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

Date: 1/6/21

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 1/6/21 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.

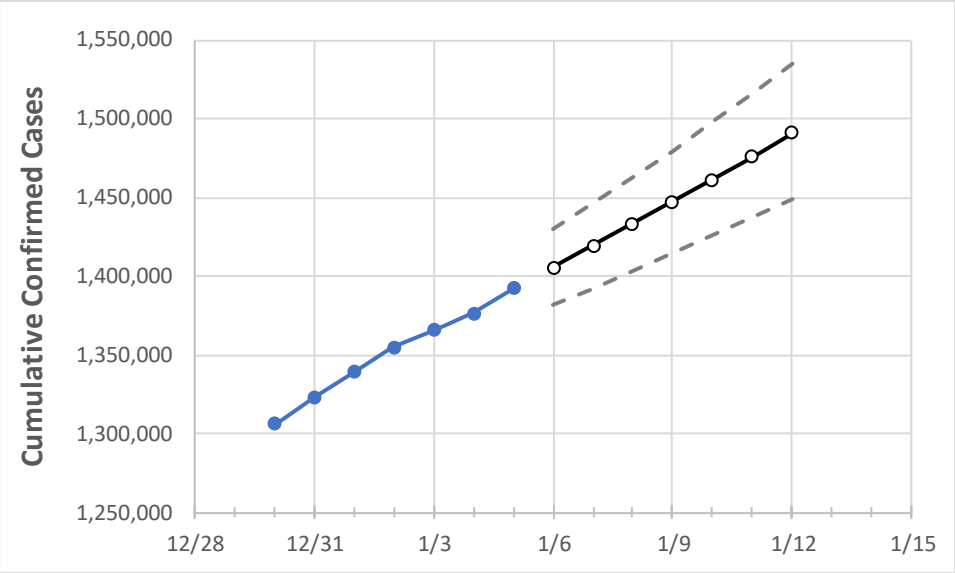
IEM's Modeling Lead

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:						
	1/2	1/3	1/4	1/5	1/6	1/7	1/8	1/9	1/10	1/11	1/12
Florida	1,354,833	1,365,436	1,376,692	1,392,123	1,405,670	1,419,476	1,433,290	1,447,110	1,461,253	1,475,878	1,490,758

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:						
	1/2	1/3	1/4	1/5	1/6	1/7	1/8	1/9	1/10	1/11	1/12
Alachua	16,230	16,335	16,437	16,585	16,711	16,839	16,964	17,091	17,221	17,354	17,492
Broward	140,110	141,010	141,993	143,186	144,267	145,373	146,477	147,604	148,734	149,903	151,059
Charlotte	7,647	7,727	7,807	7,880	7,970	8,061	8,151	8,242	8,333	8,427	8,520
Collier	22,911	23,070	23,197	23,323	23,494	23,666	23,839	24,009	24,180	24,354	24,531
Duval	62,888	63,743	64,225	65,556	66,351	67,139	67,974	68,805	69,667	70,521	71,449
Hillsborough	79,472	80,035	80,586	81,105	81,850	82,593	83,354	84,128	84,898	85,692	86,475
Lake	16,106	16,261	16,483	16,697	16,923	17,153	17,386	17,624	17,864	18,103	18,359
Lee	41,313	41,916	42,368	42,845	43,262	43,686	44,120	44,557	45,007	45,450	45,895
Manatee	22,712	22,920	23,044	23,338	23,547	23,761	23,975	24,191	24,414	24,635	24,854
Miami-Dade	304,187	305,734	308,259	311,606	314,077	316,634	319,160	321,727	324,323	326,921	329,572
Okaloosa	13,126	13,212	13,268	13,371	13,478	13,589	13,696	13,802	13,911	14,018	14,123
Orange	78,512	79,165	80,053	81,162	82,021	82,894	83,779	84,659	85,571	86,495	87,438
Osceola	26,113	26,223	26,550	26,727	26,960	27,198	27,440	27,680	27,921	28,165	28,405
Palm Beach	84,972	85,479	86,275	86,839	87,544	88,253	89,005	89,751	90,484	91,251	92,029
Pasco	22,634	22,879	23,082	23,258	23,490	23,717	23,951	24,182	24,419	24,645	24,879
Pinellas	46,310	46,860	47,207	47,739	48,214	48,681	49,165	49,649	50,158	50,657	51,163
Polk	38,414	38,843	39,268	39,739	40,214	40,706	41,218	41,728	42,238	42,775	43,323
Sarasota	19,035	19,271	19,409	19,787	20,009	20,239	20,470	20,711	20,958	21,214	21,474
Seminole	18,541	18,726	18,886	19,213	19,402	19,594	19,786	19,980	20,181	20,381	20,585
St. Johns	13,556	13,756	13,858	14,165	14,377	14,594	14,815	15,039	15,277	15,514	15,752
Sumter	5,299	5,350	5,403	5,508	5,594	5,683	5,771	5,867	5,968	6,066	6,176
Volusia	22,822	23,078	23,229	23,791	24,063	24,337	24,621	24,907	25,205	25,508	25,813

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:		
	1/2	1/3	1/4	1/5	1/7	1/9	1/11
Alachua	16,230	16,335	16,437	16,585	16,839 (3,368) [808] {404}	17,091 (3,418) [820] {410}	17,354 (3,471) [833] {416}
Broward	140,110	141,010	141,993	143,186	145,373 (29,075) [6,978] {3,489}	147,604 (29,521) [7,085] {3,542}	149,903 (29,981) [7,195] {3,598}
Charlotte	7,647	7,727	7,807	7,880	8,061 (1,612) [387] {193}	8,242 (1,648) [396] {198}	8,427 (1,685) [404] {202}
Collier	22,911	23,070	23,197	23,323	23,666 (4,733) [1,136] {568}	24,009 (4,802) [1,152] {576}	24,354 (4,871) [1,169] {584}
Duval	62,888	63,743	64,225	65,556	67,139 (13,428) [3,223] {1,611}	68,805 (13,761) [3,303] {1,651}	70,521 (14,104) [3,385] {1,693}
Hillsborough	79,472	80,035	80,586	81,105	82,593 (16,519) [3,964] {1,982}	84,128 (16,826) [4,038] {2,019}	85,692 (17,138) [4,113] {2,057}
Lake	16,106	16,261	16,483	16,697	17,153 (3,431) [823] {412}	17,624 (3,525) [846] {423}	18,103 (3,621) [869] {434}
Lee	41,313	41,916	42,368	42,845	43,686 (8,737) [2,097] {1,048}	44,557 (8,911) [2,139] {1,069}	45,450 (9,090) [2,182] {1,091}
Manatee	22,712	22,920	23,044	23,338	23,761 (4,752) [1,141] {570}	24,191 (4,838) [1,161] {581}	24,635 (4,927) [1,182] {591}
Miami-Dade	304,187	305,734	308,259	311,606	316,634 (63,327) [15,198] {7,599}	321,727 (64,345) [15,443] {7,721}	326,921 (65,384) [15,692] {7,846}
Okaloosa	13,126	13,212	13,268	13,371	13,589 (2,718) [652] {326}	13,802 (2,760) [662] {331}	14,018 (2,804) [673] {336}
Orange	78,512	79,165	80,053	81,162	82,894 (16,579) [3,979] {1,989}	84,659 (16,932) [4,064] {2,032}	86,495 (17,299) [4,152] {2,076}
Osceola	26,113	26,223	26,550	26,727	27,198 (5,440) [1,305] {653}	27,680 (5,536) [1,329] {664}	28,165 (5,633) [1,352] {676}
Palm Beach	84,972	85,479	86,275	86,839	88,253 (17,651) [4,236] {2,118}	89,751 (17,950) [4,308] {2,154}	91,251 (18,250) [4,380] {2,190}
Pasco	22,634	22,879	23,082	23,258	23,717 (4,743) [1,138] {569}	24,182 (4,836) [1,161] {580}	24,645 (4,929) [1,183] {591}
Pinellas	46,310	46,860	47,207	47,739	48,681 (9,736) [2,337] {1,168}	49,649 (9,930) [2,383] {1,192}	50,657 (10,131) [2,432] {1,216}
Polk	38,414	38,843	39,268	39,739	40,706 (8,141) [1,954] {977}	41,728 (8,346) [2,003] {1,001}	42,775 (8,555) [2,053] {1,027}
Sarasota	19,035	19,271	19,409	19,787	20,239 (4,048) [971] {486}	20,711 (4,142) [994] {497}	21,214 (4,243) [1,018] {509}
Seminole	18,541	18,726	18,886	19,213	19,594 (3,919) [941] {470}	19,980 (3,996) [959] {480}	20,381 (4,076) [978] {489}
St. Johns	13,556	13,756	13,858	14,165	14,594 (2,919) [701] {350}	15,039 (3,008) [722] {361}	15,514 (3,103) [745] {372}
Sumter	5,299	5,350	5,403	5,508	5,683 (1,137) [273] {136}	5,867 (1,173) [282] {141}	6,066 (1,213) [291] {146}
Volusia	22,822	23,078	23,229	23,791	24,337 (4,867) [1,168] {584}	24,907 (4,981) [1,196] {598}	25,508 (5,102) [1,224] {612}

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.