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

Date: 10/15/21

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 10/15/21 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.

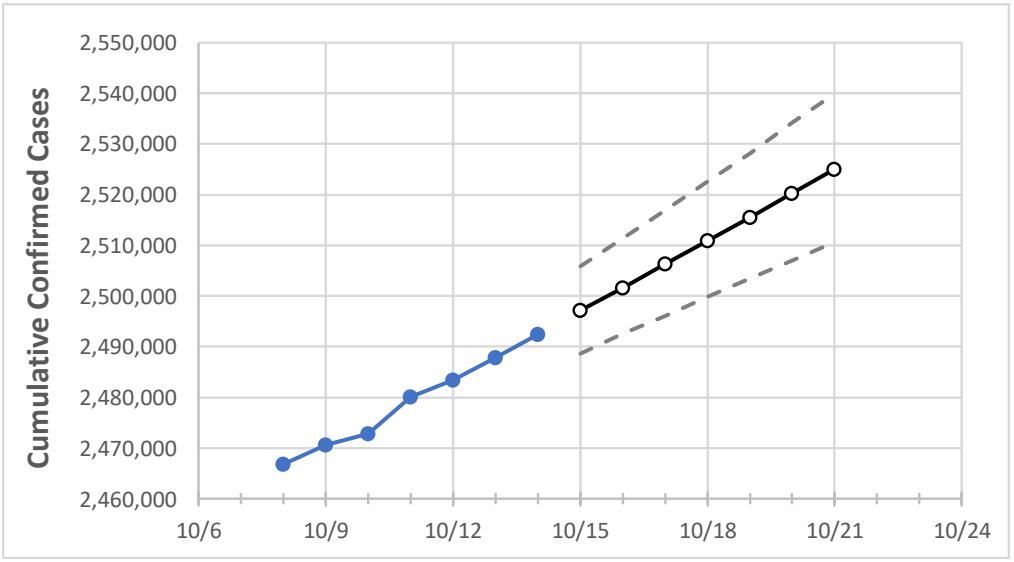
IEM's Modeling Lead

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:						
	10/11	10/12	10/13	10/14	10/15	10/16	10/17	10/18	10/19	10/20	10/21
New York	2,480,082	2,483,362	2,487,921	2,492,423	2,497,124	2,501,659	2,506,349	2,511,008	2,515,586	2,520,319	2,525,002

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:						
	10/11	10/12	10/13	10/14	10/15	10/16	10/17	10/18	10/19	10/20	10/21
Albany	29,993	30,035	30,119	30,214	30,295	30,373	30,452	30,532	30,612	30,694	30,775
Bronx	206,126	206,258	206,385	206,547	206,722	206,896	207,068	207,238	207,404	207,577	207,740
Dutchess	35,033	35,094	35,177	35,245	35,314	35,380	35,447	35,514	35,583	35,652	35,720
Erie	103,881	104,039	104,339	104,539	104,795	105,055	105,315	105,570	105,843	106,105	106,366
Kings	329,313	329,648	330,117	330,557	331,100	331,622	332,147	332,669	333,195	333,727	334,260
Monroe	82,091	82,258	82,480	82,767	82,990	83,210	83,438	83,664	83,893	84,122	84,356
Nassau	212,062	212,296	212,560	212,807	213,056	213,298	213,537	213,779	214,022	214,260	214,507
New York	166,253	166,413	166,586	166,797	166,984	167,172	167,360	167,540	167,727	167,909	168,083
Niagara	23,390	23,424	23,501	23,560	23,626	23,690	23,754	23,820	23,886	23,951	24,015
Onondaga	50,137	50,231	50,426	50,637	50,843	51,049	51,262	51,470	51,674	51,881	52,089
Orange	56,489	56,557	56,697	56,801	56,908	57,015	57,122	57,229	57,339	57,447	57,557
Putnam	12,275	12,290	12,328	12,358	12,384	12,409	12,435	12,462	12,488	12,516	12,543
Queens	312,646	312,876	313,063	313,314	313,613	313,903	314,191	314,474	314,756	315,042	315,320
Rensselaer	14,324	14,358	14,398	14,443	14,500	14,553	14,607	14,665	14,719	14,776	14,831
Richmond	87,892	87,964	88,048	88,141	88,235	88,327	88,417	88,504	88,590	88,678	88,764
Rockland	52,412	52,466	52,558	52,635	52,718	52,804	52,892	52,976	53,064	53,154	53,239
Saratoga	19,616	19,655	19,728	19,803	19,867	19,932	19,996	20,061	20,126	20,192	20,258
Schenectady	16,171	16,204	16,273	16,324	16,376	16,430	16,485	16,540	16,599	16,656	16,713
Suffolk	235,833	236,248	236,630	236,972	237,340	237,704	238,065	238,424	238,777	239,137	239,490
Sullivan	8,221	8,241	8,266	8,290	8,312	8,334	8,357	8,380	8,403	8,425	8,449
Tompkins	6,343	6,348	6,353	6,385	6,401	6,418	6,433	6,450	6,464	6,481	6,496
Ulster	16,974	17,005	17,043	17,091	17,123	17,156	17,188	17,220	17,253	17,286	17,318
Westchester	142,836	142,926	143,015	143,100	143,192	143,283	143,372	143,461	143,551	143,640	143,723

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:		
	10/11	10/12	10/13	10/14	10/16	10/18	10/20
Albany	29,993	30,035	30,119	30,214	30,373 (6,075) [1,458] {729}	30,532 (6,106) [1,466] {733}	30,694 (6,139) [1,473] {737}
Bronx	206,126	206,258	206,385	206,547	206,896 (41,379) [9,931] {4,965}	207,238 (41,448) [9,947] {4,974}	207,577 (41,515) [9,964] {4,982}
Dutchess	35,033	35,094	35,177	35,245	35,380 (7,076) [1,698] {849}	35,514 (7,103) [1,705] {852}	35,652 (7,130) [1,711] {856}
Erie	103,881	104,039	104,339	104,539	105,055 (21,011) [5,043] {2,521}	105,570 (21,114) [5,067] {2,534}	106,105 (21,221) [5,093] {2,547}
Kings	329,313	329,648	330,117	330,557	331,622 (66,324) [15,918] {7,959}	332,669 (66,534) [15,968] {7,984}	333,727 (66,745) [16,019] {8,009}
Monroe	82,091	82,258	82,480	82,767	83,210 (16,642) [3,994] {1,997}	83,664 (16,733) [4,016] {2,008}	84,122 (16,824) [4,038] {2,019}
Nassau	212,062	212,296	212,560	212,807	213,298 (42,660) [10,238] {5,119}	213,779 (42,756) [10,261] {5,131}	214,260 (42,852) [10,284] {5,142}
New York	166,253	166,413	166,586	166,797	167,172 (33,434) [8,024] {4,012}	167,540 (33,508) [8,042] {4,021}	167,909 (33,582) [8,060] {4,030}
Niagara	23,390	23,424	23,501	23,560	23,690 (4,738) [1,137] {569}	23,820 (4,764) [1,143] {572}	23,951 (4,790) [1,150] {575}
Onondaga	50,137	50,231	50,426	50,637	51,049 (10,210) [2,450] {1,225}	51,470 (10,294) [2,471] {1,235}	51,881 (10,376) [2,490] {1,245}
Orange	56,489	56,557	56,697	56,801	57,015 (11,403) [2,737] {1,368}	57,229 (11,446) [2,747] {1,373}	57,447 (11,489) [2,757] {1,379}
Putnam	12,275	12,290	12,328	12,358	12,409 (2,482) [596] {298}	12,462 (2,492) [598] {299}	12,516 (2,503) [601] {300}
Queens	312,646	312,876	313,063	313,314	313,903 (62,781) [15,067] {7,534}	314,474 (62,895) [15,095] {7,547}	315,042 (63,008) [15,122] {7,561}
Rensselaer	14,324	14,358	14,398	14,443	14,553 (2,911) [699] {349}	14,665 (2,933) [704] {352}	14,776 (2,955) [709] {355}
Richmond	87,892	87,964	88,048	88,141	88,327 (17,665) [4,240] {2,120}	88,504 (17,701) [4,248] {2,124}	88,678 (17,736) [4,257] {2,128}
Rockland	52,412	52,466	52,558	52,635	52,804 (10,561) [2,535] {1,267}	52,976 (10,595) [2,543] {1,271}	53,154 (10,631) [2,551] {1,276}
Saratoga	19,616	19,655	19,728	19,803	19,932 (3,986) [957] {478}	20,061 (4,012) [963] {481}	20,192 (4,038) [969] {485}
Schenectady	16,171	16,204	16,273	16,324	16,430 (3,286) [789] {394}	16,540 (3,308) [794] {397}	16,656 (3,331) [799] {400}
Suffolk	235,833	236,248	236,630	236,972	237,704 (47,541) [11,410] {5,705}	238,424 (47,685) [11,444] {5,722}	239,137 (47,827) [11,479] {5,739}
Sullivan	8,221	8,241	8,266	8,290	8,334 (1,667) [400] {200}	8,380 (1,676) [402] {201}	8,425 (1,685) [404] {202}
Tompkins	6,343	6,348	6,353	6,385	6,418 (1,284) [308] {154}	6,450 (1,290) [310] {155}	6,481 (1,296) [311] {156}
Ulster	16,974	17,005	17,043	17,091	17,156 (3,431) [823] {412}	17,220 (3,444) [827] {413}	17,286 (3,457) [830] {415}
Westchester	142,836	142,926	143,015	143,100	143,283 (28,657) [6,878] {3,439}	143,461 (28,692) [6,886] {3,443}	143,640 (28,728) [6,895] {3,447}

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.