	{1,079}	45,311	(9,062)	[2,175]	{1,087}	45,668	(9,134)	[2,192]	{1,096}
Putnam	9,729	9,757	9,786	9,835	9,928	(1,986)	[477]	{238}	10,023	(2,005)	[481]	{241}	10,120	(2,024)	[486]	{243}
Queens	250,990	251,972	252,963	253,766	255,729	(51,146)	[12,275]	{6,137}	257,634	(51,527)	[12,366]	{6,183}	259,447	(51,889)	[12,453]	{6,227}
Rensselaer	10,181	10,217	10,248	10,285	10,367	(2,073)	[498]	{249}	10,452	(2,090)	[502]	{251}	10,537	(2,107)	[506]	{253}
Richmond	67,083	67,363	67,627	67,861	68,414	(13,683)	[3,284]	{1,642}	68,962	(13,792)	[3,310]	{1,655}	69,497	(13,899)	[3,336]	{1,668}
Rockland	44,150	44,234	44,384	44,503	44,764	(8,953)	[2,149]	{1,074}	45,015	(9,003)	[2,161]	{1,080}	45,258	(9,052)	[2,172]	{1,086}
Saratoga	13,668	13,713	13,752	13,826	13,956	(2,791)	[670]	{335}	14,091	(2,818)	[676]	{338}	14,230	(2,846)	[683]	{342}
Schenectady	11,951	11,987	11,998	12,046	12,109	(2,422)	[581]	{291}	12,171	(2,434)	[584]	{292}	12,231	(2,446)	[587]	{294}
Suffolk	185,345	185,911	186,487	187,149	188,477	(37,695)	[9,047]	{4,523}	189,781	(37,956)	[9,109]	{4,555}	191,059	(38,212)	[9,171]	{4,585}
Sullivan	5,691	5,710	5,733	5,782	5,859	(1,172)	[281]	{141}	5,940	(1,188)	[285]	{143}	6,023	(1,205)	[289]	{145}
Tompkins	3,944	3,951	3,956	3,965	3,983	(797)	[191]	{96}	3,999	(800)	[192]	{96}	4,015	(803)	[193]	{96}
Ulster	12,271	12,322	12,378	12,437	12,562	(2,512)	[603]	{301}	12,684	(2,537)	[609]	{304}	12,803	(2,561)	[615]	{307}
Westchester	121,507	121,803	122,066	122,412	123,263	(24,653)	[5,917]	{2,958}	124,112	(24,822)	[5,957]	{2,979}	124,967	(24,993)	[5,998]	{2,999}

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