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

Date: 1/5/21

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 1/5/21 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.

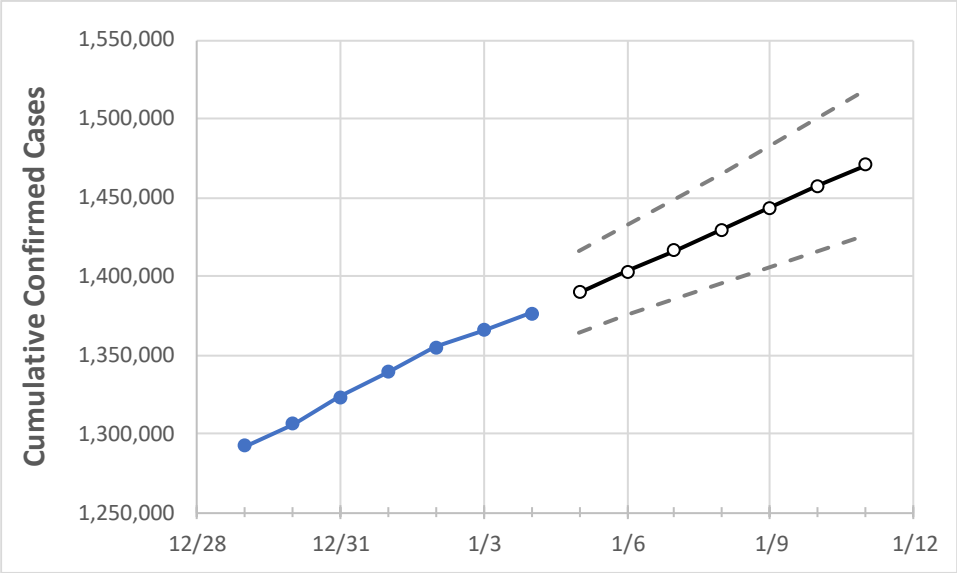
IEM's Modeling Lead

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:						
	1/1	1/2	1/3	1/4	1/5	1/6	1/7	1/8	1/9	1/10	1/11
Florida	1,339,074	1,354,833	1,365,436	1,376,692	1,389,586	1,402,687	1,416,204	1,429,666	1,443,376	1,457,179	1,470,897

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:						
	1/1	1/2	1/3	1/4	1/5	1/6	1/7	1/8	1/9	1/10	1/11
Alachua	16,048	16,230	16,335	16,437	16,553	16,666	16,784	16,909	17,032	17,156	17,279
Broward	138,860	140,110	141,010	141,993	143,045	144,122	145,202	146,283	147,397	148,525	149,622
Charlotte	7,529	7,647	7,727	7,807	7,899	7,992	8,085	8,180	8,275	8,372	8,470
Collier	22,709	22,911	23,070	23,197	23,367	23,541	23,716	23,896	24,075	24,252	24,437
Duval	62,105	62,888	63,743	64,225	64,952	65,679	66,428	67,181	67,955	68,727	69,509
Hillsborough	78,295	79,472	80,035	80,586	81,371	82,148	82,958	83,761	84,578	85,396	86,209
Lake	15,833	16,106	16,261	16,483	16,707	16,932	17,163	17,398	17,635	17,882	18,137
Lee	40,974	41,313	41,916	42,368	42,770	43,172	43,582	43,996	44,407	44,828	45,252
Manatee	22,522	22,712	22,920	23,044	23,244	23,447	23,647	23,852	24,055	24,261	24,462
Miami-Dade	301,530	304,187	305,734	308,259	310,579	312,968	315,350	317,738	320,126	322,522	324,890
Okaloosa	12,992	13,126	13,212	13,268	13,383	13,497	13,612	13,727	13,838	13,954	14,072
Orange	77,485	78,512	79,165	80,053	80,846	81,646	82,457	83,268	84,099	84,922	85,780
Osceola	25,729	26,113	26,223	26,550	26,789	27,031	27,273	27,520	27,769	28,018	28,273
Palm Beach	83,931	84,972	85,479	86,275	86,997	87,726	88,445	89,172	89,921	90,692	91,497
Pasco	22,283	22,634	22,879	23,082	23,321	23,565	23,807	24,050	24,297	24,547	24,802
Pinellas	45,643	46,310	46,860	47,207	47,667	48,127	48,581	49,048	49,526	49,999	50,476
Polk	37,909	38,414	38,843	39,268	39,740	40,219	40,703	41,208	41,728	42,261	42,796
Sarasota	18,821	19,035	19,271	19,409	19,592	19,783	19,974	20,166	20,358	20,553	20,751
Seminole	18,312	18,541	18,726	18,886	19,052	19,218	19,384	19,554	19,722	19,893	20,064
St. Johns	13,314	13,556	13,756	13,858	14,052	14,252	14,455	14,661	14,870	15,078	15,292
Sumter	5,192	5,299	5,350	5,403	5,487	5,570	5,656	5,744	5,835	5,929	6,030
Volusia	22,557	22,822	23,078	23,229	23,475	23,719	23,962	24,213	24,461	24,717	24,978

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:		
	1/1	1/2	1/3	1/4	1/6	1/8	1/10
Alachua	16,048	16,230	16,335	16,437	16,666 (3,333) [800] {400}	16,909 (3,382) [812] {406}	17,156 (3,431) [824] {412}
Broward	138,860	140,110	141,010	141,993	144,122 (28,824) [6,918] {3,459}	146,283 (29,257) [7,022] {3,511}	148,525 (29,705) [7,129] {3,565}
Charlotte	7,529	7,647	7,727	7,807	7,992 (1,598) [384] {192}	8,180 (1,636) [393] {196}	8,372 (1,674) [402] {201}
Collier	22,709	22,911	23,070	23,197	23,541 (4,708) [1,130] {565}	23,896 (4,779) [1,147] {573}	24,252 (4,850) [1,164] {582}
Duval	62,105	62,888	63,743	64,225	65,679 (13,136) [3,153] {1,576}	67,181 (13,436) [3,225] {1,612}	68,727 (13,745) [3,299] {1,649}
Hillsborough	78,295	79,472	80,035	80,586	82,148 (16,430) [3,943] {1,972}	83,761 (16,752) [4,021] {2,010}	85,396 (17,079) [4,099] {2,049}
Lake	15,833	16,106	16,261	16,483	16,932 (3,386) [813] {406}	17,398 (3,480) [835] {418}	17,882 (3,576) [858] {429}
Lee	40,974	41,313	41,916	42,368	43,172 (8,634) [2,072] {1,036}	43,996 (8,799) [2,112] {1,056}	44,828 (8,966) [2,152] {1,076}
Manatee	22,522	22,712	22,920	23,044	23,447 (4,689) [1,125] {563}	23,852 (4,770) [1,145] {572}	24,261 (4,852) [1,165] {582}
Miami-Dade	301,530	304,187	305,734	308,259	312,968 (62,594) [15,022] {7,511}	317,738 (63,548) [15,251] {7,626}	322,522 (64,504) [15,481] {7,741}
Okaloosa	12,992	13,126	13,212	13,268	13,497 (2,699) [648] {324}	13,727 (2,745) [659] {329}	13,954 (2,791) [670] {335}
Orange	77,485	78,512	79,165	80,053	81,646 (16,329) [3,919] {1,959}	83,268 (16,654) [3,997] {1,998}	84,922 (16,984) [4,076] {2,038}
Osceola	25,729	26,113	26,223	26,550	27,031 (5,406) [1,297] {649}	27,520 (5,504) [1,321] {660}	28,018 (5,604) [1,345] {672}
Palm Beach	83,931	84,972	85,479	86,275	87,726 (17,545) [4,211] {2,105}	89,172 (17,834) [4,280] {2,140}	90,692 (18,138) [4,353] {2,177}
Pasco	22,283	22,634	22,879	23,082	23,565 (4,713) [1,131] {566}	24,050 (4,810) [1,154] {577}	24,547 (4,909) [1,178] {589}
Pinellas	45,643	46,310	46,860	47,207	48,127 (9,625) [2,310] {1,155}	49,048 (9,810) [2,354] {1,177}	49,999 (10,000) [2,400] {1,200}
Polk	37,909	38,414	38,843	39,268	40,219 (8,044) [1,930] {965}	41,208 (8,242) [1,978] {989}	42,261 (8,452) [2,029] {1,014}
Sarasota	18,821	19,035	19,271	19,409	19,783 (3,957) [950] {475}	20,166 (4,033) [968] {484}	20,553 (4,111) [987] {493}
Seminole	18,312	18,541	18,726	18,886	19,218 (3,844) [922] {461}	19,554 (3,911) [939] {469}	19,893 (3,979) [955] {477}
St. Johns	13,314	13,556	13,756	13,858	14,252 (2,850) [684] {342}	14,661 (2,932) [704] {352}	15,078 (3,016) [724] {362}
Sumter	5,192	5,299	5,350	5,403	5,570 (1,114) [267] {134}	5,744 (1,149) [276] {138}	5,929 (1,186) [285] {142}
Volusia	22,557	22,822	23,078	23,229	23,719 (4,744) [1,138] {569}	24,213 (4,843) [1,162] {581}	24,717 (4,943) [1,186] {593}

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.