IEM's AI Modeling: Short-term COVID-19 Projections
Date: 12/21/20

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 10%, and are often within 5%, of actual confirmed cases.

The projections shown in this document are based on data pulled in as of 12/21/20 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
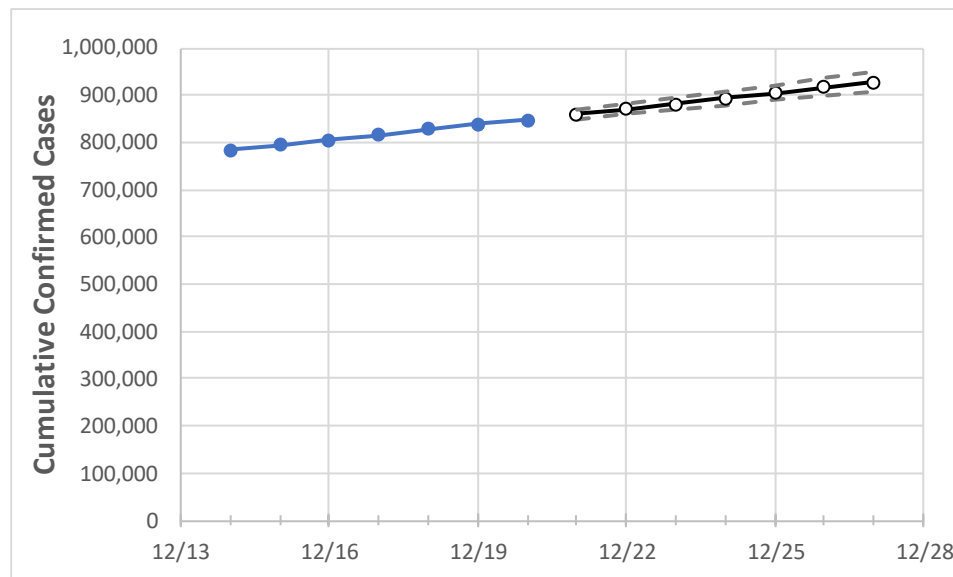
	Actual Confirmed Cases On:				Projected Cases For:						
	12/17	12/18	12/19	12/20	12/21	12/22	12/23	12/24	12/25	12/26	12/27
New York	815,469	828,166	838,085	848,042	859,169	870,421	881,799	893,305	904,940	916,704	928,598

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:						
	12/17	12/18	12/19	12/20	12/21	12/22	12/23	12/24	12/25	12/26	12/27
Albany	8,613	8,821	8,997	9,174	9,380	9,590	9,804	10,023	10,246	10,473	10,704
Bronx	73,685	74,405	74,916	75,496	76,143	76,800	77,464	78,138	78,821	79,512	80,213
Dutchess	9,800	9,959	10,090	10,238	10,411	10,587	10,766	10,948	11,132	11,320	11,511
Erie	34,757	35,507	35,953	36,400	36,877	37,351	37,821	38,287	38,750	39,209	39,664
Kings	105,006	106,355	107,392	108,330	109,481	110,656	111,854	113,075	114,320	115,590	116,885
Monroe	25,643	26,389	27,059	27,748	28,459	29,185	29,925	30,680	31,449	32,233	33,032
Nassau	73,757	74,658	75,421	76,322	77,226	78,144	79,076	80,023	80,984	81,960	82,951
New York	54,426	55,158	55,673	56,159	56,766	57,382	58,006	58,639	59,281	59,931	60,591
Niagara	6,384	6,582	6,709	6,845	6,996	7,147	7,299	7,452	7,605	7,759	7,913
Onondaga	16,429	16,860	17,267	17,586	17,984	18,389	18,800	19,219	19,644	20,076	20,515
Orange	20,324	20,717	20,876	21,072	21,308	21,549	21,795	22,045	22,300	22,559	22,824
Putnam	3,975	4,035	4,077	4,127	4,180	4,232	4,284	4,336	4,387	4,437	4,487
Queens	106,764	108,112	109,056	109,983	111,172	112,381	113,612	114,864	116,138	117,434	118,753
Rensselaer	2,904	2,991	3,091	3,168	3,269	3,374	3,483	3,596	3,713	3,835	3,962
Richmond	29,504	29,854	30,192	30,505	30,855	31,205	31,555	31,904	32,253	32,601	32,948
Rockland	24,787	24,983	25,124	25,275	25,459	25,645	25,831	26,018	26,205	26,394	26,583
Saratoga	3,809	3,908	4,008	4,096	4,210	4,327	4,447	4,569	4,694	4,822	4,953
Schenectady	4,153	4,268	4,377	4,488	4,617	4,749	4,886	5,027	5,172	5,321	5,474
Suffolk	78,850	80,047	80,989	82,134	83,313	84,507	85,715	86,937	88,173	89,424	90,689
Sullivan	2,551	2,601	2,639	2,697	2,743	2,791	2,843	2,899	2,959	3,023	3,091
Tompkins	1,671	1,710	1,728	1,781	1,815	1,849	1,884	1,919	1,954	1,990	2,025
Ulster	4,614	4,736	4,791	4,850	4,929	5,009	5,090	5,172	5,256	5,340	5,426
Westchester	61,111	61,827	62,405	62,940	63,525	64,109	64,693	65,276	65,859	66,440	67,021

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:		
	12/17	12/18	12/19	12/20	12/22	12/24	12/26
Albany	8,613	8,821	8,997	9,174	9,590 (1,918) [460] {230}	10,023 (2,005) [481] {241}	10,473 (2,095) [503] {251}
Bronx	73,685	74,405	74,916	75,496	76,800 (15,360) [3,686] {1,843}	78,138 (15,628) [3,751] {1,875}	79,512 (15,902) [3,817] {1,908}
Dutchess	9,800	9,959	10,090	10,238	10,587 (2,117) [508] {254}	10,948 (2,190) [525] {263}	11,320 (2,264) [543] {272}
Erie	34,757	35,507	35,953	36,400	37,351 (7,470) [1,793] {896}	38,287 (7,657) [1,838] {919}	39,209 (7,842) [1,882] {941}
Kings	105,006	106,355	107,392	108,330	110,656 (22,131) [5,311] {2,656}	113,075 (22,615) [5,428] {2,714}	115,590 (23,118) [5,548] {2,774}
Monroe	25,643	26,389	27,059	27,748	29,185 (5,837) [1,401] {700}	30,680 (6,136) [1,473] {736}	32,233 (6,447) [1,547] {774}
Nassau	73,757	74,658	75,421	76,322	78,144 (15,629) [3,751] {1,875}	80,023 (16,005) [3,841] {1,921}	81,960 (16,392) [3,934] {1,967}
New York	54,426	55,158	55,673	56,159	57,382 (11,476) [2,754] {1,377}	58,639 (11,728) [2,815] {1,407}	59,931 (11,986) [2,877] {1,438}
Niagara	6,384	6,582	6,709	6,845	7,147 (1,429) [343] {172}	7,452 (1,490) [358] {179}	7,759 (1,552) [372] {186}
Onondaga	16,429	16,860	17,267	17,586	18,389 (3,678) [883] {441}	19,219 (3,844) [923] {461}	20,076 (4,015) [964] {482}
Orange	20,324	20,717	20,876	21,072	21,549 (4,310) [1,034] {517}	22,045 (4,409) [1,058] {529}	22,559 (4,512) [1,083] {541}
Putnam	3,975	4,035	4,077	4,127	4,232 (846) [203] {102}	4,336 (867) [208] {104}	4,437 (887) [213] {106}
Queens	106,764	108,112	109,056	109,983	112,381 (22,476) [5,394] {2,697}	114,864 (22,973) [5,513] {2,757}	117,434 (23,487) [5,637] {2,818}
Rensselaer	2,904	2,991	3,091	3,168	3,374 (675) [162] {81}	3,596 (719) [173] {86}	3,835 (767) [184] {92}
Richmond	29,504	29,854	30,192	30,505	31,205 (6,241) [1,498] {749}	31,904 (6,381) [1,531] {766}	32,601 (6,520) [1,565] {782}
Rockland	24,787	24,983	25,124	25,275	25,645 (5,129) [1,231] {615}	26,018 (5,204) [1,249] {624}	26,394 (5,279) [1,267] {633}
Saratoga	3,809	3,908	4,008	4,096	4,327 (865) [208] {104}	4,569 (914) [219] {110}	4,822 (964) [231] {116}
Schenectady	4,153	4,268	4,377	4,488	4,749 (950) [228] {114}	5,027 (1,005) [241] {121}	5,321 (1,064) [255] {128}
Suffolk	78,850	80,047	80,989	82,134	84,507 (16,901) [4,056] {2,028}	86,937 (17,387) [4,173] {2,086}	89,424 (17,885) [4,292] {2,146}
Sullivan	2,551	2,601	2,639	2,697	2,791 (558) [134] {67}	2,899 (580) [139] {70}	3,023 (605) [145] {73}
Tompkins	1,671	1,710	1,728	1,781	1,849 (370) [89] {44}	1,919 (384) [92] {46}	1,990 (398) [96] {48}
Ulster	4,614	4,736	4,791	4,850	5,009 (1,002) [240] {120}	5,172 (1,034) [248] {124}	5,340 (1,068) [256] {128}
Westchester	61,111	61,827	62,405	62,940	64,109 (12,822) [3,077] {1,539}	65,276 (13,055) [3,133] {1,567}	66,440 (13,288) [3,189] {1,595}

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.