

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

Date: 11/24/21

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 11/24/21 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.

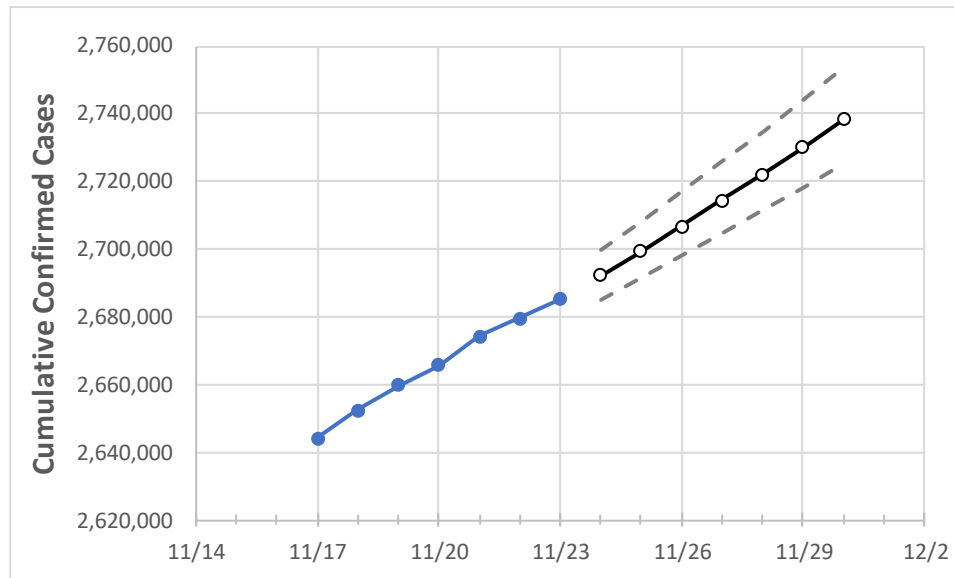
IEM's Modeling Lead

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:						
	11/20	11/21	11/22	11/23	11/24	11/25	11/26	11/27	11/28	11/29	11/30
New York	2,665,759	2,674,200	2,679,503	2,685,067	2,692,225	2,699,477	2,706,866	2,714,344	2,722,247	2,730,202	2,738,360

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:						
	11/20	11/21	11/22	11/23	11/24	11/25	11/26	11/27	11/28	11/29	11/30
Albany	33,432	33,536	33,612	33,672	33,784	33,894	33,999	34,111	34,226	34,339	34,458
Bronx	211,683	211,920	212,028	212,224	212,425	212,630	212,835	213,054	213,275	213,501	213,731
Dutchess	37,287	37,367	37,434	37,487	37,569	37,652	37,739	37,827	37,914	38,006	38,100
Erie	118,893	119,565	120,085	120,684	121,377	122,091	122,811	123,550	124,317	125,098	125,906
Kings	345,438	345,962	346,352	346,782	347,278	347,773	348,279	348,795	349,320	349,845	350,384
Monroe	93,821	94,310	94,694	95,016	95,482	95,965	96,438	96,926	97,421	97,927	98,452
Nassau	221,880	222,290	222,638	222,982	223,413	223,849	224,299	224,766	225,251	225,752	226,265
New York	174,011	174,361	174,620	174,884	175,197	175,524	175,852	176,187	176,536	176,899	177,260
Niagara	27,179	27,372	27,501	27,685	27,876	28,068	28,266	28,468	28,681	28,900	29,119
Onondaga	57,449	57,751	57,914	58,070	58,312	58,565	58,806	59,064	59,327	59,589	59,856
Orange	60,716	60,861	60,997	61,097	61,251	61,407	61,563	61,720	61,884	62,053	62,223
Putnam	12,920	12,937	12,954	12,972	12,992	13,014	13,035	13,057	13,080	13,105	13,129
Queens	322,811	323,231	323,559	324,008	324,431	324,861	325,305	325,765	326,235	326,719	327,217
Rensselaer	16,649	16,716	16,790	16,851	16,932	17,011	17,094	17,178	17,263	17,352	17,438
Richmond	91,503	91,621	91,745	91,840	91,964	92,090	92,220	92,355	92,490	92,632	92,776
Rockland	54,824	54,877	54,921	54,984	55,049	55,115	55,182	55,249	55,317	55,386	55,456
Saratoga	23,236	23,402	23,523	23,660	23,834	24,012	24,198	24,389	24,590	24,791	25,003
Schenectady	18,599	18,687	18,769	18,813	18,906	19,000	19,096	19,198	19,301	19,409	19,514
Suffolk	250,019	250,605	251,064	251,472	252,034	252,615	253,202	253,826	254,436	255,089	255,747
Sullivan	9,208	9,239	9,249	9,277	9,313	9,348	9,383	9,421	9,459	9,499	9,537
Tompkins	7,121	7,186	7,189	7,215	7,248	7,283	7,317	7,353	7,388	7,428	7,468
Ulster	18,463	18,523	18,592	18,629	18,698	18,768	18,841	18,916	18,992	19,070	19,153
Westchester	146,579	146,735	146,872	147,019	147,193	147,372	147,556	147,746	147,947	148,150	148,363

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:											
	11/20	11/21	11/22	11/23	11/25			11/27			11/29					
Albany	33,432	33,536	33,612	33,672	33,894	(6,779)	[1,627]	{813}	34,111	(6,822)	[1,637]	{819}	34,339	(6,868)	[1,648]	{824}
Bronx	211,683	211,920	212,028	212,224	212,630	(42,526)	[10,206]	{5,103}	213,054	(42,611)	[10,227]	{5,113}	213,501	(42,700)	[10,248]	{5,124}
Dutchess	37,287	37,367	37,434	37,487	37,652	(7,530)	[1,807]	{904}	37,827	(7,565)	[1,816]	{908}	38,006	(7,601)	[1,824]	{912}
Erie	118,893	119,565	120,085	120,684	122,091	(24,418)	[5,860]	{2,930}	123,550	(24,710)	[5,930]	{2,965}	125,098	(25,020)	[6,005]	{3,002}
Kings	345,438	345,962	346,352	346,782	347,773	(69,555)	[16,693]	{8,347}	348,795	(69,759)	[16,742]	{8,371}	349,845	(69,969)	[16,793]	{8,396}
Monroe	93,821	94,310	94,694	95,016	95,965	(19,193)	[4,606]	{2,303}	96,926	(19,385)	[4,652]	{2,326}	97,927	(19,585)	[4,701]	{2,350}
Nassau	221,880	222,290	222,638	222,982	223,849	(44,770)	[10,745]	{5,372}	224,766	(44,953)	[10,789]	{5,394}	225,752	(45,150)	[10,836]	{5,418}
New York	174,011	174,361	174,620	174,884	175,524	(35,105)	[8,425]	{4,213}	176,187	(35,237)	[8,457]	{4,228}	176,899	(35,380)	[8,491]	{4,246}
Niagara	27,179	27,372	27,501	27,685	28,068	(5,614)	[1,347]	{674}	28,468	(5,694)	[1,366]	{683}	28,900	(5,780)	[1,387]	{694}
Onondaga	57,449	57,751	57,914	58,070	58,565	(11,713)	[2,811]	{1,406}	59,064	(11,813)	[2,835]	{1,418}	59,589	(11,918)	[2,860]	{1,430}
Orange	60,716	60,861	60,997	61,097	61,407	(12,281)	[2,948]	{1,474}	61,720	(12,344)	[2,963]	{1,481}	62,053	(12,411)	[2,979]	{1,489}
Putnam	12,920	12,937	12,954	12,972	13,014	(2,603)	[625]	{312}	13,057	(2,611)	[627]	{313}	13,105	(2,621)	[629]	{315}
Queens	322,811	323,231	323,559	324,008	324,861	(64,972)	[15,593]	{7,797}	325,765	(65,153)	[15,637]	{7,818}	326,719	(65,344)	[15,683]	{7,841}
Rensselaer	16,649	16,716	16,790	16,851	17,011	(3,402)	[817]	{408}	17,178	(3,436)	[825]	{412}	17,352	(3,470)	[833]	{416}
Richmond	91,503	91,621	91,745	91,840	92,090	(18,418)	[4,420]	{2,210}	92,355	(18,471)	[4,433]	{2,217}	92,632	(18,526)	[4,446]	{2,223}
Rockland	54,824	54,877	54,921	54,984	55,115	(11,023)	[2,646]	{1,323}	55,249	(11,050)	[2,652]	{1,326}	55,386	(11,077)	[2,659]	{1,329}
Saratoga	23,236	23,402	23,523	23,660	24,012	(4,802)	[1,153]	{576}	24,389	(4,878)	[1,171]	{585}	24,791	(4,958)	[1,190]	{595}
Schenectady	18,599	18,687	18,769	18,813	19,000	(3,800)	[912]	{456}	19,198	(3,840)	[922]	{461}	19,409	(3,882)	[932]	{466}
Suffolk	250,019	250,605	251,064	251,472	252,615	(50,523)	[12,126]	{6,063}	253,826	(50,765)	[12,184]	{6,092}	255,089	(51,018)	[12,244]	{6,122}
Sullivan	9,208	9,239	9,249	9,277	9,348	(1,870)	[449]	{224}	9,421	(1,884)	[452]	{226}	9,499	(1,900)	[456]	{228}
Tompkins	7,121	7,186	7,189	7,215	7,283	(1,457)	[350]	{175}	7,353	(1,471)	[353]	{176}	7,428	(1,486)	[357]	{178}
Ulster	18,463	18,523	18,592	18,629	18,768	(3,754)	[901]	{450}	18,916	(3,783)	[908]	{454}	19,070	(3,814)	[915]	{458}
Westchester	146,579	146,735	146,872	147,019	147,372	(29,474)	[7,074]	{3,537}	147,746	(29,549)	[7,092]	{3,546}	148,150	(29,630)	[7,111]	{3,556}

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.