IEM's AI Modeling: Short-term COVID-19 Projections
Date: 5/20/21

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 5/20/21 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
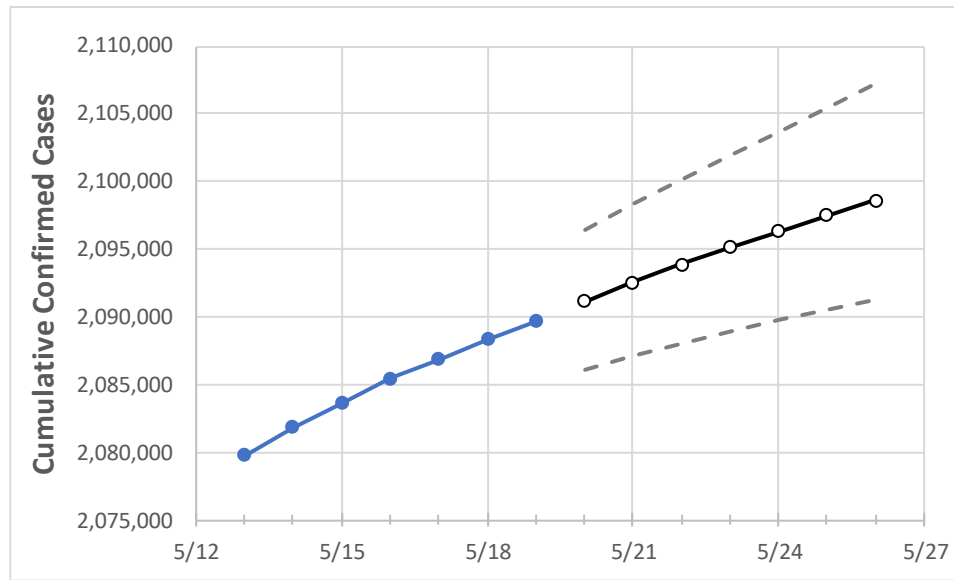
	Actual Confirmed Cases On:				Projected Cases For:						
	5/16	5/17	5/18	5/19	5/20	5/21	5/22	5/23	5/24	5/25	5/26
New York	2,085,477	2,086,836	2,088,361	2,089,698	2,091,159	2,092,540	2,093,878	2,095,112	2,096,333	2,097,521	2,098,620

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:						
	5/16	5/17	5/18	5/19	5/20	5/21	5/22	5/23	5/24	5/25	5/26
Albany	24,445	24,455	24,466	24,480	24,494	24,508	24,522	24,536	24,548	24,561	24,573
Bronx	181,406	181,500	181,617	181,665	181,759	181,851	181,941	182,025	182,107	182,185	182,259
Dutchess	29,194	29,214	29,231	29,249	29,268	29,287	29,305	29,321	29,338	29,353	29,368
Erie	88,434	88,507	88,560	88,638	88,714	88,787	88,856	88,921	88,982	89,040	89,096
Kings	277,468	277,651	277,901	278,018	278,186	278,352	278,501	278,646	278,789	278,921	279,047
Monroe	66,865	66,986	67,103	67,230	67,381	67,529	67,673	67,814	67,951	68,090	68,222
Nassau	182,343	182,422	182,491	182,565	182,637	182,705	182,772	182,835	182,896	182,954	183,008
New York	136,921	136,977	137,019	137,079	137,147	137,210	137,273	137,331	137,386	137,439	137,492
Niagara	19,704	19,721	19,736	19,766	19,788	19,809	19,829	19,849	19,867	19,885	19,901
Onondaga	38,098	38,132	38,158	38,230	38,278	38,324	38,371	38,418	38,464	38,508	38,551
Orange	47,883	47,908	47,920	47,941	47,966	47,990	48,012	48,034	48,054	48,073	48,090
Putnam	10,541	10,542	10,544	10,548	10,552	10,555	10,558	10,560	10,563	10,566	10,568
Queens	274,314	274,493	274,913	275,028	275,199	275,364	275,525	275,676	275,825	275,970	276,111
Rensselaer	11,114	11,123	11,133	11,139	11,149	11,159	11,170	11,179	11,189	11,199	11,208
Richmond	74,065	74,109	74,179	74,217	74,264	74,310	74,354	74,396	74,436	74,473	74,512
Rockland	46,673	46,697	46,704	46,715	46,728	46,741	46,753	46,765	46,776	46,786	46,796
Saratoga	15,123	15,136	15,147	15,165	15,182	15,199	15,215	15,231	15,246	15,261	15,276
Schenectady	12,999	13,009	13,018	13,029	13,041	13,053	13,065	13,076	13,087	13,097	13,107
Suffolk	199,506	199,592	199,660	199,739	199,823	199,901	199,974	200,045	200,113	200,176	200,238
Sullivan	6,552	6,558	6,560	6,564	6,570	6,575	6,580	6,585	6,590	6,594	6,598
Tompkins	4,250	4,256	4,265	4,274	4,282	4,289	4,297	4,305	4,313	4,321	4,329
Ulster	13,777	13,788	13,795	13,801	13,810	13,819	13,827	13,835	13,842	13,849	13,855
Westchester	128,864	128,897	128,921	128,967	129,004	129,041	129,075	129,108	129,139	129,167	129,195

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:		
	5/16	5/17	5/18	5/19	5/21	5/23	5/25
Albany	24,445	24,455	24,466	24,480	24,508 (4,902) [1,176] {588}	24,536 (4,907) [1,178] {589}	24,561 (4,912) [1,179] {589}
Bronx	181,406	181,500	181,617	181,665	181,851 (36,370) [8,729] {4,364}	182,025 (36,405) [8,737] {4,369}	182,185 (36,437) [8,745] {4,372}
Dutchess	29,194	29,214	29,231	29,249	29,287 (5,857) [1,406] {703}	29,321 (5,864) [1,407] {704}	29,353 (5,871) [1,409] {704}
Erie	88,434	88,507	88,560	88,638	88,787 (17,757) [4,262] {2,131}	88,921 (17,784) [4,268] {2,134}	89,040 (17,808) [4,274] {2,137}
Kings	277,468	277,651	277,901	278,018	278,352 (55,670) [13,361] {6,680}	278,646 (55,729) [13,375] {6,688}	278,921 (55,784) [13,388] {6,694}
Monroe	66,865	66,986	67,103	67,230	67,529 (13,506) [3,241] {1,621}	67,814 (13,563) [3,255] {1,628}	68,090 (13,618) [3,268] {1,634}
Nassau	182,343	182,422	182,491	182,565	182,705 (36,541) [8,770] {4,385}	182,835 (36,567) [8,776] {4,388}	182,954 (36,591) [8,782] {4,391}
New York	136,921	136,977	137,019	137,079	137,210 (27,442) [6,586] {3,293}	137,331 (27,466) [6,592] {3,296}	137,439 (27,488) [6,597] {3,299}
Niagara	19,704	19,721	19,736	19,766	19,809 (3,962) [951] {475}	19,849 (3,970) [953] {476}	19,885 (3,977) [954] {477}
Onondaga	38,098	38,132	38,158	38,230	38,324 (7,665) [1,840] {920}	38,418 (7,684) [1,844] {922}	38,508 (7,702) [1,848] {924}
Orange	47,883	47,908	47,920	47,941	47,990 (9,598) [2,304] {1,152}	48,034 (9,607) [2,306] {1,153}	48,073 (9,615) [2,308] {1,154}
Putnam	10,541	10,542	10,544	10,548	10,555 (2,111) [507] {253}	10,560 (2,112) [507] {253}	10,566 (2,113) [507] {254}
Queens	274,314	274,493	274,913	275,028	275,364 (55,073) [13,217] {6,609}	275,676 (55,135) [13,232] {6,616}	275,970 (55,194) [13,247] {6,623}
Rensselaer	11,114	11,123	11,133	11,139	11,159 (2,232) [536] {268}	11,179 (2,236) [537] {268}	11,199 (2,240) [538] {269}
Richmond	74,065	74,109	74,179	74,217	74,310 (14,862) [3,567] {1,783}	74,396 (14,879) [3,571] {1,785}	74,473 (14,895) [3,575] {1,787}
Rockland	46,673	46,697	46,704	46,715	46,741 (9,348) [2,244] {1,122}	46,765 (9,353) [2,245] {1,122}	46,786 (9,357) [2,246] {1,123}
Saratoga	15,123	15,136	15,147	15,165	15,199 (3,040) [730] {365}	15,231 (3,046) [731] {366}	15,261 (3,052) [733] {366}
Schenectady	12,999	13,009	13,018	13,029	13,053 (2,611) [627] {313}	13,076 (2,615) [628] {314}	13,097 (2,619) [629] {314}
Suffolk	199,506	199,592	199,660	199,739	199,901 (39,980) [9,595] {4,798}	200,045 (40,009) [9,602] {4,801}	200,176 (40,035) [9,608] {4,804}
Sullivan	6,552	6,558	6,560	6,564	6,575 (1,315) [316] {158}	6,585 (1,317) [316] {158}	6,594 (1,319) [317] {158}
Tompkins	4,250	4,256	4,265	4,274	4,289 (858) [206] {103}	4,305 (861) [207] {103}	4,321 (864) [207] {104}
Ulster	13,777	13,788	13,795	13,801	13,819 (2,764) [663] {332}	13,835 (2,767) [664] {332}	13,849 (2,770) [665] {332}
Westchester	128,864	128,897	128,921	128,967	129,041 (25,808) [6,194] {3,097}	129,108 (25,822) [6,197] {3,099}	129,167 (25,833) [6,200] {3,100}

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.