

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

Date: 4/14/21

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 4/14/21 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.

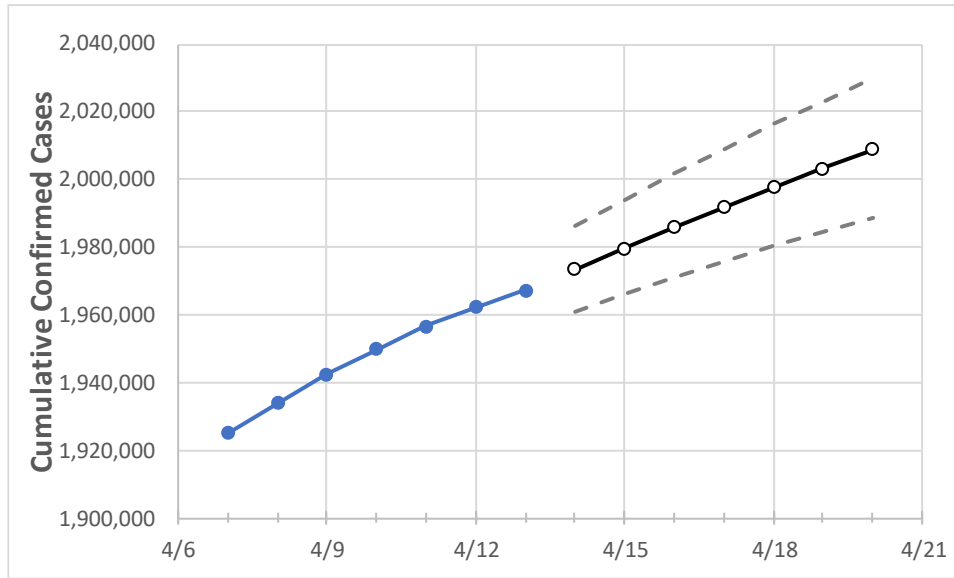
IEM's Modeling Lead

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:						
	4/10	4/11	4/12	4/13	4/14	4/15	4/16	4/17	4/18	4/19	4/20
New York	1,949,964	1,956,594	1,962,225	1,967,248	1,973,528	1,979,746	1,985,859	1,991,791	1,997,631	2,003,206	2,008,793

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:							
	4/10	4/11	4/12	4/13	4/14	4/15	4/16	4/17	4/18	4/19	4/20	
Albany	23,217	23,280	23,323	23,368	23,424	23,479	23,533	23,587	23,641	23,694	23,746	
Bronx	171,367	171,900	172,365	172,746	173,279	173,819	174,351	174,871	175,385	175,898	176,395	
Dutchess	27,258	27,371	27,449	27,510	27,611	27,709	27,806	27,902	27,997	28,089	28,179	
Erie	78,727	79,217	79,580	79,959	80,469	80,980	81,508	82,030	82,563	83,099	83,634	
Kings	257,487	258,426	259,343	260,063	260,966	261,855	262,721	263,575	264,424	265,266	266,062	
Monroe	59,062	59,315	59,539	59,738	60,013	60,293	60,582	60,875	61,177	61,490	61,805	
Nassau	173,772	174,279	174,673	175,023	175,549	176,059	176,561	177,052	177,525	178,010	178,481	
New York	129,013	129,488	129,781	130,055	130,480	130,886	131,275	131,662	132,039	132,408	132,770	
Niagara	17,527	17,633	17,712	17,780	17,897	18,020	18,147	18,278	18,415	18,556	18,703	
Onondaga	35,252	35,353	35,415	35,490	35,594	35,703	35,813	35,925	36,038	36,154	36,275	
Orange	45,057	45,194	45,320	45,423	45,569	45,711	45,853	45,991	46,126	46,258	46,389	
Putnam	9,969	10,005	10,023	10,052	10,091	10,130	10,169	10,206	10,243	10,280	10,316	
Queens	257,160	258,050	258,984	259,732	260,660	261,587	262,472	263,333	264,194	265,035	265,857	
Rensselaer	10,402	10,439	10,465	10,495	10,532	10,569	10,606	10,643	10,679	10,715	10,751	
Richmond	68,892	69,167	69,440	69,620	69,898	70,175	70,450	70,728	70,994	71,265	71,540	
Rockland	44,952	45,068	45,148	45,245	45,365	45,481	45,596	45,710	45,823	45,932	46,042	
Saratoga	14,044	14,077	14,122	14,167	14,227	14,288	14,348	14,408	14,470	14,531	14,592	
Schenectady	12,157	12,201	12,228	12,252	12,284	12,316	12,348	12,380	12,411	12,442	12,473	
Suffolk	189,424	190,014	190,463	190,889	191,498	192,092	192,689	193,275	193,848	194,410	194,976	
Sullivan	5,909	5,934	5,958	5,989	6,026	6,062	6,100	6,139	6,176	6,215	6,252	
Tompkins	3,988	3,997	4,000	4,003	4,009	4,014	4,019	4,024	4,028	4,033	4,037	
Ulster	12,664	12,712	12,755	12,791	12,847	12,901	12,954	13,008	13,060	13,112	13,162	
Westchester	123,548	123,838	124,092	124,317	124,648	124,979	125,301	125,618	125,930	126,235	126,548	

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:											
	4/10	4/11	4/12	4/13	4/15				4/17				4/19			
Albany	23,217	23,280	23,323	23,368	23,479	(4,696)	[1,127]	{564}	23,587	(4,717)	[1,132]	{566}	23,694	(4,739)	[1,137]	{569}
Bronx	171,367	171,900	172,365	172,746	173,819	(34,764)	[8,343]	{4,172}	174,871	(34,974)	[8,394]	{4,197}	175,898	(35,180)	[8,443]	{4,222}
Dutchess	27,258	27,371	27,449	27,510	27,709	(5,542)	[1,330]	{665}	27,902	(5,580)	[1,339]	{670}	28,089	(5,618)	[1,348]	{674}
Erie	78,727	79,217	79,580	79,959	80,980	(16,196)	[3,887]	{1,944}	82,030	(16,406)	[3,937]	{1,969}	83,099	(16,620)	[3,989]	{1,994}
Kings	257,487	258,426	259,343	260,063	261,855	(52,371)	[12,569]	{6,285}	263,575	(52,715)	[12,652]	{6,326}	265,266	(53,053)	[12,733]	{6,366}
Monroe	59,062	59,315	59,539	59,738	60,293	(12,059)	[2,894]	{1,447}	60,875	(12,175)	[2,922]	{1,461}	61,490	(12,298)	[2,952]	{1,476}
Nassau	173,772	174,279	174,673	175,023	176,059	(35,212)	[8,451]	{4,225}	177,052	(35,410)	[8,499]	{4,249}	178,010	(35,602)	[8,544]	{4,272}
New York	129,013	129,488	129,781	130,055	130,886	(26,177)	[6,283]	{3,141}	131,662	(26,332)	[6,320]	{3,160}	132,408	(26,482)	[6,356]	{3,178}
Niagara	17,527	17,633	17,712	17,780	18,020	(3,604)	[865]	{432}	18,278	(3,656)	[877]	{439}	18,556	(3,711)	[891]	{445}
Onondaga	35,252	35,353	35,415	35,490	35,703	(7,141)	[1,714]	{857}	35,925	(7,185)	[1,724]	{862}	36,154	(7,231)	[1,735]	{868}
Orange	45,057	45,194	45,320	45,423	45,711	(9,142)	[2,194]	{1,097}	45,991	(9,198)	[2,208]	{1,104}	46,258	(9,252)	[2,220]	{1,110}
Putnam	9,969	10,005	10,023	10,052	10,130	(2,026)	[486]	{243}	10,206	(2,041)	[490]	{245}	10,280	(2,056)	[493]	{247}
Queens	257,160	258,050	258,984	259,732	261,587	(52,317)	[12,556]	{6,278}	263,333	(52,667)	[12,640]	{6,320}	265,035	(53,007)	[12,722]	{6,361}
Rensselaer	10,402	10,439	10,465	10,495	10,569	(2,114)	[507]	{254}	10,643	(2,129)	[511]	{255}	10,715	(2,143)	[514]	{257}
Richmond	68,892	69,167	69,440	69,620	70,175	(14,035)	[3,368]	{1,684}	70,728	(14,146)	[3,395]	{1,697}	71,265	(14,253)	[3,421]	{1,710}
Rockland	44,952	45,068	45,148	45,245	45,481	(9,096)	[2,183]	{1,092}	45,710	(9,142)	[2,194]	{1,097}	45,932	(9,186)	[2,205]	{1,102}
Saratoga	14,044	14,077	14,122	14,167	14,288	(2,858)	[686]	{343}	14,408	(2,882)	[692]	{346}	14,531	(2,906)	[698]	{349}
Schenectady	12,157	12,201	12,228	12,252	12,316	(2,463)	[591]	{296}	12,380	(2,476)	[594]	{297}	12,442	(2,488)	[597]	{299}
Suffolk	189,424	190,014	190,463	190,889	192,092	(38,418)	[9,220]	{4,610}	193,275	(38,655)	[9,277]	{4,639}	194,410	(38,882)	[9,332]	{4,666}
Sullivan	5,909	5,934	5,958	5,989	6,062	(1,212)	[291]	{145}	6,139	(1,228)	[295]	{147}	6,215	(1,243)	[298]	{149}
Tompkins	3,988	3,997	4,000	4,003	4,014	(803)	[193]	{96}	4,024	(805)	[193]	{97}	4,033	(807)	[194]	{97}
Ulster	12,664	12,712	12,755	12,791	12,901	(2,580)	[619]	{310}	13,008	(2,602)	[624]	{312}	13,112	(2,622)	[629]	{315}
Westchester	123,548	123,838	124,092	124,317	124,979	(24,996)	[5,999]	{3,000}	125,618	(25,124)	[6,030]	{3,015}	126,235	(25,247)	[6,059]	{3,030}

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.