IEM's AI Modeling: Short-term COVID-19 Projections

Date: 3/3/21

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 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 3/3/21 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.

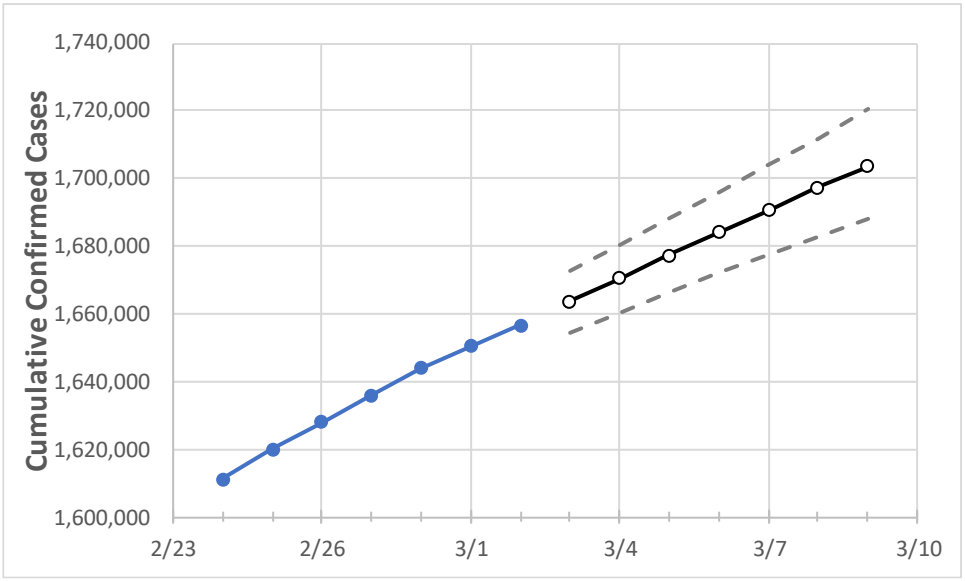
IEM's Modeling Lead

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:						
	2/27	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9
New York	1,636,040	1,643,867	1,650,303	1,656,684	1,663,595	1,670,535	1,677,319	1,684,007	1,690,666	1,697,268	1,703,643

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:						
	2/27	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9
Albany	20,758	20,848	20,890	20,931	20,979	21,028	21,074	21,118	21,164	21,208	21,252
Bronx	142,935	143,814	144,519	145,226	145,976	146,717	147,459	148,181	148,898	149,634	150,362
Dutchess	22,190	22,297	22,387	22,457	22,550	22,642	22,733	22,821	22,907	22,994	23,079
Erie	64,963	65,215	65,419	65,571	65,782	65,988	66,189	66,393	66,589	66,785	66,975
Kings	208,629	209,868	210,950	212,124	213,310	214,491	215,701	216,864	218,048	219,205	220,385
Monroe	52,371	52,543	52,679	52,759	52,876	52,993	53,108	53,221	53,329	53,437	53,541
Nassau	147,472	148,110	148,669	149,251	149,820	150,388	150,961	151,520	152,072	152,624	153,170
New York	102,643	103,289	103,922	104,444	105,061	105,681	106,285	106,906	107,515	108,119	108,731
Niagara	15,240	15,295	15,324	15,351	15,382	15,414	15,445	15,475	15,505	15,534	15,562
Onondaga	32,312	32,410	32,452	32,489	32,541	32,592	32,643	32,693	32,741	32,788	32,834
Orange	36,747	36,952	37,059	37,232	37,397	37,563	37,730	37,890	38,054	38,219	38,383
Putnam	8,307	8,340	8,369	8,389	8,417	8,445	8,472	8,499	8,524	8,550	8,575
Queens	209,641	210,793	211,812	212,927	213,990	215,066	216,131	217,193	218,232	219,299	220,313
Rensselaer	8,965	9,013	9,039	9,059	9,085	9,111	9,137	9,162	9,187	9,212	9,236
Richmond	56,649	56,938	57,201	57,405	57,642	57,876	58,104	58,339	58,574	58,801	59,029
Rockland	38,416	38,538	38,628	38,797	38,925	39,053	39,181	39,304	39,429	39,552	39,676
Saratoga	11,889	11,939	11,970	12,002	12,042	12,082	12,121	12,161	12,200	12,239	12,278
Schenectady	10,790	10,827	10,842	10,870	10,890	10,909	10,928	10,946	10,965	10,982	10,998
Suffolk	161,632	162,243	162,818	163,316	163,855	164,374	164,886	165,402	165,917	166,411	166,912
Sullivan	4,730	4,741	4,755	4,771	4,789	4,806	4,824	4,841	4,858	4,875	4,892
Tompkins	3,441	3,452	3,457	3,461	3,467	3,472	3,478	3,482	3,487	3,492	3,496
Ulster	9,981	10,037	10,069	10,096	10,132	10,168	10,205	10,239	10,275	10,310	10,344
Westchester	107,075	107,487	107,857	108,193	108,593	108,998	109,392	109,785	110,171	110,555	110,943

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:		
	2/27	2/28	3/1	3/2	3/4	3/6	3/8
Albany	20,758	20,848	20,890	20,931	21,028 (4,206) [1,009] {505}	21,118 (4,224) [1,014] {507}	21,208 (4,242) [1,018] {509}
Bronx	142,935	143,814	144,519	145,226	146,717 (29,343) [7,042] {3,521}	148,181 (29,636) [7,113] {3,556}	149,634 (29,927) [7,182] {3,591}
Dutchess	22,190	22,297	22,387	22,457	22,642 (4,528) [1,087] {543}	22,821 (4,564) [1,095] {548}	22,994 (4,599) [1,104] {552}
Erie	64,963	65,215	65,419	65,571	65,988 (13,198) [3,167] {1,584}	66,393 (13,279) [3,187] {1,593}	66,785 (13,357) [3,206] {1,603}
Kings	208,629	209,868	210,950	212,124	214,491 (42,898) [10,296] {5,148}	216,864 (43,373) [10,409] {5,205}	219,205 (43,841) [10,522] {5,261}
Monroe	52,371	52,543	52,679	52,759	52,993 (10,599) [2,544] {1,272}	53,221 (10,644) [2,555] {1,277}	53,437 (10,687) [2,565] {1,282}
Nassau	147,472	148,110	148,669	149,251	150,388 (30,078) [7,219] {3,609}	151,520 (30,304) [7,273] {3,636}	152,624 (30,525) [7,326] {3,663}
New York	102,643	103,289	103,922	104,444	105,681 (21,136) [5,073] {2,536}	106,906 (21,381) [5,131] {2,566}	108,119 (21,624) [5,190] {2,595}
Niagara	15,240	15,295	15,324	15,351	15,414 (3,083) [740] {370}	15,475 (3,095) [743] {371}	15,534 (3,107) [746] {373}
Onondaga	32,312	32,410	32,452	32,489	32,592 (6,518) [1,564] {782}	32,693 (6,539) [1,569] {785}	32,788 (6,558) [1,574] {787}
Orange	36,747	36,952	37,059	37,232	37,563 (7,513) [1,803] {902}	37,890 (7,578) [1,819] {909}	38,219 (7,644) [1,835] {917}
Putnam	8,307	8,340	8,369	8,389	8,445 (1,689) [405] {203}	8,499 (1,700) [408] {204}	8,550 (1,710) [410] {205}
Queens	209,641	210,793	211,812	212,927	215,066 (43,013) [10,323] {5,162}	217,193 (43,439) [10,425] {5,213}	219,299 (43,860) [10,526] {5,263}
Rensselaer	8,965	9,013	9,039	9,059	9,111 (1,822) [437] {219}	9,162 (1,832) [440] {220}	9,212 (1,842) [442] {221}
Richmond	56,649	56,938	57,201	57,405	57,876 (11,575) [2,778] {1,389}	58,339 (11,668) [2,800] {1,400}	58,801 (11,760) [2,822] {1,411}
Rockland	38,416	38,538	38,628	38,797	39,053 (7,811) [1,875] {937}	39,304 (7,861) [1,887] {943}	39,552 (7,910) [1,898] {949}
Saratoga	11,889	11,939	11,970	12,002	12,082 (2,416) [580] {290}	12,161 (2,432) [584] {292}	12,239 (2,448) [587] {294}
Schenectady	10,790	10,827	10,842	10,870	10,909 (2,182) [524] {262}	10,946 (2,189) [525] {263}	10,982 (2,196) [527] {264}
Suffolk	161,632	162,243	162,818	163,316	164,374 (32,875) [7,890] {3,945}	165,402 (33,080) [7,939] {3,970}	166,411 (33,282) [7,988] {3,994}
Sullivan	4,730	4,741	4,755	4,771	4,806 (961) [231] {115}	4,841 (968) [232] {116}	4,875 (975) [234] {117}
Tompkins	3,441	3,452	3,457	3,461	3,472 (694) [167] {83}	3,482 (696) [167] {84}	3,492 (698) [168] {84}
Ulster	9,981	10,037	10,069	10,096	10,168 (2,034) [488] {244}	10,239 (2,048) [491] {246}	10,310 (2,062) [495] {247}
Westchester	107,075	107,487	107,857	108,193	108,998 (21,800) [5,232] {2,616}	109,785 (21,957) [5,270] {2,635}	110,555 (22,111) [5,307] {2,653}

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.