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

Date: 3/26/21

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 3/26/21 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.

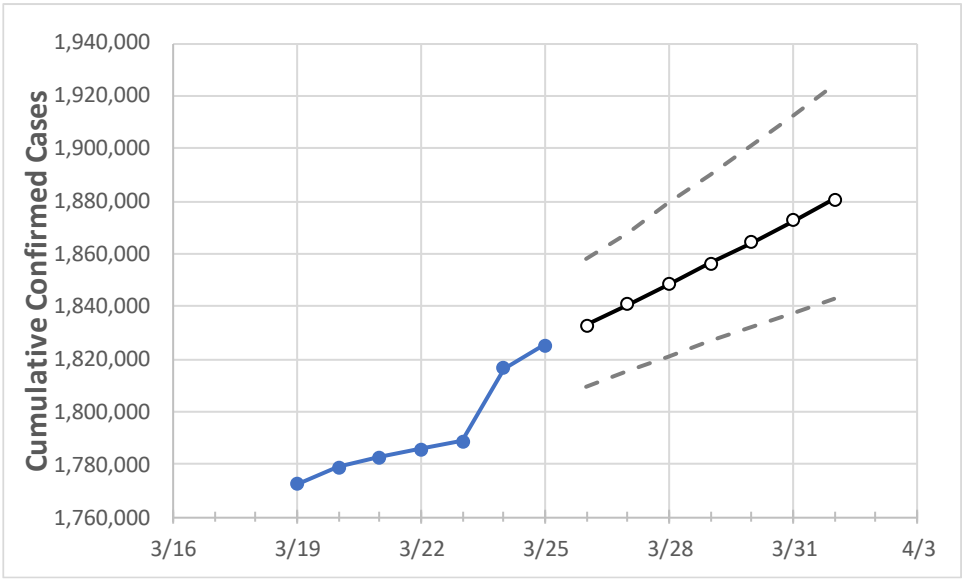
IEM's Modeling Lead

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:						
	3/22	3/23	3/24	3/25	3/26	3/27	3/28	3/29	3/30	3/31	4/1
New York	1,785,565	1,788,874	1,816,518	1,825,069	1,832,743	1,840,595	1,848,527	1,856,443	1,864,366	1,872,521	1,880,792

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:						
	3/22	3/23	3/24	3/25	3/26	3/27	3/28	3/29	3/30	3/31	4/1
Albany	22,024	22,078	22,141	22,214	22,268	22,323	22,378	22,432	22,488	22,543	22,598
Bronx	158,108	159,037	159,966	160,695	161,313	161,938	162,554	163,176	163,789	164,397	165,028
Dutchess	24,862	24,977	25,132	25,282	25,430	25,580	25,731	25,886	26,042	26,203	26,368
Erie	70,520	70,826	71,050	71,439	71,720	72,004	72,292	72,581	72,877	73,177	73,475
Kings	234,471	236,167	237,864	239,337	240,598	241,840	243,107	244,377	245,660	246,948	248,288
Monroe	55,213	55,335	55,461	55,674	55,812	55,951	56,092	56,233	56,375	56,518	56,661
Nassau	161,948	162,481	163,084	163,785	164,408	165,027	165,657	166,266	166,880	167,493	168,106
New York	116,373	117,680	118,986	119,581	120,305	121,066	121,806	122,584	123,359	124,124	124,925
Niagara	16,050	16,086	16,130	16,186	16,226	16,266	16,307	16,348	16,389	16,431	16,475
Onondaga	33,617	33,689	33,736	33,805	33,861	33,918	33,974	34,030	34,086	34,142	34,199
Orange	41,137	41,370	41,627	41,825	42,050	42,276	42,502	42,736	42,964	43,202	43,441
Putnam	9,106	9,146	9,186	9,218	9,257	9,296	9,336	9,376	9,416	9,456	9,497
Queens	234,253	235,945	237,637	238,970	240,190	241,401	242,654	243,897	245,137	246,387	247,633
Rensselaer	9,679	9,705	9,739	9,777	9,806	9,836	9,867	9,896	9,926	9,956	9,985
Richmond	62,758	63,175	63,593	63,965	64,263	64,559	64,864	65,171	65,484	65,798	66,110
Rockland	42,077	42,250	42,384	42,556	42,704	42,850	42,996	43,141	43,282	43,427	43,569
Saratoga	12,870	12,924	12,973	13,034	13,085	13,136	13,188	13,242	13,295	13,350	13,404
Schenectady	11,430	11,470	11,523	11,586	11,627	11,668	11,711	11,756	11,801	11,848	11,896
Suffolk	176,140	176,669	177,334	178,077	178,755	179,443	180,128	180,819	181,514	182,209	182,910
Sullivan	5,231	5,268	5,304	5,336	5,369	5,402	5,437	5,473	5,510	5,547	5,586
Tompkins	3,736	3,742	3,757	3,777	3,794	3,810	3,828	3,845	3,862	3,880	3,899
Ulster	11,274	11,354	11,445	11,528	11,617	11,707	11,802	11,899	12,000	12,103	12,211
Westchester	115,935	116,289	116,664	117,068	117,445	117,820	118,197	118,575	118,950	119,328	119,708

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:		
	3/22	3/23	3/24	3/25	3/27	3/29	3/31
Albany	22,024	22,078	22,141	22,214	22,323 (4,465) [1,071] {536}	22,432 (4,486) [1,077] {538}	22,543 (4,509) [1,082] {541}
Bronx	158,108	159,037	159,966	160,695	161,938 (32,388) [7,773] {3,887}	163,176 (32,635) [7,832] {3,916}	164,397 (32,879) [7,891] {3,946}
Dutchess	24,862	24,977	25,132	25,282	25,580 (5,116) [1,228] {614}	25,886 (5,177) [1,243] {621}	26,203 (5,241) [1,258] {629}
Erie	70,520	70,826	71,050	71,439	72,004 (14,401) [3,456] {1,728}	72,581 (14,516) [3,484] {1,742}	73,177 (14,635) [3,512] {1,756}
Kings	234,471	236,167	237,864	239,337	241,840 (48,368) [11,608] {5,804}	244,377 (48,875) [11,730] {5,865}	246,948 (49,390) [11,854] {5,927}
Monroe	55,213	55,335	55,461	55,674	55,951 (11,190) [2,686] {1,343}	56,233 (11,247) [2,699] {1,350}	56,518 (11,304) [2,713] {1,356}
Nassau	161,948	162,481	163,084	163,785	165,027 (33,005) [7,921] {3,961}	166,266 (33,253) [7,981] {3,990}	167,493 (33,499) [8,040] {4,020}
New York	116,373	117,680	118,986	119,581	121,066 (24,213) [5,811] {2,906}	122,584 (24,517) [5,884] {2,942}	124,124 (24,825) [5,958] {2,979}
Niagara	16,050	16,086	16,130	16,186	16,266 (3,253) [781] {390}	16,348 (3,270) [785] {392}	16,431 (3,286) [789] {394}
Onondaga	33,617	33,689	33,736	33,805	33,918 (6,784) [1,628] {814}	34,030 (6,806) [1,633] {817}	34,142 (6,828) [1,639] {819}
Orange	41,137	41,370	41,627	41,825	42,276 (8,455) [2,029] {1,015}	42,736 (8,547) [2,051] {1,026}	43,202 (8,640) [2,074] {1,037}
Putnam	9,106	9,146	9,186	9,218	9,296 (1,859) [446] {223}	9,376 (1,875) [450] {225}	9,456 (1,891) [454] {227}
Queens	234,253	235,945	237,637	238,970	241,401 (48,280) [11,587] {5,794}	243,897 (48,779) [11,707] {5,854}	246,387 (49,277) [11,827] {5,913}
Rensselaer	9,679	9,705	9,739	9,777	9,836 (1,967) [472] {236}	9,896 (1,979) [475] {238}	9,956 (1,991) [478] {239}
Richmond	62,758	63,175	63,593	63,965	64,559 (12,912) [3,099] {1,549}	65,171 (13,034) [3,128] {1,564}	65,798 (13,160) [3,158] {1,579}
Rockland	42,077	42,250	42,384	42,556	42,850 (8,570) [2,057] {1,028}	43,141 (8,628) [2,071] {1,035}	43,427 (8,685) [2,084] {1,042}
Saratoga	12,870	12,924	12,973	13,034	13,136 (2,627) [631] {315}	13,242 (2,648) [636] {318}	13,350 (2,670) [641] {320}
Schenectady	11,430	11,470	11,523	11,586	11,668 (2,334) [560] {280}	11,756 (2,351) [564] {282}	11,848 (2,370) [569] {284}
Suffolk	176,140	176,669	177,334	178,077	179,443 (35,889) [8,613] {4,307}	180,819 (36,164) [8,679] {4,340}	182,209 (36,442) [8,746] {4,373}
Sullivan	5,231	5,268	5,304	5,336	5,402 (1,080) [259] {130}	5,473 (1,095) [263] {131}	5,547 (1,109) [266] {133}
Tompkins	3,736	3,742	3,757	3,777	3,810 (762) [183] {91}	3,845 (769) [185] {92}	3,880 (776) [186] {93}
Ulster	11,274	11,354	11,445	11,528	11,707 (2,341) [562] {281}	11,899 (2,380) [571] {286}	12,103 (2,421) [581] {290}
Westchester	115,935	116,289	116,664	117,068	117,820 (23,564) [5,655] {2,828}	118,575 (23,715) [5,692] {2,846}	119,328 (23,866) [5,728] {2,864}

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.