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

Date: 10/27/20

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 10/27/20 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.

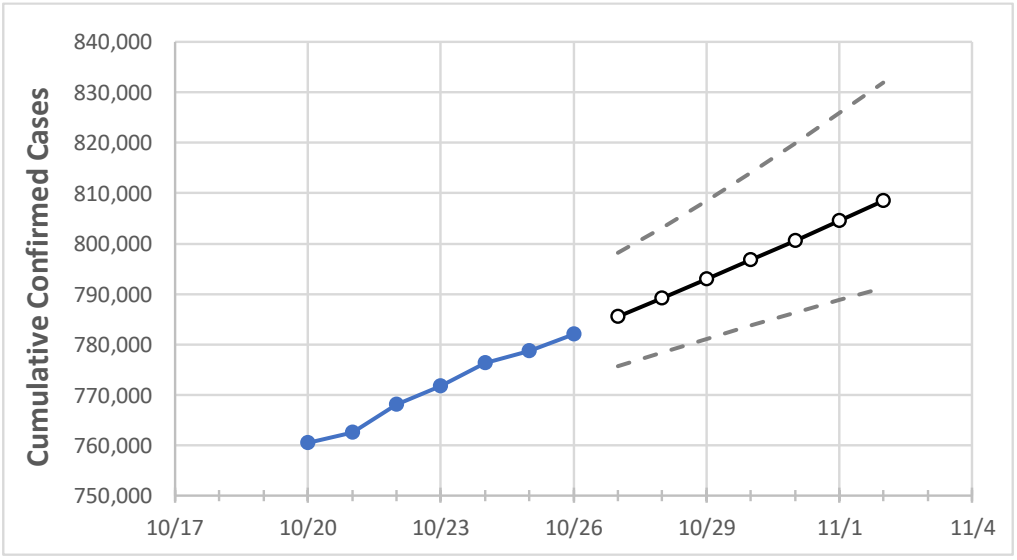
IEM's Modeling Lead

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:						
	10/23	10/24	10/25	10/26	10/27	10/28	10/29	10/30	10/31	11/1	11/2
Florida	771,780	776,251	778,636	782,013	785,569	789,199	792,902	796,682	800,539	804,475	808,491

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 20%, and are often within 10%, of actual confirmed cases.

Florida Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	10/23	10/24	10/25	10/26	10/27	10/28	10/29	10/30	10/31	11/1	11/2
Alachua	9,895	9,989	10,044	10,114	10,193	10,273	10,354	10,436	10,520	10,605	10,691
Broward	82,706	83,165	83,450	83,962	84,371	84,800	85,248	85,717	86,208	86,721	87,258
Charlotte	3,463	3,487	3,509	3,553	3,578	3,604	3,632	3,660	3,690	3,721	3,753
Collier	13,927	14,025	14,087	14,135	14,207	14,282	14,360	14,439	14,522	14,608	14,696
Duval	33,946	34,177	34,260	34,462	34,633	34,807	34,986	35,168	35,355	35,545	35,740
Hillsborough	46,518	46,790	46,907	47,080	47,282	47,486	47,692	47,901	48,112	48,326	48,542
Lake	8,387	8,415	8,445	8,479	8,519	8,560	8,602	8,644	8,687	8,730	8,774
Lee	22,480	22,619	22,711	22,887	23,019	23,156	23,299	23,447	23,600	23,759	23,924
Manatee	12,842	12,930	12,971	13,023	13,086	13,150	13,215	13,281	13,348	13,417	13,487
Miami-Dade	181,017	181,633	181,942	182,523	183,087	183,662	184,249	184,848	185,459	186,082	186,718
Okaloosa	6,032	6,098	6,146	6,189	6,251	6,314	6,381	6,449	6,520	6,593	6,668
Orange	44,605	44,921	45,042	45,242	45,482	45,726	45,977	46,233	46,494	46,762	47,035
Osceola	13,778	13,852	13,905	13,978	14,042	14,108	14,175	14,243	14,312	14,383	14,456
Palm Beach	49,988	50,316	50,525	50,816	51,027	51,244	51,470	51,703	51,944	52,193	52,451
Pasco	10,465	10,539	10,600	10,637	10,691	10,745	10,800	10,855	10,911	10,968	11,026
Pinellas	24,789	24,986	25,130	25,244	25,421	25,606	25,797	25,996	26,202	26,416	26,638
Polk	22,332	22,481	22,541	22,634	22,734	22,835	22,936	23,038	23,141	23,244	23,348
Sarasota	9,280	9,340	9,392	9,429	9,489	9,549	9,611	9,674	9,738	9,803	9,869
Seminole	9,928	10,009	10,044	10,094	10,142	10,192	10,243	10,296	10,350	10,405	10,462
St. Johns	6,193	6,236	6,280	6,326	6,373	6,421	6,471	6,522	6,574	6,627	6,682
Sumter	2,826	2,844	2,849	2,855	2,867	2,879	2,891	2,902	2,914	2,925	2,937
Volusia	12,288	12,399	12,453	12,520	12,599	12,679	12,762	12,847	12,935	13,024	13,116

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:		
	10/23	10/24	10/25	10/26	10/28	10/30	11/1
Alachua	9,895	9,989	10,044	10,114	10,273 (2,055) [493] {247}	10,436 (2,087) [501] {250}	10,605 (2,121) [509] {255}
Broward	82,706	83,165	83,450	83,962	84,800 (16,960) [4,070] {2,035}	85,717 (17,143) [4,114] {2,057}	86,721 (17,344) [4,163] {2,081
Charlotte	3,463	3,487	3,509	3,553	3,604 (721) [173] {87}	3,660 (732) [176] {88}	3,721 (744) [179] {89}
Collier	13,927	14,025	14,087	14,135	14,282 (2,856) [686] {343}	14,439 (2,888) [693] {347}	14,608 (2,922) [701] {351}
Duval	33,946	34,177	34,260	34,462	34,807 (6,961) [1,671] {835}	35,168 (7,034) [1,688] {844}	35,545 (7,109) [1,706] {853}
Hillsborough	46,518	46,790	46,907	47,080	47,486 (9,497) [2,279] {1,140}	47,901 (9,580) [2,299] {1,150}	48,326 (9,665) [2,320] {1,160}
Lake	8,387	8,415	8,445	8,479	8,560 (1,712) [411] {205}	8,644 (1,729) [415] {207}	8,730 (1,746) [419] {210}
Lee	22,480	22,619	22,711	22,887	23,156 (4,631) [1,112] {556}	23,447 (4,689) [1,125] {563}	23,759 (4,752) [1,140] {570}
Manatee	12,842	12,930	12,971	13,023	13,150 (2,630) [631] {316}	13,281 (2,656) [637] {319}	13,417 (2,683) [644] {322}
Miami-Dade	181,017	181,633	181,942	182,523	183,662 (36,732) [8,816] {4,408}	184,848 (36,970) [8,873] {4,436}	186,082 (37,216) [8,932] {4,466
Okaloosa	6,032	6,098	6,146	6,189	6,314 (1,263) [303] {152}	6,449 (1,290) [310] {155}	6,593 (1,319) [316] {158}
Orange	44,605	44,921	45,042	45,242	45,726 (9,145) [2,195] {1,097}	46,233 (9,247) [2,219] {1,110}	46,762 (9,352) [2,245] {1,122}
Osceola	13,778	13,852	13,905	13,978	14,108 (2,822) [677] {339}	14,243 (2,849) [684] {342}	14,383 (2,877) [690] {345}
Palm Beach	49,988	50,316	50,525	50,816	51,244 (10,249) [2,460] {1,230}	51,703 (10,341) [2,482] {1,241}	52,193 (10,439) [2,505] {1,253
Pasco	10,465	10,539	10,600	10,637	10,745 (2,149) [516] {258}	10,855 (2,171) [521] {261}	10,968 (2,194) [526] {263}
Pinellas	24,789	24,986	25,130	25,244	25,606 (5,121) [1,229] {615}	25,996 (5,199) [1,248] {624}	26,416 (5,283) [1,268] {634}
Polk	22,332	22,481	22,541	22,634	22,835 (4,567) [1,096] {548}	23,038 (4,608) [1,106] {553}	23,244 (4,649) [1,116] {558}
Sarasota	9,280	9,340	9,392	9,429	9,549 (1,910) [458] {229}	9,674 (1,935) [464] {232}	9,803 (1,961) [471] {235}
Seminole	9,928	10,009	10,044	10,094	10,192 (2,038) [489] {245}	10,296 (2,059) [494] {247}	10,405 (2,081) [499] {250}
St. Johns	6,193	6,236	6,280	6,326	6,421 (1,284) [308] {154}	6,522 (1,304) [313] {157}	6,627 (1,325) [318] {159}
Sumter	2,826	2,844	2,849	2,855	2,879 (576) [138] {69}	2,902 (580) [139] {70}	2,925 (585) [140] {70}
Volusia	12,288	12,399	12,453	12,520	12,679 (2,536) [609] {304}	12,847 (2,569) [617] {308}	13,024 (2,605) [625] {313}

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.