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

Date: 11/2/20

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 11/2/20 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.

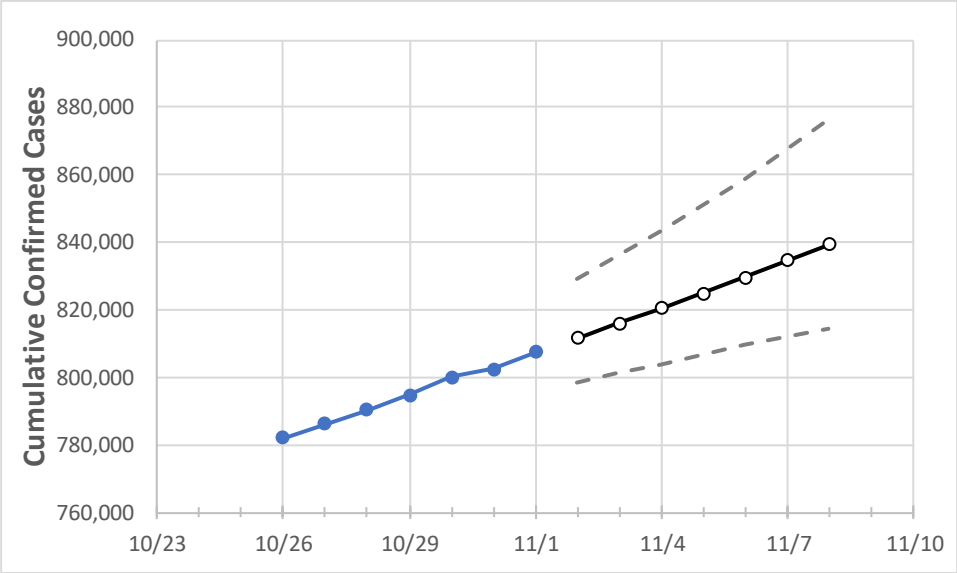
IEM's Modeling Lead

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:						
	10/29	10/30	10/31	11/1	11/2	11/3	11/4	11/5	11/6	11/7	11/8
Florida	794,624	800,216	802,547	807,412	811,638	815,977	820,431	825,005	829,700	834,520	839,467

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:						
	10/29	10/30	10/31	11/1	11/2	11/3	11/4	11/5	11/6	11/7	11/8
Alachua	10,385	10,533	10,582	10,706	10,801	10,899	10,999	11,102	11,207	11,315	11,425
Broward	85,449	86,091	86,235	86,961	87,479	88,021	88,588	89,180	89,800	90,447	91,125
Charlotte	3,638	3,689	3,715	3,741	3,777	3,815	3,855	3,897	3,941	3,988	4,037
Collier	14,404	14,542	14,587	14,664	14,752	14,842	14,937	15,034	15,135	15,239	15,347
Duval	34,963	35,171	35,256	35,429	35,600	35,773	35,949	36,127	36,309	36,493	36,680
Hillsborough	47,800	48,148	48,287	48,669	48,904	49,143	49,387	49,635	49,888	50,146	50,408
Lake	8,613	8,662	8,680	8,729	8,768	8,807	8,847	8,887	8,928	8,968	9,010
Lee	23,335	23,517	23,589	23,685	23,829	23,977	24,130	24,286	24,448	24,614	24,784
Manatee	13,258	13,403	13,463	13,550	13,635	13,722	13,812	13,906	14,002	14,102	14,205
Miami-Dade	184,669	185,552	185,891	186,809	187,467	188,141	188,831	189,537	190,259	190,998	191,754
Okaloosa	6,373	6,473	6,499	6,545	6,602	6,661	6,720	6,781	6,843	6,906	6,971
Orange	45,941	46,424	46,434	46,725	46,901	47,076	47,250	47,423	47,595	47,767	47,938
Osceola	14,203	14,252	14,287	14,380	14,450	14,522	14,594	14,669	14,744	14,821	14,899
Palm Beach	51,779	52,184	52,447	52,779	53,132	53,504	53,897	54,312	54,750	55,212	55,700
Pasco	10,826	10,923	10,972	11,063	11,126	11,191	11,258	11,325	11,395	11,466	11,538
Pinellas	25,674	25,921	25,986	26,214	26,377	26,543	26,713	26,887	27,064	27,245	27,430
Polk	22,960	23,088	23,164	23,306	23,415	23,526	23,638	23,751	23,866	23,982	24,099
Sarasota	9,657	9,706	9,745	9,811	9,870	9,930	9,991	10,053	10,115	10,178	10,242
Seminole	10,239	10,357	10,411	10,470	10,530	10,592	10,656	10,722	10,790	10,860	10,933
St. Johns	6,506	6,564	6,599	6,639	6,694	6,752	6,810	6,871	6,934	6,998	7,065
Sumter	2,891	2,928	2,945	2,960	2,973	2,985	2,998	3,010	3,023	3,035	3,048
Volusia	12,755	12,876	12,927	13,008	13,091	13,175	13,261	13,349	13,439	13,531	13,626

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:		
	10/29	10/30	10/31	11/1	11/3	11/5	11/7
Alachua	10,385	10,533	10,582	10,706	10,899 (2,180) [523] {262}	11,102 (2,220) [533] {266}	11,315 (2,263) [543] {272}
Broward	85,449	86,091	86,235	86,961	88,021 (17,604) [4,225] {2,113}	89,180 (17,836) [4,281] {2,140}	90,447 (18,089) [4,341] {2,171}
Charlotte	3,638	3,689	3,715	3,741	3,815 (763) [183] {92}	3,897 (779) [187] {94}	3,988 (798) [191] {96}
Collier	14,404	14,542	14,587	14,664	14,842 (2,968) [712] {356}	15,034 (3,007) [722] {361}	15,239 (3,048) [731] {366}
Duval	34,963	35,171	35,256	35,429	35,773 (7,155) [1,717] {859}	36,127 (7,225) [1,734] {867}	36,493 (7,299) [1,752] {876}
Hillsborough	47,800	48,148	48,287	48,669	49,143 (9,829) [2,359] {1,179}	49,635 (9,927) [2,382] {1,191}	50,146 (10,029) [2,407] {1,203}
Lake	8,613	8,662	8,680	8,729	8,807 (1,761) [423] {211}	8,887 (1,777) [427] {213}	8,968 (1,794) [430] {215}
Lee	23,335	23,517	23,589	23,685	23,977 (4,795) [1,151] {575}	24,286 (4,857) [1,166] {583}	24,614 (4,923) [1,181] {591}
Manatee	13,258	13,403	13,463	13,550	13,722 (2,744) [659] {329}	13,906 (2,781) [667] {334}	14,102 (2,820) [677] {338}
Miami-Dade	184,669	185,552	185,891	186,809	188,141 (37,628) [9,031] {4,515}	189,537 (37,907) [9,098] {4,549}	190,998 (38,200) [9,168] {4,584}
Okaloosa	6,373	6,473	6,499	6,545	6,661 (1,332) [320] {160}	6,781 (1,356) [325] {163}	6,906 (1,381) [331] {166}
Orange	45,941	46,424	46,434	46,725	47,076 (9,415) [2,260] {1,130}	47,423 (9,485) [2,276] {1,138}	47,767 (9,553) [2,293] {1,146}
Osceola	14,203	14,252	14,287	14,380	14,522 (2,904) [697] {349}	14,669 (2,934) [704] {352}	14,821 (2,964) [711] {356}
Palm Beach	51,779	52,184	52,447	52,779	53,504 (10,701) [2,568] {1,284}	54,312 (10,862) [2,607] {1,303}	55,212 (11,042) [2,650] {1,325}
Pasco	10,826	10,923	10,972	11,063	11,191 (2,238) [537] {269}	11,325 (2,265) [544] {272}	11,466 (2,293) [550] {275}
Pinellas	25,674	25,921	25,986	26,214	26,543 (5,309) [1,274] {637}	26,887 (5,377) [1,291] {645}	27,245 (5,449) [1,308] {654}
Polk	22,960	23,088	23,164	23,306	23,526 (4,705) [1,129] {565}	23,751 (4,750) [1,140] {570}	23,982 (4,796) [1,151] {576}
Sarasota	9,657	9,706	9,745	9,811	9,930 (1,986) [477] {238}	10,053 (2,011) [483] {241}	10,178 (2,036) [489] {244}
Seminole	10,239	10,357	10,411	10,470	10,592 (2,118) [508] {254}	10,722 (2,144) [515] {257}	10,860 (2,172) [521] {261}
St. Johns	6,506	6,564	6,599	6,639	6,752 (1,350) [324] {162}	6,871 (1,374) [330] {165}	6,998 (1,400) [336] {168}
Sumter	2,891	2,928	2,945	2,960	2,985 (597) [143] {72}	3,010 (602) [144] {72}	3,035 (607) [146] {73}
Volusia	12,755	12,876	12,927	13,008	13,175 (2,635) [632] {316}	13,349 (2,670) [641] {320}	13,531 (2,706) [650] {325}

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.