

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

Date: 4/27/21

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 4/27/21 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.

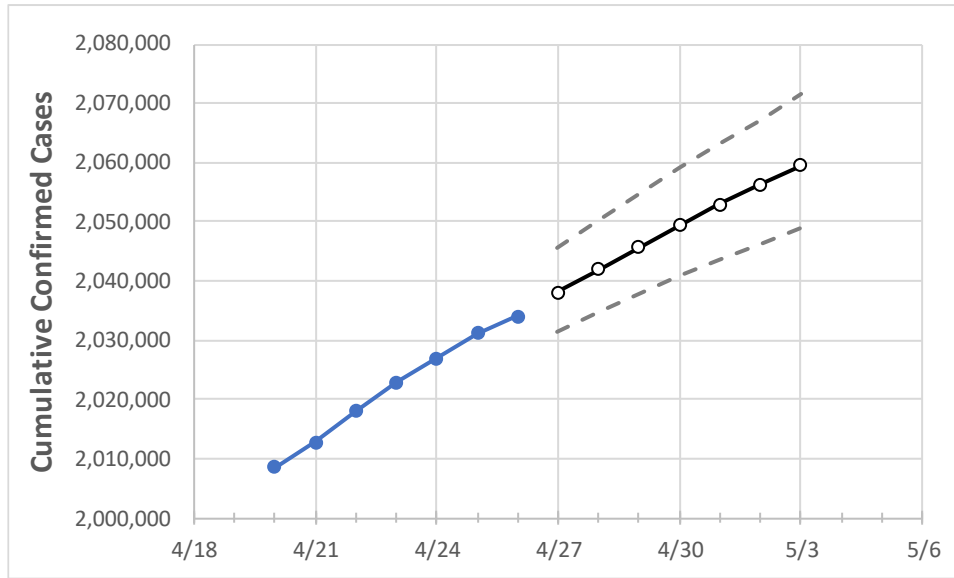
IEM's Modeling Lead

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:						
	4/23	4/24	4/25	4/26	4/27	4/28	4/29	4/30	5/1	5/2	5/3

New York 2,022,891 2,027,029 2,031,093 2,034,102 2,038,120 2,041,990 2,045,754 2,049,456 2,052,933 2,056,308 2,059,574

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:						
	4/23	4/24	4/25	4/26	4/27	4/28	4/29	4/30	5/1	5/2	5/3
Albany	23,914	23,952	23,976	24,009	24,052	24,094	24,135	24,176	24,217	24,255	24,294
Bronx	176,870	177,160	177,489	177,686	177,984	178,273	178,550	178,821	179,080	179,335	179,581
Dutchess	28,267	28,333	28,392	28,441	28,496	28,548	28,600	28,649	28,697	28,742	28,787
Erie	84,353	84,625	84,866	85,081	85,430	85,773	86,113	86,448	86,774	87,110	87,426
Kings	268,600	269,241	269,887	270,349	270,994	271,620	272,233	272,832	273,413	273,978	274,520
Monroe	62,271	62,455	62,728	62,911	63,162	63,418	63,671	63,926	64,185	64,439	64,692
Nassau	178,834	179,117	179,350	179,572	179,831	180,085	180,326	180,566	180,789	181,010	181,218
New York	133,594	133,818	134,070	134,200	134,442	134,677	134,903	135,118	135,330	135,529	135,726
Niagara	18,642	18,710	18,770	18,816	18,890	18,965	19,038	19,111	19,185	19,256	19,326
Onondaga	36,472	36,536	36,643	36,689	36,779	36,870	36,956	37,047	37,136	37,226	37,315
Orange	46,622	46,734	46,818	46,892	46,977	47,059	47,138	47,216	47,292	47,364	47,435
Putnam	10,316	10,344	10,362	10,374	10,393	10,412	10,429	10,446	10,462	10,478	10,494
Queens	266,950	267,449	267,966	268,351	268,867	269,359	269,829	270,286	270,719	271,142	271,552
Rensselaer	10,802	10,811	10,823	10,846	10,868	10,890	10,911	10,931	10,952	10,971	10,989
Richmond	71,788	71,976	72,136	72,269	72,440	72,603	72,765	72,920	73,073	73,221	73,366
Rockland	46,001	46,049	46,083	46,113	46,162	46,209	46,254	46,296	46,336	46,375	46,413
Saratoga	14,585	14,611	14,635	14,657	14,687	14,717	14,745	14,772	14,799	14,825	14,851
Schenectady	12,531	12,553	12,575	12,598	12,621	12,644	12,666	12,688	12,710	12,731	12,752
Suffolk	195,209	195,534	195,864	196,101	196,408	196,708	196,989	197,266	197,532	197,788	198,036
Sullivan	6,264	6,295	6,320	6,332	6,354	6,377	6,399	6,421	6,443	6,464	6,484
Tompkins	4,096	4,109	4,113	4,115	4,121	4,127	4,133	4,139	4,145	4,150	4,156
Ulster	13,251	13,287	13,323	13,359	13,395	13,431	13,466	13,500	13,535	13,567	13,599
Westchester	126,706	126,896	127,046	127,179	127,347	127,510	127,667	127,821	127,968	128,109	128,243

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:											
	4/23	4/24	4/25	4/26	4/28			4/30			5/2					
Albany	23,914	23,952	23,976	24,009	24,094	(4,819)	[1,157]	{578}	24,176	(4,835)	[1,160]	{580}	24,255	(4,851)	[1,164]	{582}
Bronx	176,870	177,160	177,489	177,686	178,273	(35,655)	[8,557]	{4,279}	178,821	(35,764)	[8,583]	{4,292}	179,335	(35,867)	[8,608]	{4,304}
Dutchess	28,267	28,333	28,392	28,441	28,548	(5,710)	[1,370]	{685}	28,649	(5,730)	[1,375]	{688}	28,742	(5,748)	[1,380]	{690}
Erie	84,353	84,625	84,866	85,081	85,773	(17,155)	[4,117]	{2,059}	86,448	(17,290)	[4,149]	{2,075}	87,110	(17,422)	[4,181]	{2,091}
Kings	268,600	269,241	269,887	270,349	271,620	(54,324)	[13,038]	{6,519}	272,832	(54,566)	[13,096]	{6,548}	273,978	(54,796)	[13,151]	{6,575}
Monroe	62,271	62,455	62,728	62,911	63,418	(12,684)	[3,044]	{1,522}	63,926	(12,785)	[3,068]	{1,534}	64,439	(12,888)	[3,093]	{1,547}
Nassau	178,834	179,117	179,350	179,572	180,085	(36,017)	[8,644]	{4,322}	180,566	(36,113)	[8,667]	{4,334}	181,010	(36,202)	[8,688]	{4,344}
New York	133,594	133,818	134,070	134,200	134,677	(26,935)	[6,465]	{3,232}	135,118	(27,024)	[6,486]	{3,243}	135,529	(27,106)	[6,505]	{3,253}
Niagara	18,642	18,710	18,770	18,816	18,965	(3,793)	[910]	{455}	19,111	(3,822)	[917]	{459}	19,256	(3,851)	[924]	{462}
Onondaga	36,472	36,536	36,643	36,689	36,870	(7,374)	[1,770]	{885}	37,047	(7,409)	[1,778]	{889}	37,226	(7,445)	[1,787]	{893}
Orange	46,622	46,734	46,818	46,892	47,059	(9,412)	[2,259]	{1,129}	47,216	(9,443)	[2,266]	{1,133}	47,364	(9,473)	[2,273]	{1,137}
Putnam	10,316	10,344	10,362	10,374	10,412	(2,082)	[500]	{250}	10,446	(2,089)	[501]	{251}	10,478	(2,096)	[503]	{251}
Queens	266,950	267,449	267,966	268,351	269,359	(53,872)	[12,929]	{6,465}	270,286	(54,057)	[12,974]	{6,487}	271,142	(54,228)	[13,015]	{6,507}
Rensselaer	10,802	10,811	10,823	10,846	10,890	(2,178)	[523]	{261}	10,931	(2,186)	[525]	{262}	10,971	(2,194)	[527]	{263}
Richmond	71,788	71,976	72,136	72,269	72,603	(14,521)	[3,485]	{1,742}	72,920	(14,584)	[3,500]	{1,750}	73,221	(14,644)	[3,515]	{1,757}
Rockland	46,001	46,049	46,083	46,113	46,209	(9,242)	[2,218]	{1,109}	46,296	(9,259)	[2,222]	{1,111}	46,375	(9,275)	[2,226]	{1,113}
Saratoga	14,585	14,611	14,635	14,657	14,717	(2,943)	[706]	{353}	14,772	(2,954)	[709]	{355}	14,825	(2,965)	[712]	{356}
Schenectady	12,531	12,553	12,575	12,598	12,644	(2,529)	[607]	{303}	12,688	(2,538)	[609]	{305}	12,731	(2,546)	[611]	{306}
Suffolk	195,209	195,534	195,864	196,101	196,708	(39,342)	[9,442]	{4,721}	197,266	(39,453)	[9,469]	{4,734}	197,788	(39,558)	[9,494]	{4,747}
Sullivan	6,264	6,295	6,320	6,332	6,377	(1,275)	[306]	{153}	6,421	(1,284)	[308]	{154}	6,464	(1,293)	[310]	{155}
Tompkins	4,096	4,109	4,113	4,115	4,127	(825)	[198]	{99}	4,139	(828)	[199]	{99}	4,150	(830)	[199]	{100}
Ulster	13,251	13,287	13,323	13,359	13,431	(2,686)	[645]	{322}	13,500	(2,700)	[648]	{324}	13,567	(2,713)	[651]	{326}
Westchester	126,706	126,896	127,046	127,179	127,510	(25,502)	[6,120]	{3,060}	127,821	(25,564)	[6,135]	{3,068}	128,109	(25,622)	[6,149]	{3,075}

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.