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

Date: 1/4/21

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 1/4/21 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.

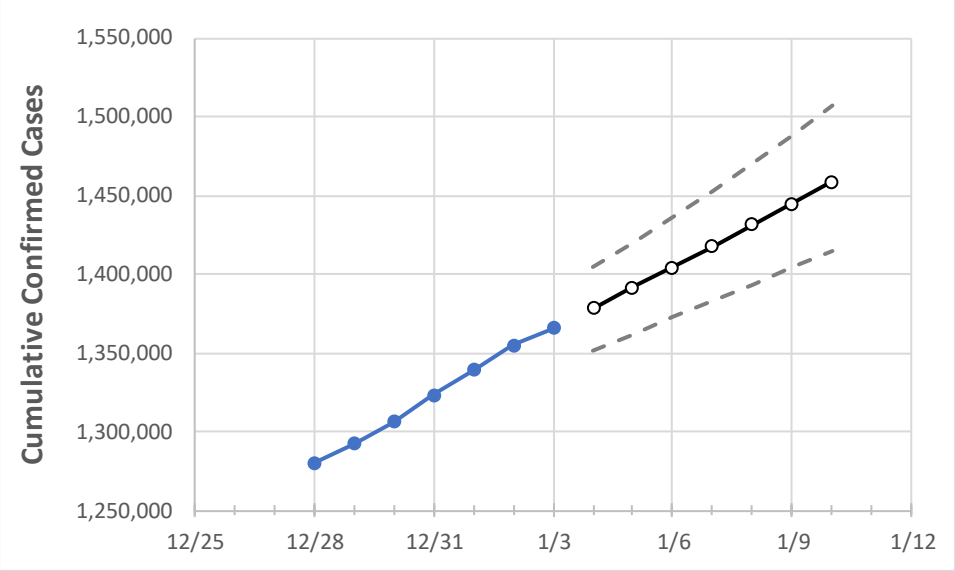
IEM's Modeling Lead

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.

Florida State Projections



	Actual Confirmed Cases On:				Projected Cases For:						
	12/31	1/1	1/2	1/3	1/4	1/5	1/6	1/7	1/8	1/9	1/10
Florida	1,323,315	1,339,074	1,354,833	1,365,436	1,378,430	1,391,390	1,404,448	1,417,603	1,431,239	1,444,980	1,458,459

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.

Florida Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	12/31	1/1	1/2	1/3	1/4	1/5	1/6	1/7	1/8	1/9	1/10
Alachua	15,866	16,048	16,230	16,335	16,453	16,575	16,696	16,820	16,947	17,072	17,202
Broward	137,610	138,860	140,110	141,010	142,050	143,074	144,104	145,159	146,241	147,308	148,365
Charlotte	7,410	7,529	7,647	7,727	7,818	7,909	8,003	8,099	8,195	8,290	8,387
Collier	22,506	22,709	22,911	23,070	23,247	23,428	23,610	23,795	23,985	24,181	24,376
Duval	61,321	62,105	62,888	63,743	64,506	65,268	66,054	66,849	67,653	68,481	69,332
Hillsborough	77,118	78,295	79,472	80,035	80,815	81,620	82,421	83,259	84,062	84,909	85,767
Lake	15,559	15,833	16,106	16,261	16,481	16,711	16,937	17,168	17,408	17,651	17,891
Lee	40,635	40,974	41,313	41,916	42,310	42,694	43,099	43,508	43,920	44,334	44,760
Manatee	22,332	22,522	22,712	22,920	23,133	23,346	23,559	23,776	23,999	24,216	24,440
Miami-Dade	298,873	301,530	304,187	305,734	308,050	310,406	312,744	315,126	317,490	319,873	322,292
Okaloosa	12,857	12,992	13,126	13,212	13,330	13,446	13,564	13,683	13,802	13,924	14,048
Orange	76,458	77,485	78,512	79,165	79,951	80,745	81,541	82,337	83,132	83,961	84,783
Osceola	25,344	25,729	26,113	26,223	26,448	26,675	26,901	27,126	27,352	27,577	27,804
Palm Beach	82,890	83,931	84,972	85,479	86,189	86,910	87,653	88,416	89,187	89,968	90,763
Pasco	21,932	22,283	22,634	22,879	23,126	23,379	23,633	23,883	24,141	24,402	24,657
Pinellas	44,975	45,643	46,310	46,860	47,375	47,901	48,440	48,987	49,532	50,096	50,679
Polk	37,403	37,909	38,414	38,843	39,318	39,793	40,283	40,779	41,306	41,830	42,380
Sarasota	18,607	18,821	19,035	19,271	19,462	19,654	19,853	20,053	20,257	20,461	20,670
Seminole	18,083	18,312	18,541	18,726	18,892	19,054	19,219	19,386	19,551	19,717	19,883
St. Johns	13,072	13,314	13,556	13,756	13,963	14,181	14,404	14,630	14,858	15,097	15,343
Sumter	5,085	5,192	5,299	5,350	5,434	5,517	5,606	5,698	5,790	5,889	5,988
Volusia	22,291	22,557	22,822	23,078	23,322	23,578	23,832	24,102	24,369	24,644	24,916

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.*

Florida Medical Demands by County

	Actual Confirmed Cases On:				Projected Cases (Hospitalized) [ICU] {Ventilator} For:		
	12/31	1/1	1/2	1/3	1/5	1/7	1/9
Alachua	15,866	16,048	16,230	16,335	16,575 (3,315) [796] {398}	16,820 (3,364) [807] {404}	17,072 (3,414) [819] {410}
Broward	137,610	138,860	140,110	141,010	143,074 (28,615) [6,868] {3,434}	145,159 (29,032) [6,968] {3,484}	147,308 (29,462) [7,071] {3,535}
Charlotte	7,410	7,529	7,647	7,727	7,909 (1,582) [380] {190}	8,099 (1,620) [389] {194}	8,290 (1,658) [398] {199}
Collier	22,506	22,709	22,911	23,070	23,428 (4,686) [1,125] {562}	23,795 (4,759) [1,142] {571}	24,181 (4,836) [1,161] {580}
Duval	61,321	62,105	62,888	63,743	65,268 (13,054) [3,133] {1,566}	66,849 (13,370) [3,209] {1,604}	68,481 (13,696) [3,287] {1,644}
Hillsborough	77,118	78,295	79,472	80,035	81,620 (16,324) [3,918] {1,959}	83,259 (16,652) [3,996] {1,998}	84,909 (16,982) [4,076] {2,038}
Lake	15,559	15,833	16,106	16,261	16,711 (3,342) [802] {401}	17,168 (3,434) [824] {412}	17,651 (3,530) [847] {424}
Lee	40,635	40,974	41,313	41,916	42,694 (8,539) [2,049] {1,025}	43,508 (8,702) [2,088] {1,044}	44,334 (8,867) [2,128] {1,064}
Manatee	22,332	22,522	22,712	22,920	23,346 (4,669) [1,121] {560}	23,776 (4,755) [1,141] {571}	24,216 (4,843) [1,162] {581}
Miami-Dade	298,873	301,530	304,187	305,734	310,406 (62,081) [14,899] {7,450}	315,126 (63,025) [15,126] {7,563}	319,873 (63,975) [15,354] {7,677}
Okaloosa	12,857	12,992	13,126	13,212	13,446 (2,689) [645] {323}	13,683 (2,737) [657] {328}	13,924 (2,785) [668] {334}
Orange	76,458	77,485	78,512	79,165	80,745 (16,149) [3,876] {1,938}	82,337 (16,467) [3,952] {1,976}	83,961 (16,792) [4,030] {2,015}
Osceola	25,344	25,729	26,113	26,223	26,675 (5,335) [1,280] {640}	27,126 (5,425) [1,302] {651}	27,577 (5,515) [1,324] {662}
Palm Beach	82,890	83,931	84,972	85,479	86,910 (17,382) [4,172] {2,086}	88,416 (17,683) [4,244] {2,122}	89,968 (17,994) [4,318] {2,159}
Pasco	21,932	22,283	22,634	22,879	23,379 (4,676) [1,122] {561}	23,883 (4,777) [1,146] {573}	24,402 (4,880) [1,171] {586}
Pinellas	44,975	45,643	46,310	46,860	47,901 (9,580) [2,299] {1,150}	48,987 (9,797) [2,351] {1,176}	50,096 (10,019) [2,405] {1,202}
Polk	37,403	37,909	38,414	38,843	39,793 (7,959) [1,910] {955}	40,779 (8,156) [1,957] {979}	41,830 (8,366) [2,008] {1,004}
Sarasota	18,607	18,821	19,035	19,271	19,654 (3,931) [943] {472}	20,053 (4,011) [963] {481}	20,461 (4,092) [982] {491}
Seminole	18,083	18,312	18,541	18,726	19,054 (3,811) [915] {457}	19,386 (3,877) [931] {465}	19,717 (3,943) [946] {473}
St. Johns	13,072	13,314	13,556	13,756	14,181 (2,836) [681] {340}	14,630 (2,926) [702] {351}	15,097 (3,019) [725] {362}
Sumter	5,085	5,192	5,299	5,350	5,517 (1,103) [265] {132}	5,698 (1,140) [273] {137}	5,889 (1,178) [283] {141}
Volusia	22,291	22,557	22,822	23,078	23,578 (4,716) [1,132] {566}	24,102 (4,820) [1,157] {578}	24,644 (4,929) [1,183] {591}

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.