

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

Date: 2/23/22

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 2/23/22 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.

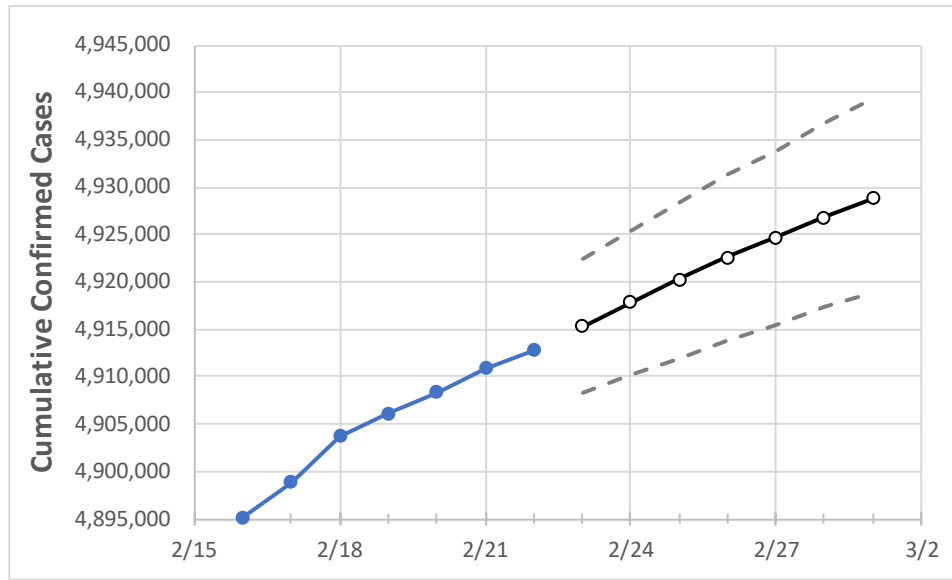
IEM's Modeling Lead

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:						
	2/19	2/20	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1
New York	4,906,178	4,908,315	4,910,920	4,912,831	4,915,369	4,917,877	4,920,278	4,922,554	4,924,705	4,926,822	4,928,846

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:						
	2/19	2/20	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1
Albany	57,649	57,686	57,715	57,743	57,783	57,824	57,859	57,895	57,930	57,964	57,994
Bronx	403,511	403,611	403,712	403,767	403,873	403,977	404,066	404,157	404,245	404,333	404,406
Dutchess	62,941	62,966	62,981	63,010	63,040	63,069	63,095	63,120	63,145	63,170	63,193
Erie	204,871	205,027	205,086	205,168	205,280	205,386	205,490	205,587	205,680	205,769	205,859
Kings	683,588	683,884	684,181	684,334	684,603	684,847	685,084	685,323	685,537	685,753	685,940
Monroe	148,684	148,773	148,843	148,884	148,963	149,039	149,110	149,181	149,244	149,310	149,368
Nassau	397,223	397,356	397,464	397,550	397,694	397,821	397,951	398,076	398,189	398,303	398,410
New York	400,444	400,714	400,832	401,008	401,260	401,493	401,722	401,922	402,155	402,370	402,570
Niagara	46,969	46,995	47,011	47,036	47,060	47,083	47,105	47,126	47,145	47,164	47,182
Onondaga	106,211	106,307	106,365	106,442	106,542	106,634	106,722	106,808	106,893	106,971	107,049
Orange	108,336	108,397	108,459	108,521	108,581	108,638	108,693	108,746	108,799	108,847	108,895
Putnam	23,229	23,238	23,245	23,250	23,263	23,274	23,285	23,296	23,307	23,317	23,326
Queens	632,817	633,085	633,234	633,358	633,620	633,867	634,050	634,253	634,456	634,637	634,818
Rensselaer	30,601	30,623	30,637	30,652	30,680	30,706	30,731	30,755	30,779	30,802	30,822
Richmond	163,634	163,700	163,765	163,807	163,863	163,919	163,970	164,019	164,066	164,113	164,155
Rockland	90,972	90,993	91,010	91,033	91,068	91,095	91,125	91,152	91,179	91,207	91,227
Saratoga	44,769	44,806	44,837	44,866	44,908	44,948	44,986	45,023	45,060	45,095	45,127
Schenectady	32,140	32,159	32,168	32,190	32,220	32,246	32,274	32,300	32,322	32,349	32,370
Suffolk	421,494	421,646	421,752	421,863	421,997	422,123	422,242	422,356	422,466	422,569	422,671
Sullivan	18,082	18,096	18,108	18,117	18,130	18,143	18,155	18,167	18,178	18,190	18,200
Tompkins	17,181	17,235	17,236	17,255	17,282	17,312	17,336	17,362	17,388	17,414	17,438
Ulster	30,596	30,626	30,642	30,663	30,691	30,716	30,739	30,763	30,786	30,809	30,830
Westchester	245,850	245,952	246,001	246,059	246,161	246,260	246,356	246,451	246,541	246,630	246,719

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:											
	2/19	2/20	2/21	2/22	2/24			2/26			2/28					
Albany	57,649	57,686	57,715	57,743	57,824	(11,565)	[2,776]	{1,388}	57,895	(11,579)	[2,779]	{1,389}	57,964	(11,593)	[2,782]	{1,391}
Bronx	403,511	403,611	403,712	403,767	403,977	(80,795)	[19,391]	{9,695}	404,157	(80,831)	[19,400]	{9,700}	404,333	(80,867)	[19,408]	{9,704}
Dutchess	62,941	62,966	62,981	63,010	63,069	(12,614)	[3,027]	{1,514}	63,120	(12,624)	[3,030]	{1,515}	63,170	(12,634)	[3,032]	{1,516}
Erie	204,871	205,027	205,086	205,168	205,386	(41,077)	[9,859]	{4,929}	205,587	(41,117)	[9,868]	{4,934}	205,769	(41,154)	[9,877]	{4,938}
Kings	683,588	683,884	684,181	684,334	684,847	(136,969)	[32,873]	{16,436}	685,323	(137,065)	[32,896]	{16,448}	685,753	(137,151)	[32,916]	{16,458}
Monroe	148,684	148,773	148,843	148,884	149,039	(29,808)	[7,154]	{3,577}	149,181	(29,836)	[7,161]	{3,580}	149,310	(29,862)	[7,167]	{3,583}
Nassau	397,223	397,356	397,464	397,550	397,821	(79,564)	[19,095]	{9,548}	398,076	(79,615)	[19,108]	{9,554}	398,303	(79,661)	[19,119]	{9,559}
New York	400,444	400,714	400,832	401,008	401,493	(80,299)	[19,272]	{9,636}	401,922	(80,384)	[19,292]	{9,646}	402,370	(80,474)	[19,314]	{9,657}
Niagara	46,969	46,995	47,011	47,036	47,083	(9,417)	[2,260]	{1,130}	47,126	(9,425)	[2,262]	{1,131}	47,164	(9,433)	[2,264]	{1,132}
Onondaga	106,211	106,307	106,365	106,442	106,634	(21,327)	[5,118]	{2,559}	106,808	(21,362)	[5,127]	{2,563}	106,971	(21,394)	[5,135]	{2,567}
Orange	108,336	108,397	108,459	108,521	108,638	(21,728)	[5,215]	{2,607}	108,746	(21,749)	[5,220]	{2,610}	108,847	(21,769)	[5,225]	{2,612}
Putnam	23,229	23,238	23,245	23,250	23,274	(4,655)	[1,117]	{559}	23,296	(4,659)	[1,118]	{559}	23,317	(4,663)	[1,119]	{560}
Queens	632,817	633,085	633,234	633,358	633,867	(126,773)	[30,426]	{15,213}	634,253	(126,851)	[30,444]	{15,222}	634,637	(126,927)	[30,463]	{15,231}
Rensselaer	30,601	30,623	30,637	30,652	30,706	(6,141)	[1,474]	{737}	30,755	(6,151)	[1,476]	{738}	30,802	(6,160)	[1,478]	{739}
Richmond	163,634	163,700	163,765	163,807	163,919	(32,784)	[7,868]	{3,934}	164,019	(32,804)	[7,873]	{3,936}	164,113	(32,823)	[7,877]	{3,939}
Rockland	90,972	90,993	91,010	91,033	91,095	(18,219)	[4,373]	{2,186}	91,152	(18,230)	[4,375]	{2,188}	91,207	(18,241)	[4,378]	{2,189}
Saratoga	44,769	44,806	44,837	44,866	44,948	(8,990)	[2,158]	{1,079}	45,023	(9,005)	[2,161]	{1,081}	45,095	(9,019)	[2,165]	{1,082}
Schenectady	32,140	32,159	32,168	32,190	32,246	(6,449)	[1,548]	{774}	32,300	(6,460)	[1,550]	{775}	32,349	(6,470)	[1,553]	{776}
Suffolk	421,494	421,646	421,752	421,863	422,123	(84,425)	[20,262]	{10,131}	422,356	(84,471)	[20,273]	{10,137}	422,569	(84,514)	[20,283]	{10,142}
Sullivan	18,082	18,096	18,108	18,117	18,143	(3,629)	[871]	{435}	18,167	(3,633)	[872]	{436}	18,190	(3,638)	[873]	{437}
Tompkins	17,181	17,235	17,236	17,255	17,312	(3,462)	[831]	{415}	17,362	(3,472)	[833]	{417}	17,414	(3,483)	[836]	{418}
Ulster	30,596	30,626	30,642	30,663	30,716	(6,143)	[1,474]	{737}	30,763	(6,153)	[1,477]	{738}	30,809	(6,162)	[1,479]	{739}
Westchester	245,850	245,952	246,001	246,059	246,260	(49,252)	[11,820]	{5,910}	246,451	(49,290)	[11,830]	{5,915}	246,630	(49,326)	[11,838]	{5,919}

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.