IEM's AI Modeling: Short-term COVID-19 Projections
Date: 6/3/21

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 <u>not</u> 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 6/3/21 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
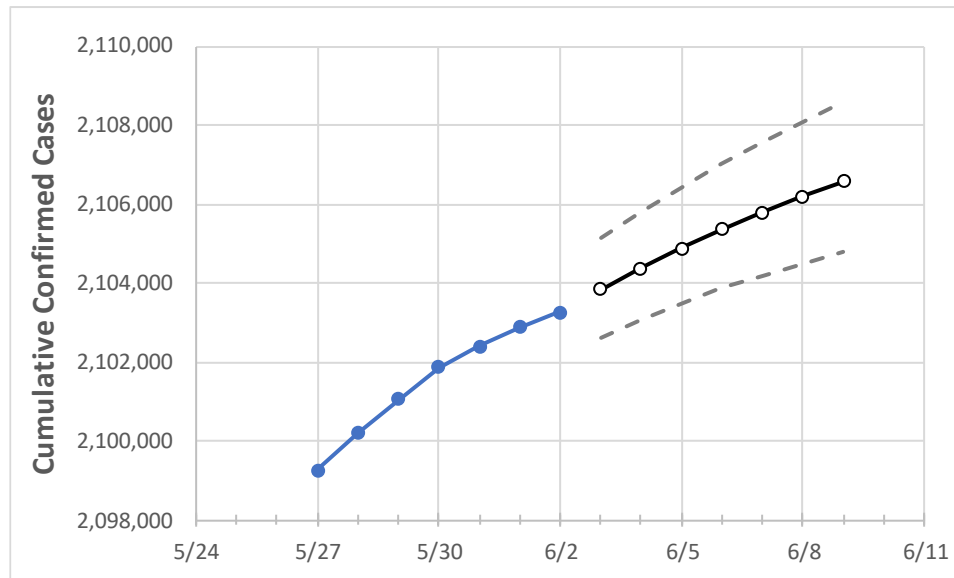
	Actual Confirmed Cases On:				Projected Cases For:						
	5/30	5/31	6/1	6/2	6/3	6/4	6/5	6/6	6/7	6/8	6/9
New York	2,101,875	2,102,404	2,102,869	2,103,269	2,103,838	2,104,383	2,104,886	2,105,356	2,105,793	2,106,202	2,106,581

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:						
	5/30	5/31	6/1	6/2	6/3	6/4	6/5	6/6	6/7	6/8	6/9
Albany	24,628	24,633	24,634	24,642	24,650	24,658	24,665	24,672	24,679	24,685	24,691
Bronx	182,548	182,591	182,635	182,676	182,723	182,768	182,812	182,853	182,891	182,929	182,963
Dutchess	29,385	29,392	29,394	29,402	29,408	29,414	29,419	29,424	29,429	29,433	29,437
Erie	89,270	89,289	89,314	89,335	89,365	89,392	89,418	89,443	89,465	89,486	89,505
Kings	279,611	279,682	279,755	279,764	279,843	279,917	279,986	280,052	280,113	280,173	280,230
Monroe	68,386	68,440	68,480	68,522	68,581	68,636	68,690	68,739	68,788	68,834	68,875
Nassau	183,169	183,195	183,212	183,233	183,262	183,288	183,313	183,335	183,356	183,376	183,395
New York	137,710	137,742	137,766	137,786	137,818	137,848	137,877	137,905	137,931	137,955	137,976
Niagara	19,968	19,970	19,980	19,986	19,995	20,003	20,011	20,018	20,026	20,032	20,038
Onondaga	38,691	38,703	38,715	38,726	38,753	38,779	38,803	38,827	38,851	38,873	38,895
Orange	48,145	48,154	48,162	48,172	48,183	48,193	48,202	48,211	48,220	48,228	48,235
Putnam	10,574	10,575	10,577	10,581	10,582	10,584	10,585	10,586	10,588	10,589	10,590
Queens	276,330	276,401	276,485	276,534	276,604	276,671	276,734	276,794	276,847	276,901	276,951
Rensselaer	11,188	11,189	11,192	11,194	11,196	11,198	11,200	11,201	11,203	11,204	11,205
Richmond	74,644	74,665	74,689	74,706	74,731	74,754	74,776	74,798	74,819	74,838	74,856
Rockland	46,844	46,849	46,857	46,864	46,871	46,878	46,884	46,890	46,895	46,901	46,906
Saratoga	15,295	15,302	15,306	15,312	15,319	15,325	15,331	15,336	15,341	15,346	15,351
Schenectady	13,152	13,154	13,156	13,167	13,174	13,181	13,187	13,193	13,199	13,205	13,211
Suffolk	200,501	200,520	200,548	200,575	200,613	200,650	200,685	200,719	200,751	200,780	200,809
Sullivan	6,636	6,637	6,638	6,638	6,641	6,645	6,648	6,651	6,654	6,657	6,659
Tompkins	4,318	4,322	4,323	4,325	4,328	4,330	4,333	4,335	4,338	4,340	4,342
Ulster	13,867	13,872	13,873	13,876	13,879	13,882	13,884	13,887	13,889	13,891	13,893
Westchester	129,369	129,387	129,399	129,411	129,432	129,451	129,469	129,487	129,505	129,521	129,536

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:		
	5/30	5/31	6/1	6/2	6/4	6/6	6/8
Albany	24,628	24,633	24,634	24,642	24,658 (4,932) [1,184] {592}	24,672 (4,934) [1,184] {592}	24,685 (4,937) [1,185] {592}
Bronx	182,548	182,591	182,635	182,676	182,768 (36,554) [8,773] {4,386}	182,853 (36,571) [8,777] {4,388}	182,929 (36,586) [8,781] {4,390}
Dutchess	29,385	29,392	29,394	29,402	29,414 (5,883) [1,412] {706}	29,424 (5,885) [1,412] {706}	29,433 (5,887) [1,413] {706}
Erie	89,270	89,289	89,314	89,335	89,392 (17,878) [4,291] {2,145}	89,443 (17,889) [4,293] {2,147}	89,486 (17,897) [4,295] {2,148}
Kings	279,611	279,682	279,755	279,764	279,917 (55,983) [13,436] {6,718}	280,052 (56,010) [13,442] {6,721}	280,173 (56,035) [13,448] {6,724}
Monroe	68,386	68,440	68,480	68,522	68,636 (13,727) [3,295] {1,647}	68,739 (13,748) [3,299] {1,650}	68,834 (13,767) [3,304] {1,652}
Nassau	183,169	183,195	183,212	183,233	183,288 (36,658) [8,798] {4,399}	183,335 (36,667) [8,800] {4,400}	183,376 (36,675) [8,802] {4,401}
New York	137,710	137,742	137,766	137,786	137,848 (27,570) [6,617] {3,308}	137,905 (27,581) [6,619] {3,310}	137,955 (27,591) [6,622] {3,311}
Niagara	19,968	19,970	19,980	19,986	20,003 (4,001) [960] {480}	20,018 (4,004) [961] {480}	20,032 (4,006) [962] {481}
Onondaga	38,691	38,703	38,715	38,726	38,779 (7,756) [1,861] {931}	38,827 (7,765) [1,864] {932}	38,873 (7,775) [1,866] {933}
Orange	48,145	48,154	48,162	48,172	48,193 (9,639) [2,313] {1,157}	48,211 (9,642) [2,314] {1,157}	48,228 (9,646) [2,315] {1,157}
Putnam	10,574	10,575	10,577	10,581	10,584 (2,117) [508] {254}	10,586 (2,117) [508] {254}	10,589 (2,118) [508] {254}
Queens	276,330	276,401	276,485	276,534	276,671 (55,334) [13,280] {6,640}	276,794 (55,359) [13,286] {6,643}	276,901 (55,380) [13,291] {6,646}
Rensselaer	11,188	11,189	11,192	11,194	11,198 (2,240) [537] {269}	11,201 (2,240) [538] {269}	11,204 (2,241) [538] {269}
Richmond	74,644	74,665	74,689	74,706	74,754 (14,951) [3,588] {1,794}	74,798 (14,960) [3,590] {1,795}	74,838 (14,968) [3,592] {1,796}
Rockland	46,844	46,849	46,857	46,864	46,878 (9,376) [2,250] {1,125}	46,890 (9,378) [2,251] {1,125}	46,901 (9,380) [2,251] {1,126}
Saratoga	15,295	15,302	15,306	15,312	15,325 (3,065) [736] {368}	15,336 (3,067) [736] {368}	15,346 (3,069) [737] {368}
Schenectady	13,152	13,154	13,156	13,167	13,181 (2,636) [633] {316}	13,193 (2,639) [633] {317}	13,205 (2,641) [634] {317}
Suffolk	200,501	200,520	200,548	200,575	200,650 (40,130) [9,631] {4,816}	200,719 (40,144) [9,634] {4,817}	200,780 (40,156) [9,637] {4,819}
Sullivan	6,636	6,637	6,638	6,638	6,645 (1,329) [319] {159}	6,651 (1,330) [319] {160}	6,657 (1,331) [320] {160}
Tompkins	4,318	4,322	4,323	4,325	4,330 (866) [208] {104}	4,335 (867) [208] {104}	4,340 (868) [208] {104}
Ulster	13,867	13,872	13,873	13,876	13,882 (2,776) [666] {333}	13,887 (2,777) [667] {333}	13,891 (2,778) [667] {333}
Westchester	129,369	129,387	129,399	129,411	129,451 (25,890) [6,214] {3,107}	129,487 (25,897) [6,215] {3,108}	129,521 (25,904) [6,217] {3,109}

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.