

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

Date: 11/9/20

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 11/9/20 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.**

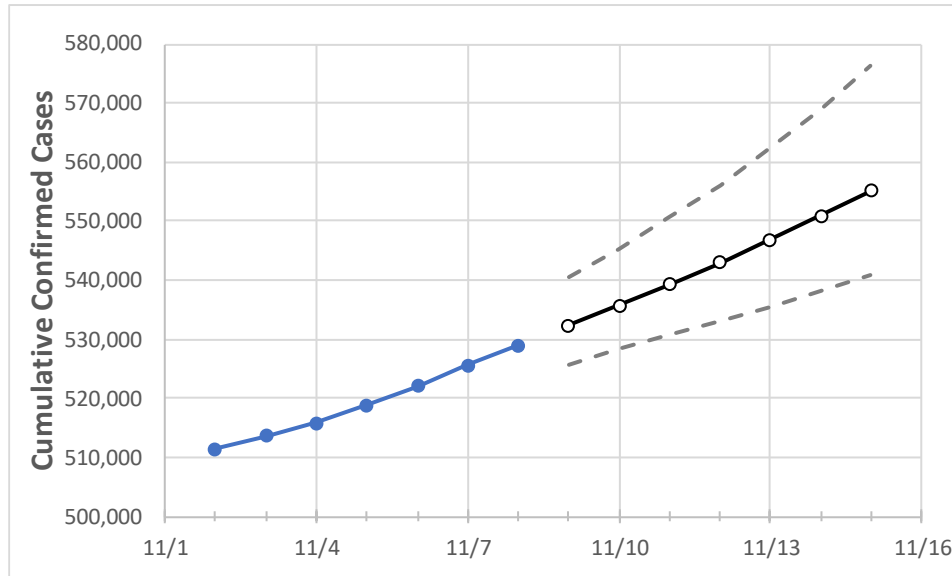
### IEM's Modeling Lead

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:					
	11/5	11/6	11/7	11/8	11/9	11/10	11/11	11/12	11/13	11/14	11/15	
New York	518,812	522,021	525,608	529,036	532,282	535,681	539,240	542,965	546,865	550,947	555,219	

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:						
	11/5	11/6	11/7	11/8	11/9	11/10	11/11	11/12	11/13	11/14	11/15
Albany	3,877	3,942	4,024	4,049	4,095	4,144	4,196	4,251	4,309	4,370	4,435
Bronx	56,460	56,655	56,817	57,064	57,259	57,463	57,677	57,900	58,134	58,378	58,634
Dutchess	5,669	5,710	5,739	5,790	5,824	5,860	5,898	5,938	5,981	6,026	6,074
Erie	14,123	14,338	14,717	14,988	15,267	15,575	15,917	16,296	16,716	17,181	17,695
Kings	77,341	77,709	78,058	78,414	78,769	79,138	79,522	79,920	80,333	80,763	81,209
Monroe	8,237	8,398	8,616	8,824	9,030	9,254	9,497	9,761	10,048	10,359	10,697
Nassau	50,918	51,164	51,418	51,682	51,912	52,153	52,407	52,674	52,955	53,250	53,559
New York	37,278	37,430	37,641	37,940	38,145	38,360	38,583	38,816	39,060	39,313	39,578
Niagara	2,231	2,274	2,313	2,354	2,392	2,433	2,478	2,527	2,581	2,639	2,703
Onondaga	6,122	6,257	6,396	6,491	6,632	6,785	6,950	7,130	7,326	7,538	7,768
Orange	14,135	14,221	14,301	14,369	14,459	14,553	14,652	14,756	14,865	14,979	15,098
Putnam	1,896	1,921	1,937	1,948	1,963	1,978	1,995	2,013	2,031	2,050	2,071
Queens	78,440	78,737	79,043	79,404	79,687	79,980	80,283	80,598	80,925	81,264	81,615
Rensselaer	1,161	1,175	1,184	1,198	1,207	1,217	1,227	1,238	1,249	1,261	1,273
Richmond	17,941	18,132	18,269	18,397	18,530	18,672	18,822	18,980	19,149	19,327	19,516
Rockland	18,683	18,756	18,854	18,910	19,007	19,105	19,205	19,307	19,410	19,514	19,621
Saratoga	1,482	1,503	1,520	1,541	1,561	1,581	1,602	1,624	1,646	1,669	1,693
Schenectady	1,666	1,687	1,701	1,716	1,732	1,750	1,768	1,788	1,809	1,831	1,855
Suffolk	50,033	50,210	50,469	50,728	50,905	51,089	51,282	51,484	51,694	51,914	52,144
Sullivan	1,862	1,882	1,891	1,894	1,904	1,914	1,924	1,935	1,946	1,957	1,968
Tompkins	675	678	690	702	707	712	717	722	727	732	737
Ulster	2,588	2,599	2,607	2,626	2,635	2,645	2,654	2,664	2,674	2,683	2,693
Westchester	41,542	41,720	41,954	42,179	42,392	42,618	42,856	43,108	43,374	43,655	43,953

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:											
	11/5	11/6	11/7	11/8	11/10			11/12			11/14					
Albany	3,877	3,942	4,024	4,049	4,144	(829)	[199]	{99}	4,251	(850)	[204]	{102}	4,370	(874)	[210]	{105}
Bronx	56,460	56,655	56,817	57,064	57,463	(11,493)	[2,758]	{1,379}	57,900	(11,580)	[2,779]	{1,390}	58,378	(11,676)	[2,802]	{1,401}
Dutchess	5,669	5,710	5,739	5,790	5,860	(1,172)	[281]	{141}	5,938	(1,188)	[285]	{143}	6,026	(1,205)	[289]	{145}
Erie	14,123	14,338	14,717	14,988	15,575	(3,115)	[748]	{374}	16,296	(3,259)	[782]	{391}	17,181	(3,436)	[825]	{412}
Kings	77,341	77,709	78,058	78,414	79,138	(15,828)	[3,799]	{1,899}	79,920	(15,984)	[3,836]	{1,918}	80,763	(16,153)	[3,877]	{1,938}
Monroe	8,237	8,398	8,616	8,824	9,254	(1,851)	[444]	{222}	9,761	(1,952)	[469]	{234}	10,359	(2,072)	[497]	{249}
Nassau	50,918	51,164	51,418	51,682	52,153	(10,431)	[2,503]	{1,252}	52,674	(10,535)	[2,528]	{1,264}	53,250	(10,650)	[2,556]	{1,278}
New York	37,278	37,430	37,641	37,940	38,360	(7,672)	[1,841]	{921}	38,816	(7,763)	[1,863]	{932}	39,313	(7,863)	[1,887]	{944}
Niagara	2,231	2,274	2,313	2,354	2,433	(487)	[117]	{58}	2,527	(505)	[121]	{61}	2,639	(528)	[127]	{63}
Onondaga	6,122	6,257	6,396	6,491	6,785	(1,357)	[326]	{163}	7,130	(1,426)	[342]	{171}	7,538	(1,508)	[362]	{181}
Orange	14,135	14,221	14,301	14,369	14,553	(2,911)	[699]	{349}	14,756	(2,951)	[708]	{354}	14,979	(2,996)	[719]	{359}
Putnam	1,896	1,921	1,937	1,948	1,978	(396)	[95]	{47}	2,013	(403)	[97]	{48}	2,050	(410)	[98]	{49}
Queens	78,440	78,737	79,043	79,404	79,980	(15,996)	[3,839]	{1,920}	80,598	(16,120)	[3,869]	{1,934}	81,264	(16,253)	[3,901]	{1,950}
Rensselaer	1,161	1,175	1,184	1,198	1,217	(243)	[58]	{29}	1,238	(248)	[59]	{30}	1,261	(252)	[61]	{30}
Richmond	17,941	18,132	18,269	18,397	18,672	(3,734)	[896]	{448}	18,980	(3,796)	[911]	{456}	19,327	(3,865)	[928]	{464}
Rockland	18,683	18,756	18,854	18,910	19,105	(3,821)	[917]	{459}	19,307	(3,861)	[927]	{463}	19,514	(3,903)	[937]	{468}
Saratoga	1,482	1,503	1,520	1,541	1,581	(316)	[76]	{38}	1,624	(325)	[78]	{39}	1,669	(334)	[80]	{40}
Schenectady	1,666	1,687	1,701	1,716	1,750	(350)	[84]	{42}	1,788	(358)	[86]	{43}	1,831	(366)	[88]	{44}
Suffolk	50,033	50,210	50,469	50,728	51,089	(10,218)	[2,452]	{1,226}	51,484	(10,297)	[2,471]	{1,236}	51,914	(10,383)	[2,492]	{1,246}
Sullivan	1,862	1,882	1,891	1,894	1,914	(383)	[92]	{46}	1,935	(387)	[93]	{46}	1,957	(391)	[94]	{47}
Tompkins	675	678	690	702	712	(142)	[34]	{17}	722	(144)	[35]	{17}	732	(146)	[35]	{18}
Ulster	2,588	2,599	2,607	2,626	2,645	(529)	[127]	{63}	2,664	(533)	[128]	{64}	2,683	(537)	[129]	{64}
Westchester	41,542	41,720	41,954	42,179	42,618	(8,524)	[2,046]	{1,023}	43,108	(8,622)	[2,069]	{1,035}	43,655	(8,731)	[2,095]	{1,048}

For additional information from IEM, please contact Bryan Koon, Vice President of Emergency Management and Homeland Security at [bryan.koon@iem.com](mailto:bryan.koon@iem.com) or 850-519-7966 or Stephanie Tennyson at [stephanie.tennyson@iem.com](mailto:stephanie.tennyson@iem.com) or 202-309-4257.