

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

Date: 11/12/20

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 11/12/20 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.

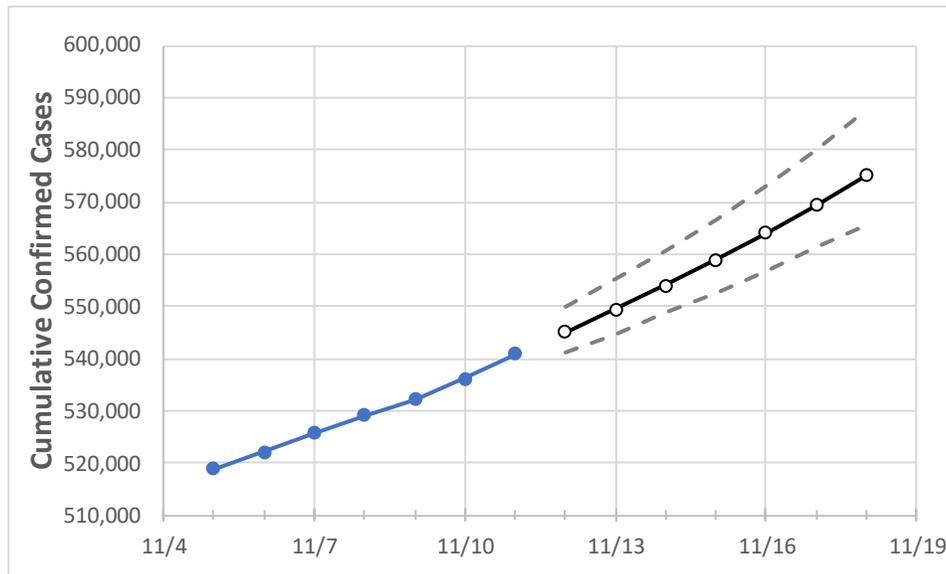
IEM's Modeling Lead

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:					
	11/8	11/9	11/10	11/11	11/12	11/13	11/14	11/15	11/16	11/17	11/18	
New York	529,036	532,180	536,145	540,965	545,085	549,434	554,024	558,868	563,980	569,373	575,065	

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 20%, and are often within 10%, of actual confirmed cases.

New York Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	11/8	11/9	11/10	11/11	11/12	11/13	11/14	11/15	11/16	11/17	11/18
Albany	4,049	4,095	4,192	4,252	4,314	4,379	4,449	4,524	4,603	4,687	4,776
Bronx	57,064	57,234	57,425	57,657	57,870	58,091	58,322	58,563	58,814	59,076	59,348
Dutchess	5,790	5,839	5,879	5,944	5,995	6,050	6,109	6,172	6,240	6,313	6,391
Erie	14,988	15,216	15,606	16,028	16,366	16,737	17,145	17,592	18,083	18,622	19,212
Kings	78,414	78,745	79,073	79,558	79,950	80,357	80,778	81,215	81,668	82,137	82,623
Monroe	8,824	8,957	9,241	9,514	9,773	10,053	10,356	10,684	11,039	11,423	11,839
Nassau	51,682	51,895	52,173	52,575	52,867	53,176	53,502	53,848	54,214	54,601	55,010
New York	37,940	38,171	38,384	38,668	38,913	39,169	39,437	39,717	40,011	40,318	40,639
Niagara	2,354	2,392	2,467	2,505	2,555	2,610	2,670	2,735	2,806	2,884	2,969
Onondaga	6,491	6,576	6,826	7,021	7,191	7,376	7,574	7,789	8,021	8,271	8,540
Orange	14,369	14,465	14,553	14,701	14,805	14,915	15,029	15,149	15,275	15,407	15,545
Putnam	1,948	1,978	2,004	2,030	2,051	2,073	2,096	2,121	2,148	2,176	2,207
Queens	79,404	79,702	80,040	80,555	80,932	81,327	81,743	82,181	82,640	83,124	83,631
Rensselaer	1,198	1,213	1,230	1,243	1,256	1,270	1,284	1,300	1,316	1,334	1,352
Richmond	18,397	18,523	18,661	18,876	19,038	19,209	19,392	19,585	19,790	20,008	20,239
Rockland	18,910	18,995	19,133	19,277	19,388	19,501	19,617	19,736	19,858	19,982	20,110
Saratoga	1,541	1,553	1,567	1,583	1,601	1,619	1,638	1,657	1,677	1,696	1,716
Schenectady	1,716	1,733	1,758	1,777	1,798	1,820	1,844	1,869	1,895	1,923	1,954
Suffolk	50,728	51,052	51,332	51,744	52,032	52,341	52,672	53,028	53,408	53,817	54,254
Sullivan	1,894	1,900	1,920	1,932	1,943	1,954	1,965	1,976	1,988	2,000	2,012
Tompkins	702	707	712	734	740	747	753	760	767	773	780
Ulster	2,626	2,647	2,670	2,694	2,708	2,723	2,738	2,754	2,771	2,788	2,806
Westchester	42,179	42,454	42,696	42,940	43,206	43,488	43,787	44,105	44,443	44,800	45,180

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:											
	11/8	11/9	11/10	11/11	11/13			11/15			11/17					
Albany	4,049	4,095	4,192	4,252	4,379	(876)	[210]	{105}	4,524	(905)	[217]	{109}	4,687	(937)	[225]	{112}
Bronx	57,064	57,234	57,425	57,657	58,091	(11,618)	[2,788]	{1,394}	58,563	(11,713)	[2,811]	{1,406}	59,076	(11,815)	[2,836]	{1,418}
Dutchess	5,790	5,839	5,879	5,944	6,050	(1,210)	[290]	{145}	6,172	(1,234)	[296]	{148}	6,313	(1,263)	[303]	{152}
Erie	14,988	15,216	15,606	16,028	16,737	(3,347)	[803]	{402}	17,592	(3,518)	[844]	{422}	18,622	(3,724)	[894]	{447}
Kings	78,414	78,745	79,073	79,558	80,357	(16,071)	[3,857]	{1,929}	81,215	(16,243)	[3,898]	{1,949}	82,137	(16,427)	[3,943]	{1,971}
Monroe	8,824	8,957	9,241	9,514	10,053	(2,011)	[483]	{241}	10,684	(2,137)	[513]	{256}	11,423	(2,285)	[548]	{274}
Nassau	51,682	51,895	52,173	52,575	53,176	(10,635)	[2,552]	{1,276}	53,848	(10,770)	[2,585]	{1,292}	54,601	(10,920)	[2,621]	{1,310}
New York	37,940	38,171	38,384	38,668	39,169	(7,834)	[1,880]	{940}	39,717	(7,943)	[1,906]	{953}	40,318	(8,064)	[1,935]	{968}
Niagara	2,354	2,392	2,467	2,505	2,610	(522)	[125]	{63}	2,735	(547)	[131]	{66}	2,884	(577)	[138]	{69}
Onondaga	6,491	6,576	6,826	7,021	7,376	(1,475)	[354]	{177}	7,789	(1,558)	[374]	{187}	8,271	(1,654)	[397]	{198}
Orange	14,369	14,465	14,553	14,701	14,915	(2,983)	[716]	{358}	15,149	(3,030)	[727]	{364}	15,407	(3,081)	[740]	{370}
Putnam	1,948	1,978	2,004	2,030	2,073	(415)	[99]	{50}	2,121	(424)	[102]	{51}	2,176	(435)	[104]	{52}
Queens	79,404	79,702	80,040	80,555	81,327	(16,265)	[3,904]	{1,952}	82,181	(16,436)	[3,945]	{1,972}	83,124	(16,625)	[3,990]	{1,995}
Rensselaer	1,198	1,213	1,230	1,243	1,270	(254)	[61]	{30}	1,300	(260)	[62]	{31}	1,334	(267)	[64]	{32}
Richmond	18,397	18,523	18,661	18,876	19,209	(3,842)	[922]	{461}	19,585	(3,917)	[940]	{470}	20,008	(4,002)	[960]	{480}
Rockland	18,910	18,995	19,133	19,277	19,501	(3,900)	[936]	{468}	19,736	(3,947)	[947]	{474}	19,982	(3,996)	[959]	{480}
Saratoga	1,541	1,553	1,567	1,583	1,619	(324)	[78]	{39}	1,657	(331)	[80]	{40}	1,696	(339)	[81]	{41}
Schenectady	1,716	1,733	1,758	1,777	1,820	(364)	[87]	{44}	1,869	(374)	[90]	{45}	1,923	(385)	[92]	{46}
Suffolk	50,728	51,052	51,332	51,744	52,341	(10,468)	[2,512]	{1,256}	53,028	(10,606)	[2,545]	{1,273}	53,817	(10,763)	[2,583]	{1,292}
Sullivan	1,894	1,900	1,920	1,932	1,954	(391)	[94]	{47}	1,976	(395)	[95]	{47}	2,000	(400)	[96]	{48}
Tompkins	702	707	712	734	747	(149)	[36]	{18}	760	(152)	[36]	{18}	773	(155)	[37]	{19}
Ulster	2,626	2,647	2,670	2,694	2,723	(545)	[131]	{65}	2,754	(551)	[132]	{66}	2,788	(558)	[134]	{67}
Westchester	42,179	42,454	42,696	42,940	43,488	(8,698)	[2,087]	{1,044}	44,105	(8,821)	[2,117]	{1,059}	44,800	(8,960)	[2,150]	{1,075}

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.