

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

Date: 4/16/21

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 4/16/21 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.

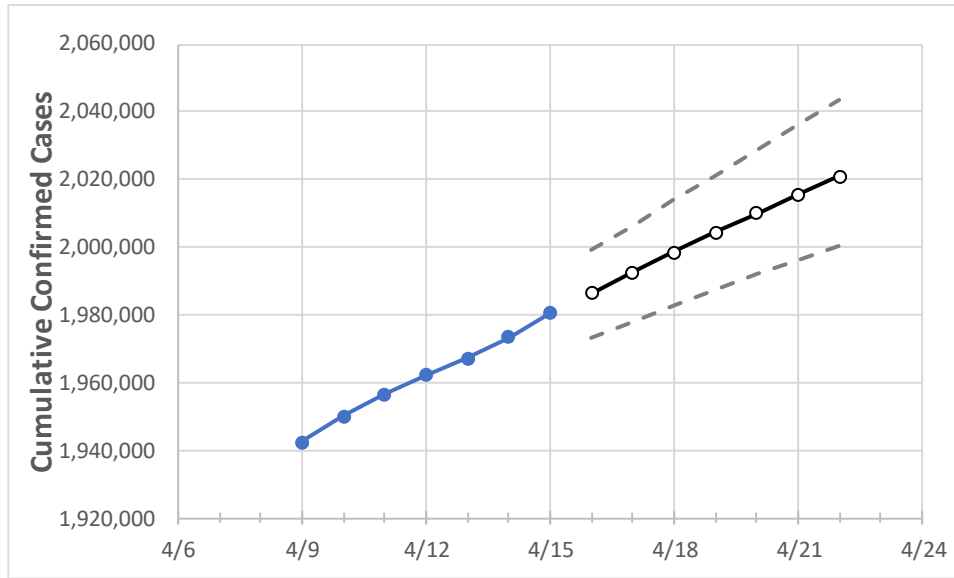
IEM's Modeling Lead

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:						
	4/12	4/13	4/14	4/15	4/16	4/17	4/18	4/19	4/20	4/21	4/22

New York 1,962,225 1,967,248 1,973,308 1,980,337 1,986,417 1,992,480 1,998,358 2,004,328 2,010,031 2,015,568 2,021,051

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:							
	4/12	4/13	4/14	4/15	4/16	4/17	4/18	4/19	4/20	4/21	4/22	
Albany	23,323	23,368	23,409	23,473	23,527	23,581	23,634	23,686	23,736	23,789	23,840	
Bronx	172,365	172,746	173,109	173,562	174,045	174,510	174,968	175,415	175,848	176,275	176,700	
Dutchess	27,449	27,510	27,616	27,720	27,814	27,907	27,999	28,090	28,181	28,268	28,353	
Erie	79,580	79,959	80,556	81,141	81,693	82,253	82,823	83,400	83,982	84,580	85,183	
Kings	259,343	260,063	261,181	262,111	263,014	263,914	264,791	265,668	266,520	267,362	268,185	
Monroe	59,539	59,738	59,944	60,325	60,619	60,923	61,234	61,555	61,889	62,235	62,591	
Nassau	174,673	175,023	175,392	175,919	176,409	176,884	177,354	177,811	178,264	178,706	179,145	
New York	129,781	130,055	130,384	130,787	131,176	131,556	131,919	132,266	132,619	132,957	133,272	
Niagara	17,712	17,780	17,888	17,999	18,124	18,253	18,389	18,528	18,672	18,822	18,977	
Onondaga	35,415	35,490	35,576	35,694	35,805	35,917	36,033	36,149	36,269	36,391	36,518	
Orange	45,320	45,423	45,583	45,755	45,895	46,034	46,171	46,304	46,434	46,559	46,682	
Putnam	10,023	10,052	10,079	10,113	10,148	10,183	10,217	10,251	10,284	10,317	10,349	
Queens	258,984	259,732	260,418	261,301	262,126	262,942	263,738	264,510	265,250	266,002	266,730	
Rensselaer	10,465	10,495	10,526	10,567	10,602	10,637	10,671	10,706	10,740	10,774	10,808	
Richmond	69,440	69,620	69,867	70,089	70,340	70,586	70,829	71,067	71,304	71,537	71,769	
Rockland	45,148	45,245	45,345	45,439	45,547	45,653	45,757	45,859	45,961	46,059	46,154	
Saratoga	14,122	14,167	14,222	14,292	14,354	14,417	14,479	14,542	14,604	14,666	14,729	
Schenectady	12,228	12,252	12,289	12,332	12,366	12,399	12,434	12,467	12,501	12,535	12,568	
Suffolk	190,463	190,889	191,379	192,006	192,576	193,138	193,692	194,233	194,786	195,321	195,845	
Sullivan	5,958	5,989	6,032	6,061	6,098	6,135	6,171	6,208	6,245	6,283	6,320	
Tompkins	4,000	4,003	4,019	4,034	4,041	4,048	4,055	4,062	4,069	4,075	4,081	
Ulster	12,755	12,791	12,835	12,882	12,932	12,981	13,029	13,076	13,122	13,168	13,212	
Westchester	124,092	124,317	124,535	124,881	125,164	125,443	125,721	125,985	126,246	126,506	126,760	

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:											
	4/12	4/13	4/14	4/15	4/17				4/19				4/21			
Albany	23,323	23,368	23,409	23,473	23,581	(4,716)	[1,132]	{566}	23,686	(4,737)	[1,137]	{568}	23,789	(4,758)	[1,142]	{571}
Bronx	172,365	172,746	173,109	173,562	174,510	(34,902)	[8,376]	{4,188}	175,415	(35,083)	[8,420]	{4,210}	176,275	(35,255)	[8,461]	{4,231}
Dutchess	27,449	27,510	27,616	27,720	27,907	(5,581)	[1,340]	{670}	28,090	(5,618)	[1,348]	{674}	28,268	(5,654)	[1,357]	{678}
Erie	79,580	79,959	80,556	81,141	82,253	(16,451)	[3,948]	{1,974}	83,400	(16,680)	[4,003]	{2,002}	84,580	(16,916)	[4,060]	{2,030}
Kings	259,343	260,063	261,181	262,111	263,914	(52,783)	[12,668]	{6,334}	265,668	(53,134)	[12,752]	{6,376}	267,362	(53,472)	[12,833]	{6,417}
Monroe	59,539	59,738	59,944	60,325	60,923	(12,185)	[2,924]	{1,462}	61,555	(12,311)	[2,955]	{1,477}	62,235	(12,447)	[2,987]	{1,494}
Nassau	174,673	175,023	175,392	175,919	176,884	(35,377)	[8,490]	{4,245}	177,811	(35,562)	[8,535]	{4,267}	178,706	(35,741)	[8,578]	{4,289}
New York	129,781	130,055	130,384	130,787	131,556	(26,311)	[6,315]	{3,157}	132,266	(26,453)	[6,349]	{3,174}	132,957	(26,591)	[6,382]	{3,191}
Niagara	17,712	17,780	17,888	17,999	18,253	(3,651)	[876]	{438}	18,528	(3,706)	[889]	{445}	18,822	(3,764)	[903]	{452}
Onondaga	35,415	35,490	35,576	35,694	35,917	(7,183)	[1,724]	{862}	36,149	(7,230)	[1,735]	{868}	36,391	(7,278)	[1,747]	{873}
Orange	45,320	45,423	45,583	45,755	46,034	(9,207)	[2,210]	{1,105}	46,304	(9,261)	[2,223]	{1,111}	46,559	(9,312)	[2,235]	{1,117}
Putnam	10,023	10,052	10,079	10,113	10,183	(2,037)	[489]	{244}	10,251	(2,050)	[492]	{246}	10,317	(2,063)	[495]	{248}
Queens	258,984	259,732	260,418	261,301	262,942	(52,588)	[12,621]	{6,311}	264,510	(52,902)	[12,696]	{6,348}	266,002	(53,200)	[12,768]	{6,384}
Rensselaer	10,465	10,495	10,526	10,567	10,637	(2,127)	[511]	{255}	10,706	(2,141)	[514]	{257}	10,774	(2,155)	[517]	{259}
Richmond	69,440	69,620	69,867	70,089	70,586	(14,117)	[3,388]	{1,694}	71,067	(14,213)	[3,411]	{1,706}	71,537	(14,307)	[3,434]	{1,717}
Rockland	45,148	45,245	45,345	45,439	45,653	(9,131)	[2,191]	{1,096}	45,859	(9,172)	[2,201]	{1,101}	46,059	(9,212)	[2,211]	{1,105}
Saratoga	14,122	14,167	14,222	14,292	14,417	(2,883)	[692]	{346}	14,542	(2,908)	[698]	{349}	14,666	(2,933)	[704]	{352}
Schenectady	12,228	12,252	12,289	12,332	12,399	(2,480)	[595]	{298}	12,467	(2,493)	[598]	{299}	12,535	(2,507)	[602]	{301}
Suffolk	190,463	190,889	191,379	192,006	193,138	(38,628)	[9,271]	{4,635}	194,233	(38,847)	[9,323]	{4,662}	195,321	(39,064)	[9,375]	{4,688}
Sullivan	5,958	5,989	6,032	6,061	6,135	(1,227)	[294]	{147}	6,208	(1,242)	[298]	{149}	6,283	(1,257)	[302]	{151}
Tompkins	4,000	4,003	4,019	4,034	4,048	(810)	[194]	{97}	4,062	(812)	[195]	{97}	4,075	(815)	[196]	{98}
Ulster	12,755	12,791	12,835	12,882	12,981	(2,596)	[623]	{312}	13,076	(2,615)	[628]	{314}	13,168	(2,634)	[632]	{316}
Westchester	124,092	124,317	124,535	124,881	125,443	(25,089)	[6,021]	{3,011}	125,985	(25,197)	[6,047]	{3,024}	126,506	(25,301)	[6,072]	{3,036}

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.