

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

Date: 4/12/21

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 4/12/21 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.

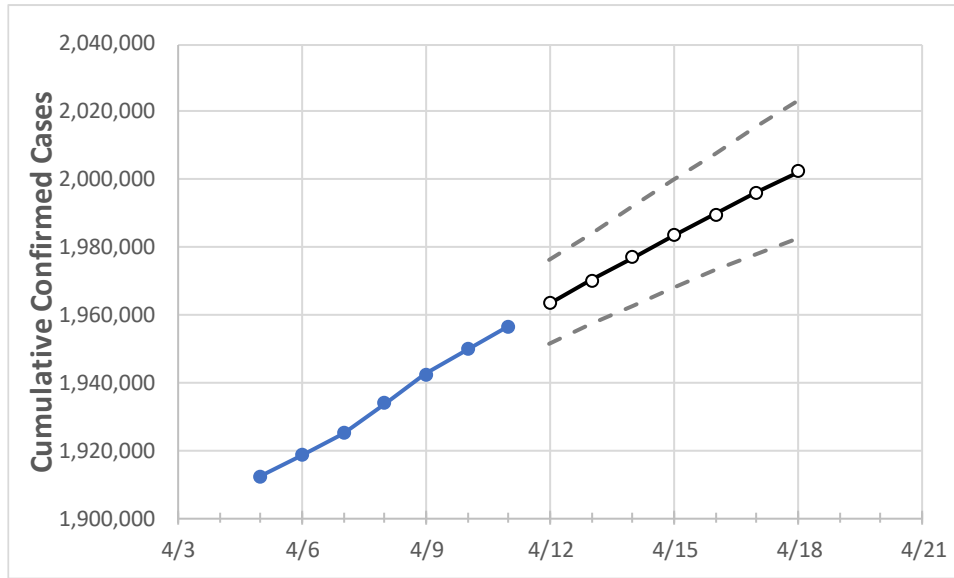
IEM's Modeling Lead

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:							
	4/8	4/9	4/10	4/11	4/12	4/13	4/14	4/15	4/16	4/17	4/18	

New York 1,933,807 1,942,469 1,949,964 1,956,594 1,963,407 1,970,195 1,976,854 1,983,405 1,989,723 1,996,174 2,002,360

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:							
	4/8	4/9	4/10	4/11	4/12	4/13	4/14	4/15	4/16	4/17	4/18	
Albany	23,079	23,149	23,217	23,280	23,342	23,403	23,464	23,526	23,588	23,651	23,713	
Bronx	170,032	170,768	171,367	171,900	172,480	173,044	173,624	174,191	174,718	175,253	175,794	
Dutchess	27,032	27,142	27,258	27,371	27,485	27,601	27,714	27,828	27,940	28,052	28,164	
Erie	77,615	78,193	78,727	79,217	79,759	80,314	80,877	81,463	82,055	82,656	83,269	
Kings	255,210	256,399	257,487	258,426	259,394	260,366	261,324	262,276	263,225	264,154	265,074	
Monroe	58,455	58,774	59,062	59,315	59,605	59,903	60,205	60,529	60,856	61,195	61,543	
Nassau	172,548	173,216	173,772	174,279	174,870	175,453	176,038	176,619	177,199	177,778	178,347	
New York	127,817	128,483	129,013	129,488	129,964	130,435	130,903	131,363	131,805	132,249	132,680	
Niagara	17,266	17,405	17,527	17,633	17,765	17,904	18,052	18,209	18,375	18,548	18,729	
Onondaga	35,014	35,149	35,252	35,353	35,472	35,594	35,721	35,849	35,980	36,119	36,262	
Orange	44,693	44,911	45,057	45,194	45,362	45,522	45,685	45,840	45,992	46,140	46,290	
Putnam	9,890	9,938	9,969	10,005	10,048	10,092	10,135	10,178	10,220	10,264	10,307	
Queens	255,044	256,156	257,160	258,050	259,031	259,983	260,939	261,871	262,800	263,714	264,576	
Rensselaer	10,317	10,359	10,402	10,439	10,480	10,521	10,563	10,605	10,648	10,690	10,732	
Richmond	68,283	68,593	68,892	69,167	69,464	69,762	70,061	70,365	70,660	70,953	71,248	
Rockland	44,642	44,823	44,952	45,068	45,199	45,329	45,458	45,584	45,711	45,836	45,959	
Saratoga	13,875	13,944	14,044	14,077	14,145	14,213	14,282	14,352	14,422	14,492	14,564	
Schenectady	12,088	12,128	12,157	12,201	12,235	12,269	12,304	12,338	12,373	12,409	12,444	
Suffolk	188,074	188,805	189,424	190,014	190,701	191,384	192,064	192,743	193,410	194,085	194,754	
Sullivan	5,819	5,864	5,909	5,934	5,974	6,015	6,055	6,096	6,138	6,180	6,224	
Tompkins	3,971	3,980	3,988	3,997	4,004	4,011	4,018	4,024	4,030	4,036	4,042	
Ulster	12,502	12,588	12,664	12,712	12,774	12,836	12,897	12,958	13,019	13,079	13,138	
Westchester	122,780	123,203	123,548	123,838	124,200	124,553	124,919	125,279	125,630	125,986	126,334	

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:											
	4/8	4/9	4/10	4/11	4/13				4/15				4/17			
Albany	23,079	23,149	23,217	23,280	23,403	(4,681)	[1,123]	{562}	23,526	(4,705)	[1,129]	{565}	23,651	(4,730)	[1,135]	{568}
Bronx	170,032	170,768	171,367	171,900	173,044	(34,609)	[8,306]	{4,153}	174,191	(34,838)	[8,361]	{4,181}	175,253	(35,051)	[8,412]	{4,206}
Dutchess	27,032	27,142	27,258	27,371	27,601	(5,520)	[1,325]	{662}	27,828	(5,566)	[1,336]	{668}	28,052	(5,610)	[1,346]	{673}
Erie	77,615	78,193	78,727	79,217	80,314	(16,063)	[3,855]	{1,928}	81,463	(16,293)	[3,910]	{1,955}	82,656	(16,531)	[3,967]	{1,984}
Kings	255,210	256,399	257,487	258,426	260,366	(52,073)	[12,498]	{6,249}	262,276	(52,455)	[12,589]	{6,295}	264,154	(52,831)	[12,679]	{6,340}
Monroe	58,455	58,774	59,062	59,315	59,903	(11,981)	[2,875]	{1,438}	60,529	(12,106)	[2,905]	{1,453}	61,195	(12,239)	[2,937]	{1,469}
Nassau	172,548	173,216	173,772	174,279	175,453	(35,091)	[8,422]	{4,211}	176,619	(35,324)	[8,478]	{4,239}	177,778	(35,556)	[8,533]	{4,267}
New York	127,817	128,483	129,013	129,488	130,435	(26,087)	[6,261]	{3,130}	131,363	(26,273)	[6,305]	{3,153}	132,249	(26,450)	[6,348]	{3,174}
Niagara	17,266	17,405	17,527	17,633	17,904	(3,581)	[859]	{430}	18,209	(3,642)	[874]	{437}	18,548	(3,710)	[890]	{445}
Onondaga	35,014	35,149	35,252	35,353	35,594	(7,119)	[1,709]	{854}	35,849	(7,170)	[1,721]	{860}	36,119	(7,224)	[1,734]	{867}
Orange	44,693	44,911	45,057	45,194	45,522	(9,104)	[2,185]	{1,093}	45,840	(9,168)	[2,200]	{1,100}	46,140	(9,228)	[2,215]	{1,107}
Putnam	9,890	9,938	9,969	10,005	10,092	(2,018)	[484]	{242}	10,178	(2,036)	[489]	{244}	10,264	(2,053)	[493]	{246}
Queens	255,044	256,156	257,160	258,050	259,983	(51,997)	[12,479]	{6,240}	261,871	(52,374)	[12,570]	{6,285}	263,714	(52,743)	[12,658]	{6,329}
Rensselaer	10,317	10,359	10,402	10,439	10,521	(2,104)	[505]	{253}	10,605	(2,121)	[509]	{255}	10,690	(2,138)	[513]	{257}
Richmond	68,283	68,593	68,892	69,167	69,762	(13,952)	[3,349]	{1,674}	70,365	(14,073)	[3,377]	{1,689}	70,953	(14,191)	[3,406]	{1,703}
Rockland	44,642	44,823	44,952	45,068	45,329	(9,066)	[2,176]	{1,088}	45,584	(9,117)	[2,188]	{1,094}	45,836	(9,167)	[2,200]	{1,100}
Saratoga	13,875	13,944	14,044	14,077	14,213	(2,843)	[682]	{341}	14,352	(2,870)	[689]	{344}	14,492	(2,898)	[696]	{348}
Schenectady	12,088	12,128	12,157	12,201	12,269	(2,454)	[589]	{294}	12,338	(2,468)	[592]	{296}	12,409	(2,482)	[596]	{298}
Suffolk	188,074	188,805	189,424	190,014	191,384	(38,277)	[9,186]	{4,593}	192,743	(38,549)	[9,252]	{4,626}	194,085	(38,817)	[9,316]	{4,658}
Sullivan	5,819	5,864	5,909	5,934	6,015	(1,203)	[289]	{144}	6,096	(1,219)	[293]	{146}	6,180	(1,236)	[297]	{148}
Tompkins	3,971	3,980	3,988	3,997	4,011	(802)	[193]	{96}	4,024	(805)	[193]	{97}	4,036	(807)	[194]	{97}
Ulster	12,502	12,588	12,664	12,712	12,836	(2,567)	[616]	{308}	12,958	(2,592)	[622]	{311}	13,079	(2,616)	[628]	{314}
Westchester	122,780	123,203	123,548	123,838	124,553	(24,911)	[5,979]	{2,989}	125,279	(25,056)	[6,013]	{3,007}	125,986	(25,197)	[6,047]	{3,024}

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.