IEM's AI Modeling: Short-term COVID-19 Projections
Date: 9/8/21

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 9/8/21 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
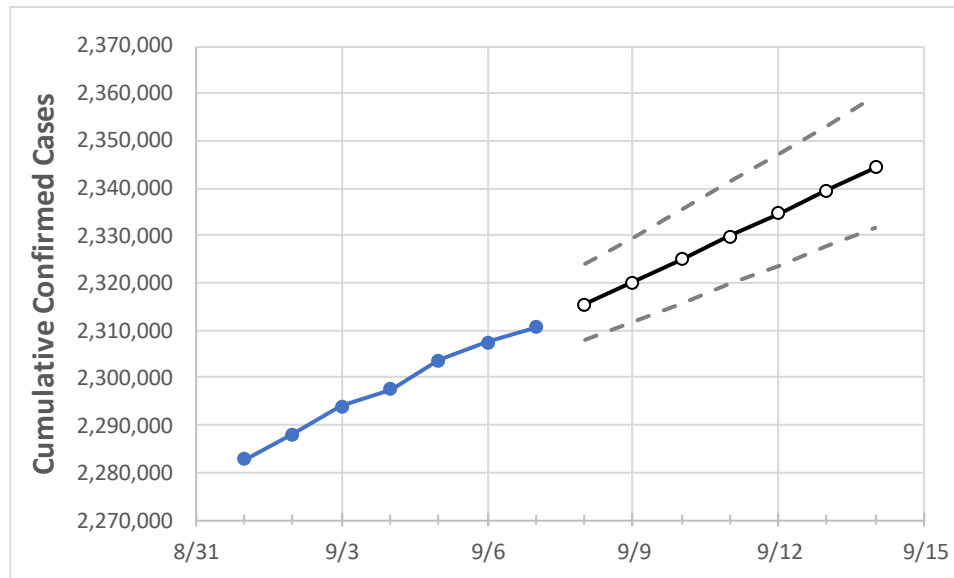
	Actual Confirmed Cases On:				Projected Cases For:						
	9/4	9/5	9/6	9/7	9/8	9/9	9/10	9/11	9/12	9/13	9/14
New York	2,297,642	2,303,739	2,307,414	2,310,662	2,315,417	2,320,174	2,324,990	2,329,872	2,334,674	2,339,513	2,344,345

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:						
	9/4	9/5	9/6	9/7	9/8	9/9	9/10	9/11	9/12	9/13	9/14
Albany	27,200	27,252	27,306	27,355	27,433	27,514	27,592	27,674	27,757	27,839	27,925
Bronx	197,236	197,557	197,759	197,900	198,193	198,481	198,760	199,049	199,328	199,617	199,890
Dutchess	32,349	32,426	32,483	32,529	32,605	32,679	32,753	32,827	32,900	32,975	33,049
Erie	95,380	95,513	95,686	95,853	96,050	96,249	96,448	96,658	96,864	97,079	97,295
Kings	308,389	308,946	309,335	309,602	310,095	310,595	311,077	311,551	312,034	312,510	312,993
Monroe	74,987	75,117	75,259	75,370	75,545	75,719	75,894	76,072	76,249	76,435	76,611
Nassau	200,062	200,481	200,720	200,945	201,308	201,665	202,023	202,380	202,726	203,084	203,453
New York	155,638	155,958	156,183	156,339	156,646	156,936	157,223	157,508	157,798	158,087	158,363
Niagara	21,240	21,294	21,328	21,366	21,417	21,469	21,523	21,577	21,634	21,694	21,754
Onondaga	43,076	43,166	43,325	43,420	43,573	43,725	43,881	44,037	44,202	44,367	44,534
Orange	52,607	52,709	52,782	52,862	52,968	53,073	53,178	53,283	53,390	53,499	53,602
Putnam	11,442	11,460	11,483	11,497	11,519	11,540	11,562	11,584	11,607	11,629	11,651
Queens	298,295	298,692	298,952	299,276	299,621	299,970	300,311	300,650	300,987	301,316	301,646
Rensselaer	12,570	12,601	12,642	12,667	12,710	12,752	12,795	12,839	12,884	12,930	12,975
Richmond	82,939	83,122	83,262	83,364	83,525	83,687	83,846	84,007	84,170	84,330	84,492
Rockland	49,503	49,570	49,597	49,679	49,744	49,808	49,871	49,937	50,002	50,070	50,136
Saratoga	17,498	17,551	17,606	17,650	17,710	17,773	17,833	17,895	17,957	18,021	18,084
Schenectady	14,626	14,654	14,678	14,703	14,741	14,778	14,816	14,855	14,893	14,932	14,969
Suffolk	218,840	219,387	219,702	220,096	220,607	221,120	221,641	222,162	222,696	223,227	223,773
Sullivan	7,423	7,450	7,464	7,480	7,502	7,524	7,547	7,570	7,593	7,616	7,639
Tompkins	5,376	5,437	5,453	5,471	5,531	5,596	5,661	5,727	5,799	5,869	5,946
Ulster	15,503	15,559	15,592	15,633	15,679	15,723	15,769	15,814	15,858	15,905	15,951
Westchester	137,873	138,048	138,196	138,299	138,468	138,637	138,800	138,969	139,132	139,302	139,467

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:		
	9/4	9/5	9/6	9/7	9/9	9/11	9/13
Albany	27,200	27,252	27,306	27,355	27,514 (5,503) [1,321] {660}	27,674 (5,535) [1,328] {664}	27,839 (5,568) [1,336] {668}
Bronx	197,236	197,557	197,759	197,900	198,481 (39,696) [9,527] {4,764}	199,049 (39,810) [9,554] {4,777}	199,617 (39,923) [9,582] {4,791}
Dutchess	32,349	32,426	32,483	32,529	32,679 (6,536) [1,569] {784}	32,827 (6,565) [1,576] {788}	32,975 (6,595) [1,583] {791}
Erie	95,380	95,513	95,686	95,853	96,249 (19,250) [4,620] {2,310}	96,658 (19,332) [4,640] {2,320}	97,079 (19,416) [4,660] {2,330}
Kings	308,389	308,946	309,335	309,602	310,595 (62,119) [14,909] {7,454}	311,551 (62,310) [14,954] {7,477}	312,510 (62,502) [15,000] {7,500}
Monroe	74,987	75,117	75,259	75,370	75,719 (15,144) [3,634] {1,817}	76,072 (15,214) [3,651] {1,826}	76,435 (15,287) [3,669] {1,834}
Nassau	200,062	200,481	200,720	200,945	201,665 (40,333) [9,680] {4,840}	202,380 (40,476) [9,714] {4,857}	203,084 (40,617) [9,748] {4,874}
New York	155,638	155,958	156,183	156,339	156,936 (31,387) [7,533] {3,766}	157,508 (31,502) [7,560] {3,780}	158,087 (31,617) [7,588] {3,794}
Niagara	21,240	21,294	21,328	21,366	21,469 (4,294) [1,031] {515}	21,577 (4,315) [1,036] {518}	21,694 (4,339) [1,041] {521}
Onondaga	43,076	43,166	43,325	43,420	43,725 (8,745) [2,099] {1,049}	44,037 (8,807) [2,114] {1,057}	44,367 (8,873) [2,130] {1,065}
Orange	52,607	52,709	52,782	52,862	53,073 (10,615) [2,547] {1,274}	53,283 (10,657) [2,558] {1,279}	53,499 (10,700) [2,568] {1,284}
Putnam	11,442	11,460	11,483	11,497	11,540 (2,308) [554] {277}	11,584 (2,317) [556] {278}	11,629 (2,326) [558] {279}
Queens	298,295	298,692	298,952	299,276	299,970 (59,994) [14,399] {7,199}	300,650 (60,130) [14,431] {7,216}	301,316 (60,263) [14,463] {7,232}
Rensselaer	12,570	12,601	12,642	12,667	12,752 (2,550) [612] {306}	12,839 (2,568) [616] {308}	12,930 (2,586) [621] {310}
Richmond	82,939	83,122	83,262	83,364	83,687 (16,737) [4,017] {2,008}	84,007 (16,801) [4,032] {2,016}	84,330 (16,866) [4,048] {2,024}
Rockland	49,503	49,570	49,597	49,679	49,808 (9,962) [2,391] {1,195}	49,937 (9,987) [2,397] {1,198}	50,070 (10,014) [2,403] {1,202}
Saratoga	17,498	17,551	17,606	17,650	17,773 (3,555) [853] {427}	17,895 (3,579) [859] {429}	18,021 (3,604) [865] {433}
Schenectady	14,626	14,654	14,678	14,703	14,778 (2,956) [709] {355}	14,855 (2,971) [713] {357}	14,932 (2,986) [717] {358}
Suffolk	218,840	219,387	219,702	220,096	221,120 (44,224) [10,614] {5,307}	222,162 (44,432) [10,664] {5,332}	223,227 (44,645) [10,715] {5,357}
Sullivan	7,423	7,450	7,464	7,480	7,524 (1,505) [361] {181}	7,570 (1,514) [363] {182}	7,616 (1,523) [366] {183}
Tompkins	5,376	5,437	5,453	5,471	5,596 (1,119) [269] {134}	5,727 (1,145) [275] {137}	5,869 (1,174) [282] {141}
Ulster	15,503	15,559	15,592	15,633	15,723 (3,145) [755] {377}	15,814 (3,163) [759] {380}	15,905 (3,181) [763] {382}
Westchester	137,873	138,048	138,196	138,299	138,637 (27,727) [6,655] {3,327}	138,969 (27,794) [6,671] {3,335}	139,302 (27,860) [6,687] {3,343}

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.