IEM's AI Modeling: Short-term COVID-19 Projections
Date: 7/17/20

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

The projections shown in this document are based on data pulled in as of 7/17/20 11 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
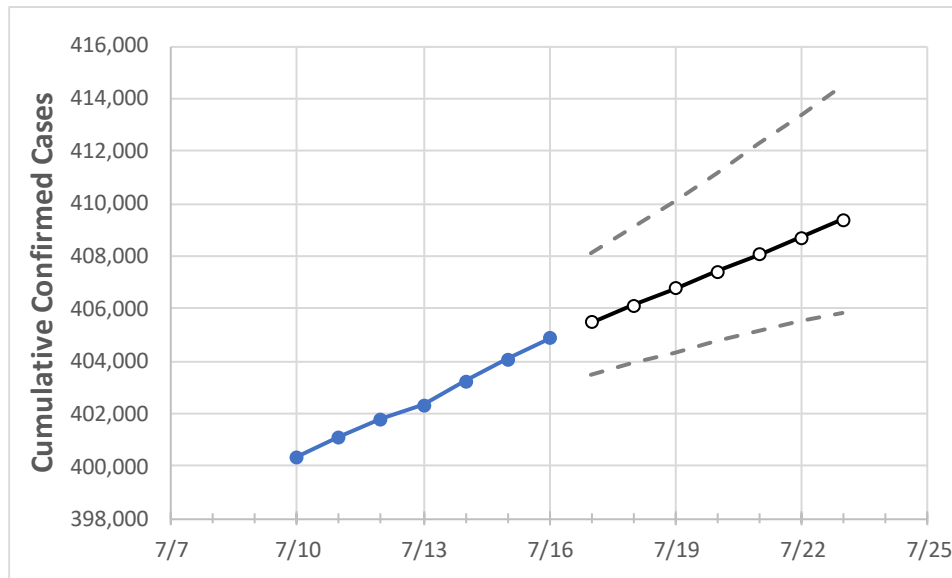
	Actual Confirmed Cases On:				Projected Cases For:						
	7/13	7/14	7/15	7/16	7/17	7/18	7/19	7/20	7/21	7/22	7/23
New York	402,332	403,244	404,075	404,844	405,481	406,122	406,765	407,411	408,061	408,713	409,368

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:						
	7/13	7/14	7/15	7/16	7/17	7/18	7/19	7/20	7/21	7/22	7/23
Albany	2,225	2,247	2,280	2,290	2,305	2,320	2,336	2,353	2,371	2,390	2,409
Bronx	48,377	48,433	48,496	48,575	48,628	48,680	48,732	48,784	48,834	48,885	48,935
Dutchess	4,280	4,318	4,337	4,357	4,367	4,377	4,387	4,398	4,409	4,421	4,433
Erie	7,766	7,833	7,891	7,927	7,966	8,007	8,047	8,089	8,131	8,174	8,217
Kings	60,815	60,904	61,012	61,124	61,211	61,298	61,385	61,471	61,558	61,644	61,730
Monroe	4,200	4,247	4,281	4,317	4,348	4,379	4,410	4,441	4,472	4,502	4,533
Nassau	42,354	42,423	42,462	42,506	42,550	42,595	42,640	42,686	42,733	42,780	42,827
New York	29,302	29,363	29,442	29,516	29,579	29,642	29,705	29,768	29,831	29,894	29,957
Niagara	1,342	1,351	1,356	1,364	1,370	1,376	1,382	1,388	1,394	1,400	1,406
Onondaga	3,142	3,179	3,203	3,225	3,249	3,273	3,298	3,323	3,348	3,374	3,400
Orange	10,841	10,850	10,878	10,895	10,906	10,917	10,928	10,939	10,951	10,963	10,975
Putnam	1,365	1,376	1,382	1,385	1,390	1,396	1,401	1,408	1,414	1,422	1,429
Queens	66,466	66,544	66,643	66,735	66,808	66,880	66,951	67,022	67,091	67,160	67,228
Rensselaer	617	625	632	639	645	652	659	666	674	683	692
Richmond	14,341	14,372	14,389	14,417	14,437	14,458	14,478	14,499	14,520	14,542	14,563
Rockland	13,719	13,733	13,743	13,763	13,773	13,782	13,792	13,802	13,812	13,821	13,831
Saratoga	610	616	623	624	629	635	641	647	654	661	668
Schenectady	868	883	891	896	901	906	912	917	922	928	933
Suffolk	42,112	42,214	42,267	42,333	42,404	42,476	42,551	42,627	42,705	42,786	42,869
Sullivan	1,466	1,466	1,467	1,469	1,470	1,470	1,471	1,472	1,473	1,473	1,474
Tompkins	190	194	198	198	202	205	208	211	214	217	220
Ulster	1,862	1,872	1,888	1,894	1,899	1,903	1,908	1,913	1,917	1,922	1,926
Westchester	35,327	35,366	35,394	35,422	35,451	35,480	35,508	35,535	35,562	35,589	35,615

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:		
	7/13	7/14	7/15	7/16	7/18	7/20	7/22
Albany	2,225	2,247	2,280	2,290	2,320 (464) [111] {56}	2,353 (471) [113] {56}	2,390 (478) [115] {57}
Bronx	48,377	48,433	48,496	48,575	48,680 (9,736) [2,337] {1,168}	48,784 (9,757) [2,342] {1,171}	48,885 (9,777) [2,346] {1,173}
Dutchess	4,280	4,318	4,337	4,357	4,377 (875) [210] {105}	4,398 (880) [211] {106}	4,421 (884) [212] {106}
Erie	7,766	7,833	7,891	7,927	8,007 (1,601) [384] {192}	8,089 (1,618) [388] {194}	8,174 (1,635) [392] {196}
Kings	60,815	60,904	61,012	61,124	61,298 (12,260) [2,942] {1,471}	61,471 (12,294) [2,951] {1,475}	61,644 (12,329) [2,959] {1,479}
Monroe	4,200	4,247	4,281	4,317	4,379 (876) [210] {105}	4,441 (888) [213] {107}	4,502 (900) [216] {108}
Nassau	42,354	42,423	42,462	42,506	42,595 (8,519) [2,045] {1,022}	42,686 (8,537) [2,049] {1,024}	42,780 (8,556) [2,053] {1,027}
New York	29,302	29,363	29,442	29,516	29,642 (5,928) [1,423] {711}	29,768 (5,954) [1,429] {714}	29,894 (5,979) [1,435] {717}
Niagara	1,342	1,351	1,356	1,364	1,376 (275) [66] {33}	1,388 (278) [67] {33}	1,400 (280) [67] {34}
Onondaga	3,142	3,179	3,203	3,225	3,273 (655) [157] {79}	3,323 (665) [160] {80}	3,374 (675) [162] {81}
Orange	10,841	10,850	10,878	10,895	10,917 (2,183) [524] {262}	10,939 (2,188) [525] {263}	10,963 (2,193) [526] {263}
Putnam	1,365	1,376	1,382	1,385	1,396 (279) [67] {33}	1,408 (282) [68] {34}	1,422 (284) [68] {34}
Queens	66,466	66,544	66,643	66,735	66,880 (13,376) [3,210] {1,605}	67,022 (13,404) [3,217] {1,609}	67,160 (13,432) [3,224] {1,612}
Rensselaer	617	625	632	639	652 (130) [31] {16}	666 (133) [32] {16}	683 (137) [33] {16}
Richmond	14,341	14,372	14,389	14,417	14,458 (2,892) [694] {347}	14,499 (2,900) [696] {348}	14,542 (2,908) [698] {349}
Rockland	13,719	13,733	13,743	13,763	13,782 (2,756) [662] {331}	13,802 (2,760) [662] {331}	13,821 (2,764) [663] {332}
Saratoga	610	616	623	624	635 (127) [30] {15}	647 (129) [31] {16}	661 (132) [32] {16}
Schenectady	868	883	891	896	906 (181) [44] {22}	917 (183) [44] {22}	928 (186) [45] {22}
Suffolk	42,112	42,214	42,267	42,333	42,476 (8,495) [2,039] {1,019}	42,627 (8,525) [2,046] {1,023}	42,786 (8,557) [2,054] {1,027}
Sullivan	1,466	1,466	1,467	1,469	1,470 (294) [71] {35}	1,472 (294) [71] {35}	1,473 (295) [71] {35}
Tompkins	190	194	198	198	205 (41) [10] {5}	211 (42) [10] {5}	217 (43) [10] {5}
Ulster	1,862	1,872	1,888	1,894	1,903 (381) [91] {46}	1,913 (383) [92] {46}	1,922 (384) [92] {46}
Westchester	35,327	35,366	35,394	35,422	35,480 (7,096) [1,703] {852}	35,535 (7,107) [1,706] {853}	35,589 (7,118) [1,708] {854}

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.