IEM's AI Modeling: Short-term COVID-19 Projections
Date: 10/19/20

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 <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 10/19/20 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
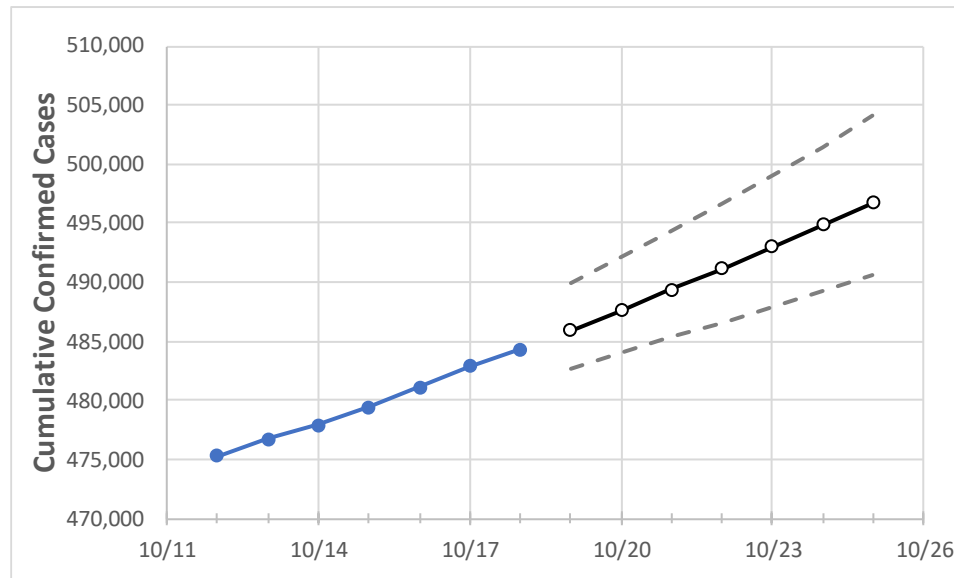
	Actual Confirmed Cases On:				Projected Cases For:						
	10/15	10/16	10/17	10/18	10/19	10/20	10/21	10/22	10/23	10/24	10/25
New York	479,400	481,107	482,891	484,281	485,941	487,641	489,381	491,161	492,984	494,849	496,759

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:						
	10/15	10/16	10/17	10/18	10/19	10/20	10/21	10/22	10/23	10/24	10/25
Albany	3,369	3,383	3,398	3,416	3,434	3,453	3,472	3,491	3,511	3,531	3,552
Bronx	54,077	54,198	54,307	54,409	54,496	54,586	54,677	54,771	54,868	54,967	55,068
Dutchess	5,289	5,305	5,318	5,328	5,340	5,352	5,364	5,377	5,390	5,403	5,416
Erie	12,269	12,324	12,393	12,451	12,500	12,550	12,600	12,651	12,701	12,752	12,803
Kings	72,369	72,598	72,894	73,123	73,369	73,619	73,871	74,126	74,383	74,644	74,907
Monroe	6,572	6,628	6,671	6,707	6,750	6,795	6,842	6,890	6,940	6,992	7,046
Nassau	48,272	48,377	48,494	48,596	48,702	48,810	48,920	49,033	49,147	49,263	49,381
New York	34,637	34,735	34,871	34,991	35,086	35,184	35,285	35,388	35,495	35,605	35,718
Niagara	1,928	1,938	1,946	1,958	1,967	1,977	1,987	1,998	2,008	2,019	2,030
Onondaga	4,908	4,946	4,977	5,011	5,049	5,089	5,129	5,171	5,213	5,257	5,301
Orange	13,033	13,098	13,139	13,169	13,226	13,285	13,344	13,404	13,465	13,527	13,591
Putnam	1,710	1,716	1,731	1,736	1,743	1,750	1,758	1,766	1,774	1,782	1,791
Queens	74,632	74,798	74,998	75,109	75,275	75,445	75,619	75,795	75,976	76,160	76,348
Rensselaer	1,007	1,020	1,021	1,027	1,033	1,038	1,044	1,051	1,057	1,064	1,071
Richmond	16,559	16,605	16,670	16,720	16,771	16,823	16,876	16,932	16,989	17,048	17,109
Rockland	16,972	17,063	17,125	17,171	17,250	17,330	17,412	17,494	17,577	17,662	17,747
Saratoga	1,182	1,190	1,202	1,207	1,215	1,223	1,231	1,239	1,247	1,255	1,264
Schenectady	1,477	1,485	1,491	1,498	1,502	1,507	1,512	1,517	1,522	1,527	1,532
Suffolk	47,711	47,815	47,941	48,029	48,129	48,231	48,337	48,445	48,556	48,670	48,788
Sullivan	1,663	1,668	1,674	1,675	1,679	1,682	1,686	1,690	1,694	1,699	1,703
Tompkins	515	523	534	540	548	557	566	576	586	597	608
Ulster	2,392	2,395	2,402	2,411	2,419	2,428	2,437	2,446	2,456	2,466	2,476
Westchester	39,200	39,288	39,398	39,476	39,561	39,649	39,739	39,833	39,929	40,028	40,131

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: | | |
	10/15	10/16	10/17	10/18	10/20	10/22	10/24
Albany	3,369	3,383	3,398	3,416	3,453 (691) [166] {83}	3,491 (698) [168] {84}	3,531 (706) [169] {85}
Bronx	54,077	54,198	54,307	54,409	54,586 (10,917) [2,620] {1,310}	54,771 (10,954) [2,629] {1,315}	54,967 (10,993) [2,638] {1,319}
Dutchess	5,289	5,305	5,318	5,328	5,352 (1,070) [257] {128}	5,377 (1,075) [258] {129}	5,403 (1,081) [259] {130}
Erie	12,269	12,324	12,393	12,451	12,550 (2,510) [602] {301}	12,651 (2,530) [607] {304}	12,752 (2,550) [612] {306}
Kings	72,369	72,598	72,894	73,123	73,619 (14,724) [3,534] {1,767}	74,126 (14,825) [3,558] {1,779}	74,644 (14,929) [3,583] {1,791}
Monroe	6,572	6,628	6,671	6,707	6,795 (1,359) [326] {163}	6,890 (1,378) [331] {165}	6,992 (1,398) [336] {168}
Nassau	48,272	48,377	48,494	48,596	48,810 (9,762) [2,343] {1,171}	49,033 (9,807) [2,354] {1,177}	49,263 (9,853) [2,365] {1,182}
New York	34,637	34,735	34,871	34,991	35,184 (7,037) [1,689] {844}	35,388 (7,078) [1,699] {849}	35,605 (7,121) [1,709] {855}
Niagara	1,928	1,938	1,946	1,958	1,977 (395) [95] {47}	1,998 (400) [96] {48}	2,019 (404) [97] {48}
Onondaga	4,908	4,946	4,977	5,011	5,089 (1,018) [244] {122}	5,171 (1,034) [248] {124}	5,257 (1,051) [252] {126}
Orange	13,033	13,098	13,139	13,169	13,285 (2,657) [638] {319}	13,404 (2,681) [643] {322}	13,527 (2,705) [649] {325}
Putnam	1,710	1,716	1,731	1,736	1,750 (350) [84] {42}	1,766 (353) [85] {42}	1,782 (356) [86] {43}
Queens	74,632	74,798	74,998	75,109	75,445 (15,089) [3,621] {1,811}	75,795 (15,159) [3,638] {1,819}	76,160 (15,232) [3,656] {1,828}
Rensselaer	1,007	1,020	1,021	1,027	1,038 (208) [50] {25}	1,051 (210) [50] {25}	1,064 (213) [51] {26}
Richmond	16,559	16,605	16,670	16,720	16,823 (3,365) [807] {404}	16,932 (3,386) [813] {406}	17,048 (3,410) [818] {409}
Rockland	16,972	17,063	17,125	17,171	17,330 (3,466) [832] {416}	17,494 (3,499) [840] {420}	17,662 (3,532) [848] {424}
Saratoga	1,182	1,190	1,202	1,207	1,223 (245) [59] {29}	1,239 (248) [59] {30}	1,255 (251) [60] {30}
Schenectady	1,477	1,485	1,491	1,498	1,507 (301) [72] {36}	1,517 (303) [73] {36}	1,527 (305) [73] {37}
Suffolk	47,711	47,815	47,941	48,029	48,231 (9,646) [2,315] {1,158}	48,445 (9,689) [2,325] {1,163}	48,670 (9,734) [2,336] {1,168}
Sullivan	1,663	1,668	1,674	1,675	1,682 (336) [81] {40}	1,690 (338) [81] {41}	1,699 (340) [82] {41}
Tompkins	515	523	534	540	557 (111) [27] {13}	576 (115) [28] {14}	597 (119) [29] {14}
Ulster	2,392	2,395	2,402	2,411	2,428 (486) [117] {58}	2,446 (489) [117] {59}	2,466 (493) [118] {59}
Westchester	39,200	39,288	39,398	39,476	39,649 (7,930) [1,903] {952}	39,833 (7,967) [1,912] {956}	40,028 (8,006) [1,921] {961}

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.