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

Date: 7/12/21

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 7/12/21 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.

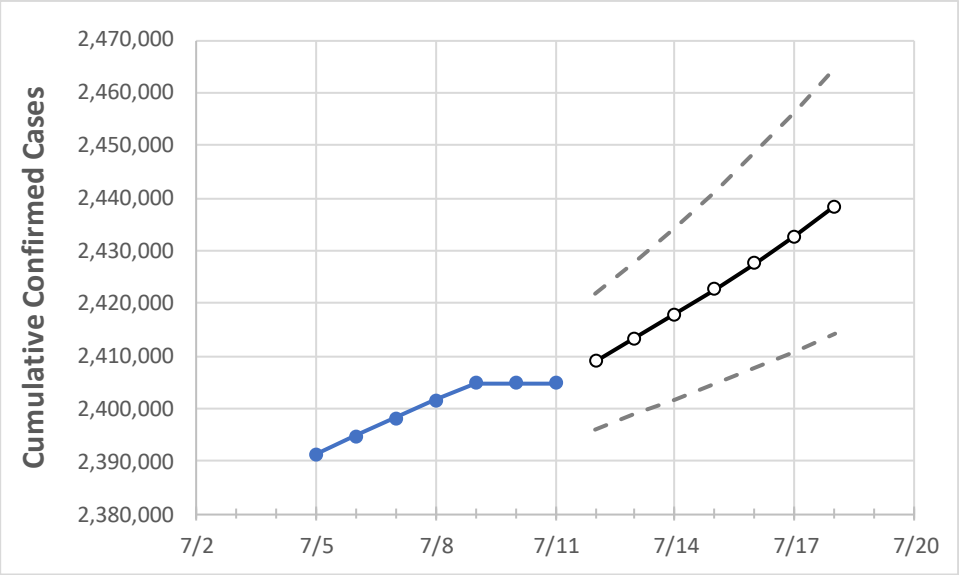
IEM's Modeling Lead

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:						
	7/8	7/9	7/10	7/11	7/12	7/13	7/14	7/15	7/16	7/17	7/18
Florida	2,401,503	2,404,895	2,404,895	2,404,895	2,408,977	2,413,405	2,417,936	2,422,680	2,427,620	2,432,802	2,438,338

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:						
	7/8	7/9	7/10	7/11	7/12	7/13	7/14	7/15	7/16	7/17	7/18
Alachua	25,945	25,964	25,964	25,964	25,986	26,008	26,031	26,055	26,081	26,107	26,134
Broward	252,131	252,436	252,436	252,436	252,798	253,175	253,563	253,967	254,388	254,830	255,293
Charlotte	13,778	13,792	13,792	13,792	13,805	13,818	13,832	13,845	13,859	13,873	13,888
Collier	38,338	38,392	38,392	38,392	38,458	38,526	38,598	38,673	38,750	38,832	38,918
Duval	106,492	106,798	106,798	106,798	107,216	107,657	108,134	108,631	109,159	109,718	110,298
Hillsborough	148,515	148,702	148,702	148,702	148,897	149,098	149,300	149,507	149,722	149,942	150,164
Lake	32,297	32,359	32,359	32,359	32,439	32,522	32,611	32,702	32,800	32,902	33,009
Lee	75,801	75,880	75,880	75,880	75,963	76,049	76,135	76,226	76,319	76,415	76,514
Manatee	40,801	40,836	40,836	40,836	40,870	40,905	40,941	40,978	41,016	41,054	41,093
Miami-Dade	515,141	515,765	515,765	515,765	516,512	517,309	518,143	519,001	519,918	520,859	521,837
Okaloosa	21,458	21,481	21,481	21,481	21,508	21,537	21,566	21,597	21,629	21,661	21,695
Orange	148,523	148,792	148,792	148,792	149,127	149,478	149,852	150,245	150,658	151,102	151,562
Osceola	48,106	48,189	48,189	48,189	48,288	48,390	48,496	48,608	48,724	48,847	48,974
Palm Beach	152,931	153,129	153,129	153,129	153,367	153,619	153,877	154,149	154,432	154,723	155,029
Pasco	44,129	44,186	44,186	44,186	44,257	44,333	44,412	44,496	44,583	44,674	44,769
Pinellas	83,458	83,540	83,540	83,540	83,627	83,717	83,809	83,906	84,005	84,107	84,210
Polk	73,543	73,643	73,643	73,643	73,760	73,879	74,001	74,128	74,259	74,395	74,538
Sarasota	34,428	34,461	34,461	34,461	34,501	34,544	34,589	34,634	34,682	34,733	34,787
Seminole	37,167	37,250	37,250	37,250	37,350	37,456	37,567	37,685	37,806	37,933	38,062
St. Johns	24,532	24,592	24,592	24,592	24,665	24,742	24,824	24,907	24,994	25,084	25,180
Sumter	9,747	9,759	9,759	9,759	9,773	9,787	9,802	9,819	9,835	9,853	9,871
Volusia	46,850	46,953	46,953	46,953	47,078	47,208	47,343	47,486	47,639	47,798	47,964

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:		
	7/8	7/9	7/10	7/11	7/13	7/15	7/17
Alachua	25,945	25,964	25,964	25,964	26,008 (5,202) [1,248] {624}	26,055 (5,211) [1,251] {625}	26,107 (5,221) [1,253] {627}
Broward	252,131	252,436	252,436	252,436	253,175 (50,635) [12,152] {6,076}	253,967 (50,793) [12,190] {6,095}	254,830 (50,966) [12,232] {6,116}
Charlotte	13,778	13,792	13,792	13,792	13,818 (2,764) [663] {332}	13,845 (2,769) [665] {332}	13,873 (2,775) [666] {333}
Collier	38,338	38,392	38,392	38,392	38,526 (7,705) [1,849] {925}	38,673 (7,735) [1,856] {928}	38,832 (7,766) [1,864] {932}
Duval	106,492	106,798	106,798	106,798	107,657 (21,531) [5,168] {2,584}	108,631 (21,726) [5,214] {2,607}	109,718 (21,944) [5,266] {2,633}
Hillsborough	148,515	148,702	148,702	148,702	149,098 (29,820) [7,157] {3,578}	149,507 (29,901) [7,176] {3,588}	149,942 (29,988) [7,197] {3,599}
Lake	32,297	32,359	32,359	32,359	32,522 (6,504) [1,561] {781}	32,702 (6,540) [1,570] {785}	32,902 (6,580) [1,579] {790}
Lee	75,801	75,880	75,880	75,880	76,049 (15,210) [3,650] {1,825}	76,226 (15,245) [3,659] {1,829}	76,415 (15,283) [3,668] {1,834}
Manatee	40,801	40,836	40,836	40,836	40,905 (8,181) [1,963] {982}	40,978 (8,196) [1,967] {983}	41,054 (8,211) [1,971] {985}
Miami-Dade	515,141	515,765	515,765	515,765	517,309 (103,462) [24,831] {12,415}	519,001 (103,800) [24,912] {12,456}	520,859 (104,172) [25,001] {12,501}
Okaloosa	21,458	21,481	21,481	21,481	21,537 (4,307) [1,034] {517}	21,597 (4,319) [1,037] {518}	21,661 (4,332) [1,040] {520}
Orange	148,523	148,792	148,792	148,792	149,478 (29,896) [7,175] {3,587}	150,245 (30,049) [7,212] {3,606}	151,102 (30,220) [7,253] {3,626}
Osceola	48,106	48,189	48,189	48,189	48,390 (9,678) [2,323] {1,161}	48,608 (9,722) [2,333] {1,167}	48,847 (9,769) [2,345] {1,172}
Palm Beach	152,931	153,129	153,129	153,129	153,619 (30,724) [7,374] {3,687}	154,149 (30,830) [7,399] {3,700}	154,723 (30,945) [7,427] {3,713}
Pasco	44,129	44,186	44,186	44,186	44,333 (8,867) [2,128] {1,064}	44,496 (8,899) [2,136] {1,068}	44,674 (8,935) [2,144] {1,072}
Pinellas	83,458	83,540	83,540	83,540	83,717 (16,743) [4,018] {2,009}	83,906 (16,781) [4,027] {2,014}	84,107 (16,821) [4,037] {2,019}
Polk	73,543	73,643	73,643	73,643	73,879 (14,776) [3,546] {1,773}	74,128 (14,826) [3,558] {1,779}	74,395 (14,879) [3,571] {1,785}
Sarasota	34,428	34,461	34,461	34,461	34,544 (6,909) [1,658] {829}	34,634 (6,927) [1,662] {831}	34,733 (6,947) [1,667] {834}
Seminole	37,167	37,250	37,250	37,250	37,456 (7,491) [1,798] {899}	37,685 (7,537) [1,809] {904}	37,933 (7,587) [1,821] {910}
St. Johns	24,532	24,592	24,592	24,592	24,742 (4,948) [1,188] {594}	24,907 (4,981) [1,196] {598}	25,084 (5,017) [1,204] {602}
Sumter	9,747	9,759	9,759	9,759	9,787 (1,957) [470] {235}	9,819 (1,964) [471] {236}	9,853 (1,971) [473] {236}
Volusia	46,850	46,953	46,953	46,953	47,208 (9,442) [2,266] {1,133}	47,486 (9,497) [2,279] {1,140}	47,798 (9,560) [2,294] {1,147}

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.