

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

Date: 3/25/21

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 3/25/21 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.

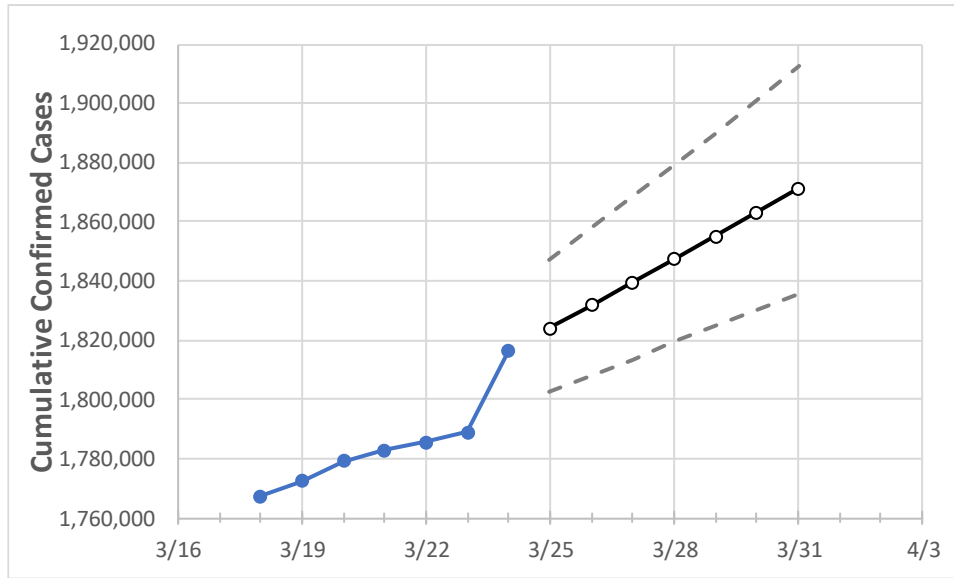
IEM's Modeling Lead

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:						
	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28	3/29	3/30	3/31

New York 1,782,769 1,785,565 1,788,874 1,816,518 1,823,984 1,831,775 1,839,407 1,847,252 1,855,200 1,863,247 1,871,271

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:							
	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28	3/29	3/30	3/31	
Albany	21,982	22,024	22,078	22,141	22,192	22,243	22,293	22,343	22,394	22,445	22,495	
Bronx	157,179	158,108	159,037	159,966	160,583	161,196	161,802	162,406	163,007	163,608	164,210	
Dutchess	24,744	24,862	24,977	25,132	25,279	25,428	25,579	25,731	25,885	26,043	26,203	
Erie	70,323	70,520	70,826	71,050	71,319	71,590	71,866	72,143	72,422	72,705	72,993	
Kings	232,774	234,471	236,167	237,864	239,057	240,274	241,524	242,766	244,022	245,274	246,547	
Monroe	55,119	55,213	55,335	55,461	55,582	55,706	55,825	55,944	56,065	56,187	56,311	
Nassau	161,408	161,948	162,481	163,084	163,688	164,291	164,897	165,496	166,094	166,691	167,296	
New York	115,067	116,373	117,680	118,986	119,766	120,586	121,408	122,227	123,075	123,931	124,830	
Niagara	16,009	16,050	16,086	16,130	16,165	16,201	16,236	16,272	16,308	16,344	16,378	
Onondaga	33,584	33,617	33,689	33,736	33,791	33,846	33,901	33,954	34,010	34,064	34,117	
Orange	40,993	41,137	41,370	41,627	41,851	42,080	42,312	42,540	42,780	43,013	43,252	
Putnam	9,079	9,106	9,146	9,186	9,226	9,267	9,308	9,349	9,391	9,433	9,476	
Queens	232,560	234,253	235,945	237,637	238,794	239,970	241,132	242,314	243,499	244,678	245,861	
Rensselaer	9,657	9,679	9,705	9,739	9,767	9,795	9,824	9,852	9,879	9,907	9,936	
Richmond	62,340	62,758	63,175	63,593	63,889	64,190	64,497	64,814	65,132	65,451	65,767	
Rockland	41,990	42,077	42,250	42,384	42,534	42,685	42,833	42,979	43,122	43,264	43,407	
Saratoga	12,834	12,870	12,924	12,973	13,020	13,068	13,116	13,165	13,214	13,264	13,315	
Schenectady	11,407	11,430	11,470	11,523	11,554	11,586	11,617	11,649	11,681	11,713	11,747	
Suffolk	175,528	176,140	176,669	177,334	178,004	178,670	179,331	179,992	180,671	181,348	182,018	
Sullivan	5,216	5,231	5,268	5,304	5,337	5,369	5,403	5,438	5,473	5,509	5,547	
Tompkins	3,730	3,736	3,742	3,757	3,773	3,788	3,804	3,821	3,837	3,853	3,870	
Ulster	11,203	11,274	11,354	11,445	11,532	11,620	11,712	11,807	11,905	12,005	12,108	
Westchester	115,563	115,935	116,289	116,664	117,033	117,403	117,769	118,136	118,498	118,862	119,228	

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:											
	3/21	3/22	3/23	3/24	3/26			3/28			3/30					
Albany	21,982	22,024	22,078	22,141	22,243	(4,449)	[1,068]	{534}	22,343	(4,469)	[1,072]	{536}	22,445	(4,489)	[1,077]	{539}
Bronx	157,179	158,108	159,037	159,966	161,196	(32,239)	[7,737]	{3,869}	162,406	(32,481)	[7,795]	{3,898}	163,608	(32,722)	[7,853]	{3,927}
Dutchess	24,744	24,862	24,977	25,132	25,428	(5,086)	[1,221]	{610}	25,731	(5,146)	[1,235]	{618}	26,043	(5,209)	[1,250]	{625}
Erie	70,323	70,520	70,826	71,050	71,590	(14,318)	[3,436]	{1,718}	72,143	(14,429)	[3,463]	{1,731}	72,705	(14,541)	[3,490]	{1,745}
Kings	232,774	234,471	236,167	237,864	240,274	(48,055)	[11,533]	{5,767}	242,766	(48,553)	[11,653]	{5,826}	245,274	(49,055)	[11,773]	{5,887}
Monroe	55,119	55,213	55,335	55,461	55,706	(11,141)	[2,674]	{1,337}	55,944	(11,189)	[2,685]	{1,343}	56,187	(11,237)	[2,697]	{1,348}
Nassau	161,408	161,948	162,481	163,084	164,291	(32,858)	[7,886]	{3,943}	165,496	(33,099)	[7,944]	{3,972}	166,691	(33,338)	[8,001]	{4,001}
New York	115,067	116,373	117,680	118,986	120,586	(24,117)	[5,788]	{2,894}	122,227	(24,445)	[5,867]	{2,933}	123,931	(24,786)	[5,949]	{2,974}
Niagara	16,009	16,050	16,086	16,130	16,201	(3,240)	[778]	{389}	16,272	(3,254)	[781]	{391}	16,344	(3,269)	[784]	{392}
Onondaga	33,584	33,617	33,689	33,736	33,846	(6,769)	[1,625]	{812}	33,954	(6,791)	[1,630]	{815}	34,064	(6,813)	[1,635]	{818}
Orange	40,993	41,137	41,370	41,627	42,080	(8,416)	[2,020]	{1,010}	42,540	(8,508)	[2,042]	{1,021}	43,013	(8,603)	[2,065]	{1,032}
Putnam	9,079	9,106	9,146	9,186	9,267	(1,853)	[445]	{222}	9,349	(1,870)	[449]	{224}	9,433	(1,887)	[453]	{226}
Queens	232,560	234,253	235,945	237,637	239,970	(47,994)	[11,519]	{5,759}	242,314	(48,463)	[11,631]	{5,816}	244,678	(48,936)	[11,745]	{5,872}
Rensselaer	9,657	9,679	9,705	9,739	9,795	(1,959)	[470]	{235}	9,852	(1,970)	[473]	{236}	9,907	(1,981)	[476]	{238}
Richmond	62,340	62,758	63,175	63,593	64,190	(12,838)	[3,081]	{1,541}	64,814	(12,963)	[3,111]	{1,556}	65,451	(13,090)	[3,142]	{1,571}
Rockland	41,990	42,077	42,250	42,384	42,685	(8,537)	[2,049]	{1,024}	42,979	(8,596)	[2,063]	{1,031}	43,264	(8,653)	[2,077]	{1,038}
Saratoga	12,834	12,870	12,924	12,973	13,068	(2,614)	[627]	{314}	13,165	(2,633)	[632]	{316}	13,264	(2,653)	[637]	{318}
Schenectady	11,407	11,430	11,470	11,523	11,586	(2,317)	[556]	{278}	11,649	(2,330)	[559]	{280}	11,713	(2,343)	[562]	{281}
Suffolk	175,528	176,140	176,669	177,334	178,670	(35,734)	[8,576]	{4,288}	179,992	(35,998)	[8,640]	{4,320}	181,348	(36,270)	[8,705]	{4,352}
Sullivan	5,216	5,231	5,268	5,304	5,369	(1,074)	[258]	{129}	5,438	(1,088)	[261]	{131}	5,509	(1,102)	[264]	{132}
Tompkins	3,730	3,736	3,742	3,757	3,788	(758)	[182]	{91}	3,821	(764)	[183]	{92}	3,853	(771)	[185]	{92}
Ulster	11,203	11,274	11,354	11,445	11,620	(2,324)	[558]	{279}	11,807	(2,361)	[567]	{283}	12,005	(2,401)	[576]	{288}
Westchester	115,563	115,935	116,289	116,664	117,403	(23,481)	[5,635]	{2,818}	118,136	(23,627)	[5,671]	{2,835}	118,862	(23,772)	[5,705]	{2,853}

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.