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

Date: 4/8/21

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 4/8/21 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.

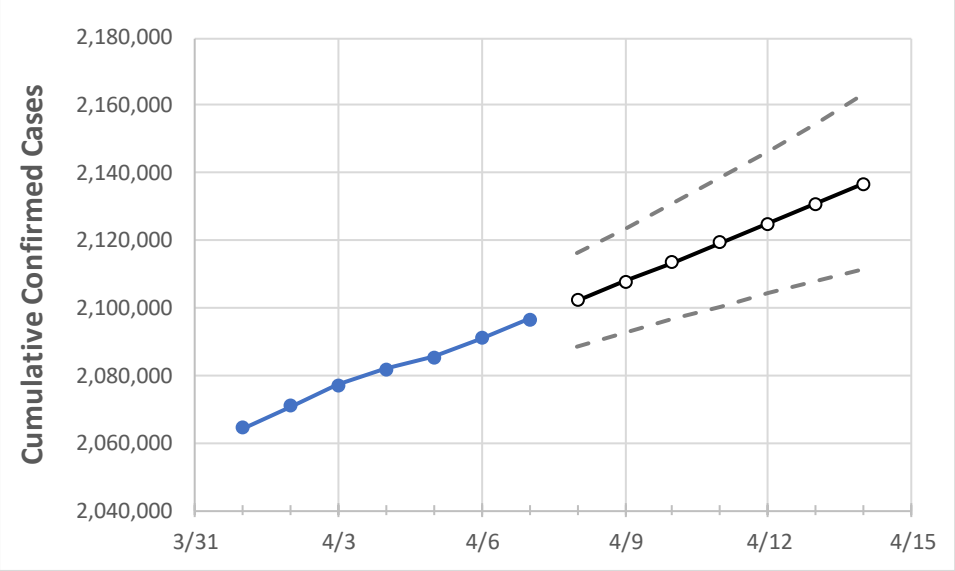
IEM's Modeling Lead

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:						
	4/4	4/5	4/6	4/7	4/8	4/9	4/10	4/11	4/12	4/13	4/14
Florida	2,081,826	2,085,306	2,090,862	2,096,747	2,102,274	2,107,858	2,113,531	2,119,302	2,125,117	2,130,945	2,136,677

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:						
	4/4	4/5	4/6	4/7	4/8	4/9	4/10	4/11	4/12	4/13	4/14
Alachua	23,588	23,611	23,645	23,674	23,719	23,763	23,807	23,852	23,899	23,945	23,992
Broward	217,780	218,184	218,973	219,792	220,551	221,311	222,073	222,842	223,619	224,419	225,230
Charlotte	11,766	11,796	11,842	11,882	11,933	11,985	12,037	12,090	12,145	12,203	12,261
Collier	32,927	32,967	33,074	33,179	33,280	33,385	33,488	33,594	33,704	33,813	33,929
Duval	93,097	93,200	93,290	93,426	93,545	93,664	93,783	93,902	94,022	94,142	94,261
Hillsborough	123,479	123,770	124,167	124,636	125,063	125,491	125,920	126,372	126,819	127,292	127,758
Lake	26,983	27,028	27,081	27,173	27,242	27,311	27,380	27,448	27,517	27,586	27,654
Lee	63,512	63,572	63,774	63,957	64,143	64,329	64,513	64,700	64,886	65,071	65,257
Manatee	35,249	35,280	35,411	35,534	35,634	35,737	35,838	35,942	36,045	36,150	36,253
Miami-Dade	451,019	451,829	453,345	454,405	455,662	456,938	458,199	459,494	460,781	462,085	463,418
Okaloosa	19,809	19,816	19,834	19,847	19,858	19,868	19,878	19,888	19,898	19,908	19,917
Orange	125,414	125,661	126,044	126,468	126,874	127,266	127,673	128,086	128,499	128,920	129,349
Osceola	40,121	40,214	40,362	40,496	40,623	40,756	40,889	41,023	41,163	41,305	41,451
Palm Beach	133,286	133,571	133,836	134,337	134,713	135,099	135,484	135,864	136,259	136,647	137,040
Pasco	36,906	37,013	37,136	37,272	37,402	37,535	37,670	37,803	37,940	38,080	38,223
Pinellas	73,290	73,429	73,591	73,828	74,051	74,271	74,496	74,724	74,962	75,189	75,421
Polk	61,888	61,995	62,197	62,402	62,587	62,777	62,966	63,163	63,367	63,570	63,776
Sarasota	29,766	29,846	29,929	30,044	30,142	30,241	30,340	30,441	30,542	30,641	30,745
Seminole	30,495	30,570	30,642	30,759	30,863	30,966	31,069	31,172	31,272	31,378	31,480
St. Johns	21,337	21,362	21,394	21,431	21,486	21,541	21,597	21,654	21,712	21,772	21,831
Sumter	8,868	8,880	8,886	8,909	8,920	8,930	8,940	8,949	8,958	8,965	8,973
Volusia	38,939	39,045	39,120	39,322	39,482	39,649	39,816	39,985	40,151	40,321	40,492

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:		
	4/4	4/5	4/6	4/7	4/9	4/11	4/13
Alachua	23,588	23,611	23,645	23,674	23,763 (4,753) [1,141] {570}	23,852 (4,770) [1,145] {572}	23,945 (4,789) [1,149] {575}
Broward	217,780	218,184	218,973	219,792	221,311 (44,262) [10,623] {5,311}	222,842 (44,568) [10,696] {5,348}	224,419 (44,884) [10,772] {5,386}
Charlotte	11,766	11,796	11,842	11,882	11,985 (2,397) [575] {288}	12,090 (2,418) [580] {290}	12,203 (2,441) [586] {293}
Collier	32,927	32,967	33,074	33,179	33,385 (6,677) [1,602] {801}	33,594 (6,719) [1,613] {806}	33,813 (6,763) [1,623] {812}
Duval	93,097	93,200	93,290	93,426	93,664 (18,733) [4,496] {2,248}	93,902 (18,780) [4,507] {2,254}	94,142 (18,828) [4,519] {2,259}
Hillsborough	123,479	123,770	124,167	124,636	125,491 (25,098) [6,024] {3,012}	126,372 (25,274) [6,066] {3,033}	127,292 (25,458) [6,110] {3,055}
Lake	26,983	27,028	27,081	27,173	27,311 (5,462) [1,311] {655}	27,448 (5,490) [1,318] {659}	27,586 (5,517) [1,324] {662}
Lee	63,512	63,572	63,774	63,957	64,329 (12,866) [3,088] {1,544}	64,700 (12,940) [3,106] {1,553}	65,071 (13,014) [3,123] {1,562}
Manatee	35,249	35,280	35,411	35,534	35,737 (7,147) [1,715] {858}	35,942 (7,188) [1,725] {863}	36,150 (7,230) [1,735] {868}
Miami-Dade	451,019	451,829	453,345	454,405	456,938 (91,388) [21,933] {10,967}	459,494 (91,899) [22,056] {11,028}	462,085 (92,417) [22,180] {11,090}
Okaloosa	19,809	19,816	19,834	19,847	19,868 (3,974) [954] {477}	19,888 (3,978) [955] {477}	19,908 (3,982) [956] {478}
Orange	125,414	125,661	126,044	126,468	127,266 (25,453) [6,109] {3,054}	128,086 (25,617) [6,148] {3,074}	128,920 (25,784) [6,188] {3,094}
Osceola	40,121	40,214	40,362	40,496	40,756 (8,151) [1,956] {978}	41,023 (8,205) [1,969] {985}	41,305 (8,261) [1,983] {991}
Palm Beach	133,286	133,571	133,836	134,337	135,099 (27,020) [6,485] {3,242}	135,864 (27,173) [6,521] {3,261}	136,647 (27,329) [6,559] {3,280}
Pasco	36,906	37,013	37,136	37,272	37,535 (7,507) [1,802] {901}	37,803 (7,561) [1,815] {907}	38,080 (7,616) [1,828] {914}
Pinellas	73,290	73,429	73,591	73,828	74,271 (14,854) [3,565] {1,783}	74,724 (14,945) [3,587] {1,793}	75,189 (15,038) [3,609] {1,805}
Polk	61,888	61,995	62,197	62,402	62,777 (12,555) [3,013] {1,507}	63,163 (12,633) [3,032] {1,516}	63,570 (12,714) [3,051] {1,526}
Sarasota	29,766	29,846	29,929	30,044	30,241 (6,048) [1,452] {726}	30,441 (6,088) [1,461] {731}	30,641 (6,128) [1,471] {735}
Seminole	30,495	30,570	30,642	30,759	30,966 (6,193) [1,486] {743}	31,172 (6,234) [1,496] {748}	31,378 (6,276) [1,506] {753}
St. Johns	21,337	21,362	21,394	21,431	21,541 (4,308) [1,034] {517}	21,654 (4,331) [1,039] {520}	21,772 (4,354) [1,045] {523}
Sumter	8,868	8,880	8,886	8,909	8,930 (1,786) [429] {214}	8,949 (1,790) [430] {215}	8,965 (1,793) [430] {215}
Volusia	38,939	39,045	39,120	39,322	39,649 (7,930) [1,903] {952}	39,985 (7,997) [1,919] {960}	40,321 (8,064) [1,935] {968}

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.