

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

Date: 7/23/20

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 7/23/20 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.

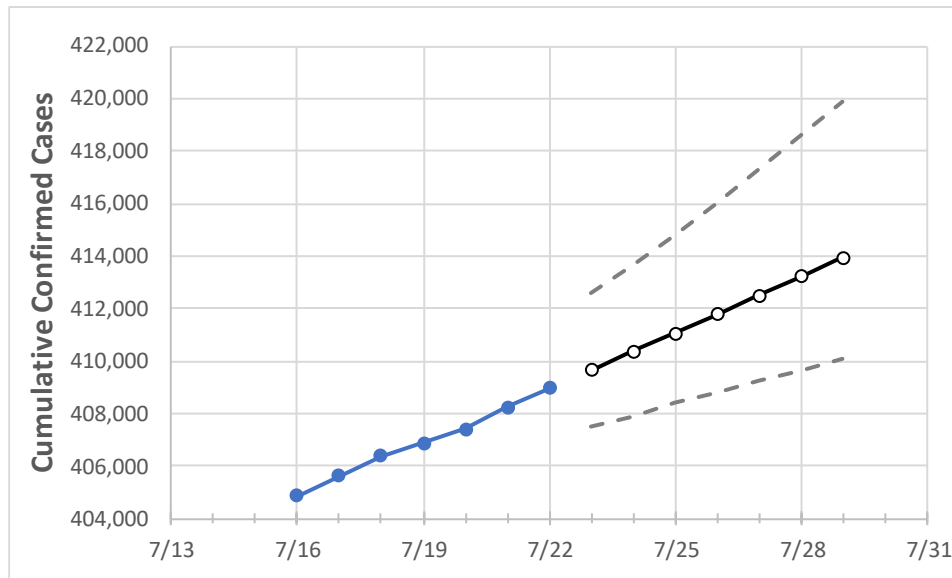
IEM's Modeling Lead

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:						
	7/19	7/20	7/21	7/22	7/23	7/24	7/25	7/26	7/27	7/28	7/29
New York	406,876	407,395	408,250	408,945	409,648	410,354	411,065	411,780	412,499	413,223	413,951

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:						
	7/19	7/20	7/21	7/22	7/23	7/24	7/25	7/26	7/27	7/28	7/29
Albany	2,318	2,322	2,351	2,369	2,380	2,392	2,404	2,417	2,430	2,443	2,457
Bronx	48,769	48,837	48,926	49,017	49,095	49,174	49,255	49,339	49,424	49,511	49,601
Dutchess	4,376	4,378	4,380	4,387	4,392	4,398	4,403	4,409	4,414	4,419	4,424
Erie	8,035	8,046	8,106	8,135	8,166	8,196	8,226	8,256	8,286	8,316	8,345
Kings	61,432	61,488	61,568	61,662	61,749	61,837	61,924	62,012	62,100	62,188	62,276
Monroe	4,401	4,422	4,452	4,492	4,522	4,551	4,581	4,611	4,641	4,671	4,701
Nassau	42,622	42,678	42,729	42,765	42,810	42,855	42,901	42,947	42,994	43,041	43,089
New York	29,731	29,796	29,867	29,943	30,016	30,091	30,168	30,245	30,324	30,405	30,487
Niagara	1,382	1,384	1,388	1,395	1,400	1,404	1,409	1,413	1,418	1,422	1,426
Onondaga	3,278	3,290	3,312	3,326	3,343	3,359	3,375	3,391	3,407	3,423	3,439
Orange	10,931	10,938	10,953	10,960	10,970	10,981	10,992	11,003	11,014	11,025	11,037
Putnam	1,391	1,392	1,393	1,394	1,396	1,398	1,399	1,401	1,403	1,405	1,406
Queens	67,007	67,079	67,194	67,265	67,347	67,429	67,511	67,594	67,676	67,759	67,842
Rensselaer	651	653	658	668	673	679	685	691	698	704	711
Richmond	14,480	14,503	14,539	14,557	14,581	14,605	14,629	14,654	14,680	14,706	14,733
Rockland	13,793	13,798	13,806	13,812	13,820	13,828	13,836	13,844	13,852	13,860	13,868
Saratoga	637	639	646	650	654	658	663	667	672	676	681
Schenectady	915	921	926	926	933	941	949	958	967	976	985
Suffolk	42,466	42,496	42,575	42,621	42,669	42,716	42,763	42,810	42,856	42,902	42,948
Sullivan	1,473	1,473	1,473	1,473	1,475	1,477	1,479	1,481	1,484	1,486	1,489
Tompkins	208	209	209	209	212	214	218	221	225	229	234
Ulster	1,901	1,904	1,906	1,909	1,912	1,915	1,917	1,920	1,923	1,925	1,928
Westchester	35,515	35,551	35,587	35,636	35,667	35,697	35,728	35,758	35,788	35,819	35,849

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:											
	7/19	7/20	7/21	7/22	7/24				7/26				7/28			
Albany	2,318	2,322	2,351	2,369	2,392	(478)	[115]	{57}	2,417	(483)	[116]	{58}	2,443	(489)	[117]	{59}
Bronx	48,769	48,837	48,926	49,017	49,174	(9,835)	[2,360]	{1,180}	49,339	(9,868)	[2,368]	{1,184}	49,511	(9,902)	[2,377]	{1,188}
Dutchess	4,376	4,378	4,380	4,387	4,398	(880)	[211]	{106}	4,409	(882)	[212]	{106}	4,419	(884)	[212]	{106}
Erie	8,035	8,046	8,106	8,135	8,196	(1,639)	[393]	{197}	8,256	(1,651)	[396]	{198}	8,316	(1,663)	[399]	{200}
Kings	61,432	61,488	61,568	61,662	61,837	(12,367)	[2,968]	{1,484}	62,012	(12,402)	[2,977]	{1,488}	62,188	(12,438)	[2,985]	{1,493}
Monroe	4,401	4,422	4,452	4,492	4,551	(910)	[218]	{109}	4,611	(922)	[221]	{111}	4,671	(934)	[224]	{112}
Nassau	42,622	42,678	42,729	42,765	42,855	(8,571)	[2,057]	{1,029}	42,947	(8,589)	[2,061]	{1,031}	43,041	(8,608)	[2,066]	{1,033}
New York	29,731	29,796	29,867	29,943	30,091	(6,018)	[1,444]	{722}	30,245	(6,049)	[1,452]	{726}	30,405	(6,081)	[1,459]	{730}
Niagara	1,382	1,384	1,388	1,395	1,404	(281)	[67]	{34}	1,413	(283)	[68]	{34}	1,422	(284)	[68]	{34}
Onondaga	3,278	3,290	3,312	3,326	3,359	(672)	[161]	{81}	3,391	(678)	[163]	{81}	3,423	(685)	[164]	{82}
Orange	10,931	10,938	10,953	10,960	10,981	(2,196)	[527]	{264}	11,003	(2,201)	[528]	{264}	11,025	(2,205)	[529]	{265}
Putnam	1,391	1,392	1,393	1,394	1,398	(280)	[67]	{34}	1,401	(280)	[67]	{34}	1,405	(281)	[67]	{34}
Queens	67,007	67,079	67,194	67,265	67,429	(13,486)	[3,237]	{1,618}	67,594	(13,519)	[3,244]	{1,622}	67,759	(13,552)	[3,252]	{1,626}
Rensselaer	651	653	658	668	679	(136)	[33]	{16}	691	(138)	[33]	{17}	704	(141)	[34]	{17}
Richmond	14,480	14,503	14,539	14,557	14,605	(2,921)	[701]	{351}	14,654	(2,931)	[703]	{352}	14,706	(2,941)	[706]	{353}
Rockland	13,793	13,798	13,806	13,812	13,828	(2,766)	[664]	{332}	13,844	(2,769)	[665]	{332}	13,860	(2,772)	[665]	{333}
Saratoga	637	639	646	650	658	(132)	[32]	{16}	667	(133)	[32]	{16}	676	(135)	[32]	{16}
Schenectady	915	921	926	926	941	(188)	[45]	{23}	958	(192)	[46]	{23}	976	(195)	[47]	{23}
Suffolk	42,466	42,496	42,575	42,621	42,716	(8,543)	[2,050]	{1,025}	42,810	(8,562)	[2,055]	{1,027}	42,902	(8,580)	[2,059]	{1,030}
Sullivan	1,473	1,473	1,473	1,473	1,477	(295)	[71]	{35}	1,481	(296)	[71]	{36}	1,486	(297)	[71]	{36}
Tompkins	208	209	209	209	214	(43)	[10]	{5}	221	(44)	[11]	{5}	229	(46)	[11]	{6}
Ulster	1,901	1,904	1,906	1,909	1,915	(383)	[92]	{46}	1,920	(384)	[92]	{46}	1,925	(385)	[92]	{46}
Westchester	35,515	35,551	35,587	35,636	35,697	(7,139)	[1,713]	{857}	35,758	(7,152)	[1,716]	{858}	35,819	(7,164)	[1,719]	{860}

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.