

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

Date: 7/30/20

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

The projections shown in this document are based on data pulled in as of 7/30/20 11 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.

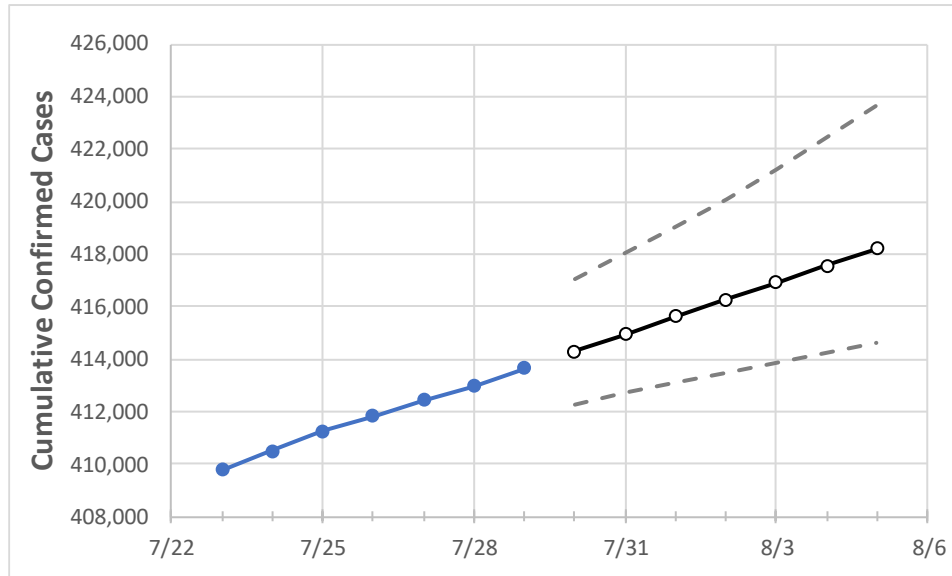
IEM's Modeling Lead

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:					
	7/26	7/27	7/28	7/29	7/30	7/31	8/1	8/2	8/3	8/4	8/5
New York	411,805	412,413	412,947	413,662	414,308	414,956	415,605	416,256	416,908	417,562	418,217

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:						
	7/26	7/27	7/28	7/29	7/30	7/31	8/1	8/2	8/3	8/4	8/5
Albany	2,451	2,453	2,468	2,480	2,491	2,502	2,514	2,525	2,537	2,549	2,561
Bronx	49,336	49,388	49,422	49,481	49,542	49,603	49,665	49,726	49,788	49,850	49,912
Dutchess	4,425	4,440	4,447	4,453	4,460	4,466	4,473	4,480	4,487	4,493	4,500
Erie	8,301	8,327	8,364	8,410	8,441	8,473	8,504	8,536	8,567	8,598	8,630
Kings	61,988	62,053	62,110	62,194	62,258	62,321	62,383	62,443	62,503	62,561	62,618
Monroe	4,591	4,620	4,632	4,656	4,677	4,697	4,717	4,736	4,755	4,774	4,793
Nassau	42,960	43,017	43,059	43,100	43,147	43,195	43,243	43,291	43,341	43,390	43,440
New York	30,193	30,250	30,280	30,329	30,375	30,421	30,466	30,509	30,552	30,595	30,636
Niagara	1,422	1,424	1,427	1,430	1,433	1,436	1,440	1,443	1,446	1,449	1,451
Onondaga	3,389	3,398	3,419	3,437	3,451	3,466	3,480	3,494	3,507	3,521	3,534
Orange	10,998	11,010	11,024	11,034	11,043	11,052	11,062	11,071	11,080	11,089	11,098
Putnam	1,404	1,408	1,412	1,416	1,418	1,420	1,422	1,425	1,427	1,429	1,431
Queens	67,595	67,679	67,739	67,820	67,893	67,966	68,039	68,111	68,184	68,256	68,329
Rensselaer	684	687	690	694	697	701	704	708	711	715	718
Richmond	14,649	14,681	14,698	14,727	14,749	14,772	14,795	14,818	14,842	14,865	14,889
Rockland	13,839	13,841	13,845	13,852	13,856	13,860	13,864	13,867	13,871	13,874	13,877
Saratoga	685	688	691	701	707	714	720	727	735	742	750
Schenectady	987	990	998	1,010	1,020	1,030	1,041	1,052	1,063	1,076	1,088
Suffolk	42,883	42,967	43,024	43,084	43,143	43,203	43,263	43,325	43,387	43,450	43,513
Sullivan	1,476	1,476	1,476	1,476	1,477	1,477	1,478	1,478	1,479	1,479	1,480
Tompkins	224	225	225	225	228	230	233	236	240	244	248
Ulster	1,925	1,926	1,942	1,973	1,978	1,982	1,987	1,993	1,998	2,003	2,009
Westchester	35,777	35,799	35,838	35,874	35,906	35,939	35,972	36,004	36,038	36,071	36,105

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:											
	7/26	7/27	7/28	7/29	7/31			8/2			8/4					
Albany	2,451	2,453	2,468	2,480	2,502	(500)	[120]	{60}	2,525	(505)	[121]	{61}	2,549	(510)	[122]	{61}
Bronx	49,336	49,388	49,422	49,481	49,603	(9,921)	[2,381]	{1,190}	49,726	(9,945)	[2,387]	{1,193}	49,850	(9,970)	[2,393]	{1,196}
Dutchess	4,425	4,440	4,447	4,453	4,466	(893)	[214]	{107}	4,480	(896)	[215]	{108}	4,493	(899)	[216]	{108}
Erie	8,301	8,327	8,364	8,410	8,473	(1,695)	[407]	{203}	8,536	(1,707)	[410]	{205}	8,598	(1,720)	[413]	{206}
Kings	61,988	62,053	62,110	62,194	62,321	(12,464)	[2,991]	{1,496}	62,443	(12,489)	[2,997]	{1,499}	62,561	(12,512)	[3,003]	{1,501}
Monroe	4,591	4,620	4,632	4,656	4,697	(939)	[225]	{113}	4,736	(947)	[227]	{114}	4,774	(955)	[229]	{115}
Nassau	42,960	43,017	43,059	43,100	43,195	(8,639)	[2,073]	{1,037}	43,291	(8,658)	[2,078]	{1,039}	43,390	(8,678)	[2,083]	{1,041}
New York	30,193	30,250	30,280	30,329	30,421	(6,084)	[1,460]	{730}	30,509	(6,102)	[1,464]	{732}	30,595	(6,119)	[1,469]	{734}
Niagara	1,422	1,424	1,427	1,430	1,436	(287)	[69]	{34}	1,443	(289)	[69]	{35}	1,449	(290)	[70]	{35}
Onondaga	3,389	3,398	3,419	3,437	3,466	(693)	[166]	{83}	3,494	(699)	[168]	{84}	3,521	(704)	[169]	{85}
Orange	10,998	11,010	11,024	11,034	11,052	(2,210)	[531]	{265}	11,071	(2,214)	[531]	{266}	11,089	(2,218)	[532]	{266}
Putnam	1,404	1,408	1,412	1,416	1,420	(284)	[68]	{34}	1,425	(285)	[68]	{34}	1,429	(286)	[69]	{34}
Queens	67,595	67,679	67,739	67,820	67,966	(13,593)	[3,262]	{1,631}	68,111	(13,622)	[3,269]	{1,635}	68,256	(13,651)	[3,276]	{1,638}
Rensselaer	684	687	690	694	701	(140)	[34]	{17}	708	(142)	[34]	{17}	715	(143)	[34]	{17}
Richmond	14,649	14,681	14,698	14,727	14,772	(2,954)	[709]	{355}	14,818	(2,964)	[711]	{356}	14,865	(2,973)	[714]	{357}
Rockland	13,839	13,841	13,845	13,852	13,860	(2,772)	[665]	{333}	13,867	(2,773)	[666]	{333}	13,874	(2,775)	[666]	{333}
Saratoga	685	688	691	701	714	(143)	[34]	{17}	727	(145)	[35]	{17}	742	(148)	[36]	{18}
Schenectady	987	990	998	1,010	1,030	(206)	[49]	{25}	1,052	(210)	[50]	{25}	1,076	(215)	[52]	{26}
Suffolk	42,883	42,967	43,024	43,084	43,203	(8,641)	[2,074]	{1,037}	43,325	(8,665)	[2,080]	{1,040}	43,450	(8,690)	[2,086]	{1,043}
Sullivan	1,476	1,476	1,476	1,476	1,477	(295)	[71]	{35}	1,478	(296)	[71]	{35}	1,479	(296)	[71]	{36}
Tompkins	224	225	225	225	230	(46)	[11]	{6}	236	(47)	[11]	{6}	244	(49)	[12]	{6}
Ulster	1,925	1,926	1,942	1,973	1,982	(396)	[95]	{48}	1,993	(399)	[96]	{48}	2,003	(401)	[96]	{48}
Westchester	35,777	35,799	35,838	35,874	35,939	(7,188)	[1,725]	{863}	36,004	(7,201)	[1,728]	{864}	36,071	(7,214)	[1,731]	{866}

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.