

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

Date: 4/21/21

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 4/21/21 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.

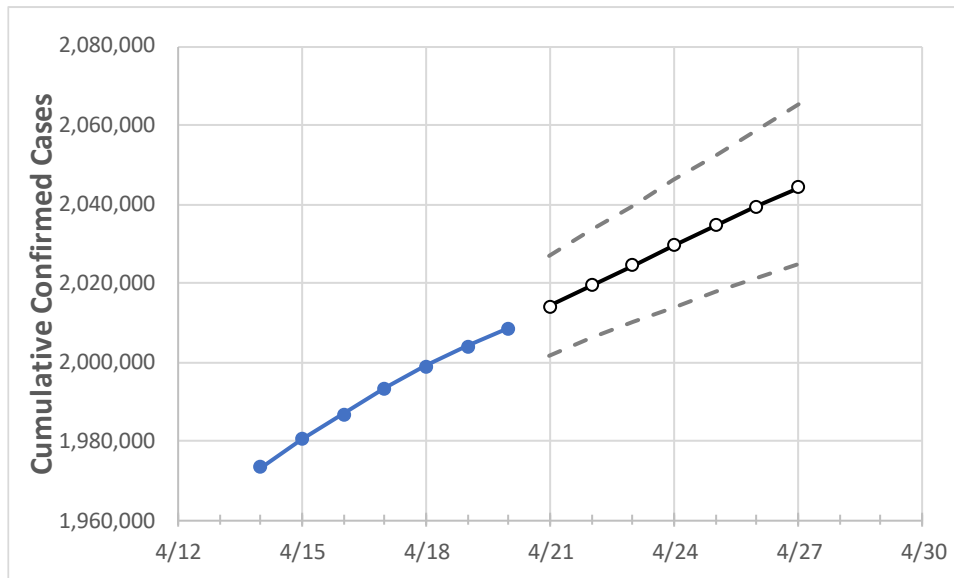
IEM's Modeling Lead

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:						
	4/17	4/18	4/19	4/20	4/21	4/22	4/23	4/24	4/25	4/26	4/27

New York 1,993,271 1,998,912 2,003,938 2,008,514 2,014,038 2,019,433 2,024,587 2,029,633 2,034,568 2,039,403 2,044,170

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:						
	4/17	4/18	4/19	4/20	4/21	4/22	4/23	4/24	4/25	4/26	4/27
Albany	23,609	23,679	23,718	23,772	23,826	23,880	23,934	23,987	24,042	24,095	24,149
Bronx	174,406	174,852	175,323	175,767	176,161	176,547	176,928	177,301	177,663	178,017	178,353
Dutchess	27,902	27,982	28,027	28,092	28,167	28,239	28,310	28,378	28,443	28,505	28,567
Erie	82,158	82,588	82,901	83,198	83,660	84,116	84,585	85,041	85,502	85,963	86,417
Kings	263,918	264,753	265,709	266,498	267,338	268,168	268,995	269,797	270,579	271,366	272,132
Monroe	60,881	61,114	61,314	61,493	61,767	62,047	62,326	62,616	62,910	63,204	63,509
Nassau	177,001	177,344	177,656	177,933	178,327	178,712	179,088	179,449	179,797	180,138	180,470
New York	131,895	132,296	132,551	132,760	133,096	133,419	133,734	134,039	134,339	134,633	134,918
Niagara	18,211	18,314	18,367	18,436	18,539	18,640	18,745	18,848	18,954	19,058	19,164
Onondaga	35,941	36,061	36,119	36,191	36,295	36,399	36,503	36,606	36,712	36,820	36,927
Orange	46,021	46,133	46,223	46,304	46,409	46,510	46,610	46,706	46,797	46,885	46,970
Putnam	10,186	10,217	10,231	10,245	10,270	10,294	10,317	10,339	10,360	10,380	10,401
Queens	262,764	263,513	264,360	265,118	265,836	266,527	267,207	267,860	268,497	269,127	269,750
Rensselaer	10,642	10,679	10,709	10,726	10,757	10,786	10,816	10,846	10,875	10,904	10,932
Richmond	70,501	70,701	70,965	71,196	71,413	71,626	71,837	72,040	72,238	72,430	72,618
Rockland	45,651	45,700	45,739	45,795	45,869	45,940	46,007	46,074	46,139	46,202	46,262
Saratoga	14,380	14,418	14,454	14,477	14,520	14,562	14,602	14,642	14,682	14,720	14,760
Schenectady	12,395	12,420	12,435	12,457	12,485	12,513	12,540	12,567	12,593	12,620	12,646
Suffolk	193,151	193,546	193,919	194,209	194,656	195,084	195,501	195,906	196,297	196,677	197,047
Sullivan	6,126	6,153	6,167	6,192	6,220	6,248	6,275	6,302	6,329	6,355	6,381
Tompkins	4,050	4,058	4,064	4,066	4,071	4,076	4,082	4,086	4,091	4,095	4,099
Ulster	12,972	13,039	13,082	13,116	13,158	13,199	13,239	13,277	13,314	13,349	13,385
Westchester	125,487	125,726	125,913	126,094	126,317	126,534	126,746	126,947	127,147	127,343	127,534

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:											
	4/17	4/18	4/19	4/20	4/22			4/24			4/26					
Albany	23,609	23,679	23,718	23,772	23,880	(4,776)	[1,146]	{573}	23,987	(4,797)	[1,151]	{576}	24,095	(4,819)	[1,157]	{578}
Bronx	174,406	174,852	175,323	175,767	176,547	(35,309)	[8,474]	{4,237}	177,301	(35,460)	[8,510]	{4,255}	178,017	(35,603)	[8,545]	{4,272}
Dutchess	27,902	27,982	28,027	28,092	28,239	(5,648)	[1,355]	{678}	28,378	(5,676)	[1,362]	{681}	28,505	(5,701)	[1,368]	{684}
Erie	82,158	82,588	82,901	83,198	84,116	(16,823)	[4,038]	{2,019}	85,041	(17,008)	[4,082]	{2,041}	85,963	(17,193)	[4,126]	{2,063}
Kings	263,918	264,753	265,709	266,498	268,168	(53,634)	[12,872]	{6,436}	269,797	(53,959)	[12,950]	{6,475}	271,366	(54,273)	[13,026]	{6,513}
Monroe	60,881	61,114	61,314	61,493	62,047	(12,409)	[2,978]	{1,489}	62,616	(12,523)	[3,006]	{1,503}	63,204	(12,641)	[3,034]	{1,517}
Nassau	177,001	177,344	177,656	177,933	178,712	(35,742)	[8,578]	{4,289}	179,449	(35,890)	[8,614]	{4,307}	180,138	(36,028)	[8,647]	{4,323}
New York	131,895	132,296	132,551	132,760	133,419	(26,684)	[6,404]	{3,202}	134,039	(26,808)	[6,434]	{3,217}	134,633	(26,927)	[6,462]	{3,231}
Niagara	18,211	18,314	18,367	18,436	18,640	(3,728)	[895]	{447}	18,848	(3,770)	[905]	{452}	19,058	(3,812)	[915]	{457}
Onondaga	35,941	36,061	36,119	36,191	36,399	(7,280)	[1,747]	{874}	36,606	(7,321)	[1,757]	{879}	36,820	(7,364)	[1,767]	{884}
Orange	46,021	46,133	46,223	46,304	46,510	(9,302)	[2,232]	{1,116}	46,706	(9,341)	[2,242]	{1,121}	46,885	(9,377)	[2,250]	{1,125}
Putnam	10,186	10,217	10,231	10,245	10,294	(2,059)	[494]	{247}	10,339	(2,068)	[496]	{248}	10,380	(2,076)	[498]	{249}
Queens	262,764	263,513	264,360	265,118	266,527	(53,305)	[12,793]	{6,397}	267,860	(53,572)	[12,857]	{6,429}	269,127	(53,825)	[12,918]	{6,459}
Rensselaer	10,642	10,679	10,709	10,726	10,786	(2,157)	[518]	{259}	10,846	(2,169)	[521]	{260}	10,904	(2,181)	[523]	{262}
Richmond	70,501	70,701	70,965	71,196	71,626	(14,325)	[3,438]	{1,719}	72,040	(14,408)	[3,458]	{1,729}	72,430	(14,486)	[3,477]	{1,738}
Rockland	45,651	45,700	45,739	45,795	45,940	(9,188)	[2,205]	{1,103}	46,074	(9,215)	[2,212]	{1,106}	46,202	(9,240)	[2,218]	{1,109}
Saratoga	14,380	14,418	14,454	14,477	14,562	(2,912)	[699]	{349}	14,642	(2,928)	[703]	{351}	14,720	(2,944)	[707]	{353}
Schenectady	12,395	12,420	12,435	12,457	12,513	(2,503)	[601]	{300}	12,567	(2,513)	[603]	{302}	12,620	(2,524)	[606]	{303}
Suffolk	193,151	193,546	193,919	194,209	195,084	(39,017)	[9,364]	{4,682}	195,906	(39,181)	[9,403]	{4,702}	196,777	(39,335)	[9,441]	{4,720}
Sullivan	6,126	6,153	6,167	6,192	6,248	(1,250)	[300]	{150}	6,302	(1,260)	[303]	{151}	6,355	(1,271)	[305]	{153}
Tompkins	4,050	4,058	4,064	4,066	4,076	(815)	[196]	{98}	4,086	(817)	[196]	{98}	4,095	(819)	[197]	{98}
Ulster	12,972	13,039	13,082	13,116	13,199	(2,640)	[634]	{317}	13,277	(2,655)	[637]	{319}	13,349	(2,670)	[641]	{320}
Westchester	125,487	125,726	125,913	126,094	126,534	(25,307)	[6,074]	{3,037}	126,947	(25,389)	[6,093]	{3,047}	127,343	(25,469)	[6,112]	{3,056}

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.