

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

Date: 4/9/21

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 4/9/21 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.

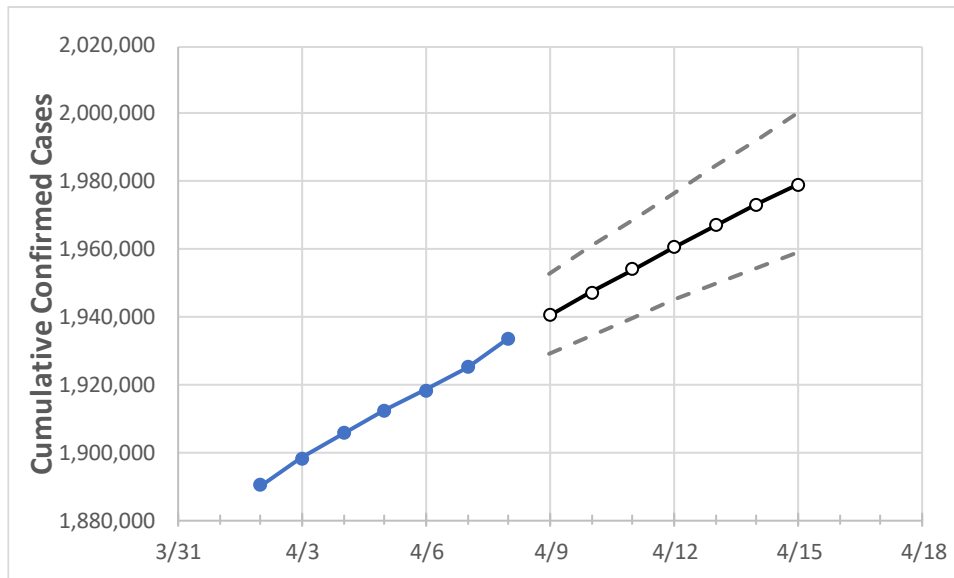
IEM's Modeling Lead

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:						
	4/5	4/6	4/7	4/8	4/9	4/10	4/11	4/12	4/13	4/14	4/15

New York	1,912,396	1,918,437	1,925,080	1,933,807	1,940,598	1,947,302	1,954,029	1,960,493	1,966,917	1,973,217	1,979,273
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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:						
	4/5	4/6	4/7	4/8	4/9	4/10	4/11	4/12	4/13	4/14	4/15
Albany	22,925	22,965	23,011	23,079	23,138	23,197	23,257	23,316	23,374	23,434	23,493
Bronx	168,418	168,921	169,333	170,032	170,625	171,232	171,814	172,381	172,942	173,496	174,039
Dutchess	26,680	26,776	26,899	27,032	27,151	27,267	27,383	27,498	27,611	27,726	27,839
Erie	76,365	76,665	77,089	77,615	78,119	78,627	79,151	79,678	80,219	80,775	81,334
Kings	252,049	253,120	254,022	255,210	256,178	257,117	258,031	258,949	259,833	260,708	261,568
Monroe	57,780	57,911	58,139	58,455	58,705	58,960	59,225	59,498	59,779	60,065	60,360
Nassau	170,680	171,185	171,738	172,548	173,168	173,786	174,397	175,008	175,622	176,232	176,846
New York	126,316	126,686	127,213	127,817	128,299	128,768	129,229	129,686	130,127	130,564	130,972
Niagara	17,014	17,076	17,156	17,266	17,376	17,494	17,618	17,749	17,888	18,033	18,185
Onondaga	34,741	34,773	34,868	35,014	35,122	35,234	35,349	35,466	35,586	35,712	35,841
Orange	44,185	44,370	44,565	44,693	44,870	45,042	45,211	45,381	45,545	45,707	45,863
Putnam	9,757	9,786	9,835	9,890	9,938	9,987	10,036	10,085	10,134	10,184	10,233
Queens	251,972	252,963	253,766	255,044	256,085	257,090	258,100	259,100	260,099	261,065	262,030
Rensselaer	10,217	10,248	10,285	10,317	10,357	10,398	10,439	10,479	10,520	10,561	10,603
Richmond	67,363	67,627	67,861	68,283	68,586	68,880	69,179	69,481	69,776	70,068	70,362
Rockland	44,234	44,384	44,503	44,642	44,775	44,907	45,037	45,165	45,293	45,420	45,544
Saratoga	13,713	13,752	13,826	13,875	13,938	14,001	14,066	14,131	14,197	14,263	14,329
Schenectady	11,987	11,998	12,046	12,088	12,122	12,154	12,187	12,221	12,254	12,286	12,319
Suffolk	185,911	186,487	187,149	188,074	188,798	189,522	190,231	190,955	191,678	192,401	193,128
Sullivan	5,710	5,733	5,782	5,819	5,858	5,899	5,940	5,981	6,023	6,067	6,111
Tompkins	3,951	3,956	3,965	3,971	3,980	3,988	3,996	4,004	4,012	4,019	4,026
Ulster	12,322	12,378	12,437	12,502	12,563	12,622	12,682	12,740	12,797	12,853	12,908
Westchester	121,803	122,066	122,412	122,780	123,169	123,566	123,958	124,353	124,745	125,144	125,535

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:											
	4/5	4/6	4/7	4/8	4/10				4/12				4/14			
Albany	22,925	22,965	23,011	23,079	23,197	(4,639)	[1,113]	{557}	23,316	(4,663)	[1,119]	{560}	23,434	(4,687)	[1,125]	{562}
Bronx	168,418	168,921	169,333	170,032	171,232	(34,246)	[8,219]	{4,110}	172,381	(34,476)	[8,274]	{4,137}	173,496	(34,699)	[8,328]	{4,164}
Dutchess	26,680	26,776	26,899	27,032	27,267	(5,453)	[1,309]	{654}	27,498	(5,500)	[1,320]	{660}	27,726	(5,545)	[1,331]	{665}
Erie	76,365	76,665	77,089	77,615	78,627	(15,725)	[3,774]	{1,887}	79,678	(15,936)	[3,825]	{1,912}	80,775	(16,155)	[3,877]	{1,939}
Kings	252,049	253,120	254,022	255,210	257,117	(51,423)	[12,342]	{6,171}	258,949	(51,790)	[12,430]	{6,215}	260,708	(52,142)	[12,514]	{6,257}
Monroe	57,780	57,911	58,139	58,455	58,960	(11,792)	[2,830]	{1,415}	59,498	(11,900)	[2,856]	{1,428}	60,065	(12,013)	[2,883]	{1,442}
Nassau	170,680	171,185	171,738	172,548	173,786	(34,757)	[8,342]	{4,171}	175,008	(35,002)	[8,400]	{4,200}	176,232	(35,246)	[8,459]	{4,230}
New York	126,316	126,686	127,213	127,817	128,768	(25,754)	[6,181]	{3,090}	129,686	(25,937)	[6,225]	{3,112}	130,564	(26,113)	[6,267]	{3,134}
Niagara	17,014	17,076	17,156	17,266	17,494	(3,499)	[840]	{420}	17,749	(3,550)	[852]	{426}	18,033	(3,607)	[866]	{433}
Onondaga	34,741	34,773	34,868	35,014	35,234	(7,047)	[1,691]	{846}	35,466	(7,093)	[1,702]	{851}	35,712	(7,142)	[1,714]	{857}
Orange	44,185	44,370	44,565	44,693	45,042	(9,008)	[2,162]	{1,081}	45,381	(9,076)	[2,178]	{1,089}	45,707	(9,141)	[2,194]	{1,097}
Putnam	9,757	9,786	9,835	9,890	9,987	(1,997)	[479]	{240}	10,085	(2,017)	[484]	{242}	10,184	(2,037)	[489]	{244}
Queens	251,972	252,963	253,766	255,044	257,090	(51,418)	[12,340]	{6,170}	259,100	(51,820)	[12,437]	{6,218}	261,065	(52,213)	[12,531]	{6,266}
Rensselaer	10,217	10,248	10,285	10,317	10,398	(2,080)	[499]	{250}	10,479	(2,096)	[503]	{251}	10,561	(2,112)	[507]	{253}
Richmond	67,363	67,627	67,861	68,283	68,880	(13,776)	[3,306]	{1,653}	69,481	(13,896)	[3,335]	{1,668}	70,068	(14,014)	[3,363]	{1,682}
Rockland	44,234	44,384	44,503	44,642	44,907	(8,981)	[2,156]	{1,078}	45,165	(9,033)	[2,168]	{1,084}	45,420	(9,084)	[2,180]	{1,090}
Saratoga	13,713	13,752	13,826	13,875	14,001	(2,800)	[672]	{336}	14,131	(2,826)	[678]	{339}	14,263	(2,853)	[685]	{342}
Schenectady	11,987	11,998	12,046	12,088	12,154	(2,431)	[583]	{292}	12,221	(2,444)	[587]	{293}	12,286	(2,457)	[590]	{295}
Suffolk	185,911	186,487	187,149	188,074	189,522	(37,904)	[9,097]	{4,549}	190,955	(38,191)	[9,166]	{4,583}	192,401	(38,480)	[9,235]	{4,618}
Sullivan	5,710	5,733	5,782	5,819	5,899	(1,180)	[283]	{142}	5,981	(1,196)	[287]	{144}	6,067	(1,213)	[291]	{146}
Tompkins	3,951	3,956	3,965	3,971	3,988	(798)	[191]	{96}	4,004	(801)	[192]	{96}	4,019	(804)	[193]	{96}
Ulster	12,322	12,378	12,437	12,502	12,622	(2,524)	[606]	{303}	12,740	(2,548)	[612]	{306}	12,853	(2,571)	[617]	{308}
Westchester	121,803	122,066	122,412	122,780	123,566	(24,713)	[5,931]	{2,966}	124,353	(24,871)	[5,969]	{2,984}	125,144	(25,029)	[6,007]	{3,003}

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.