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

Date: 11/20/20

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 11/20/20 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.

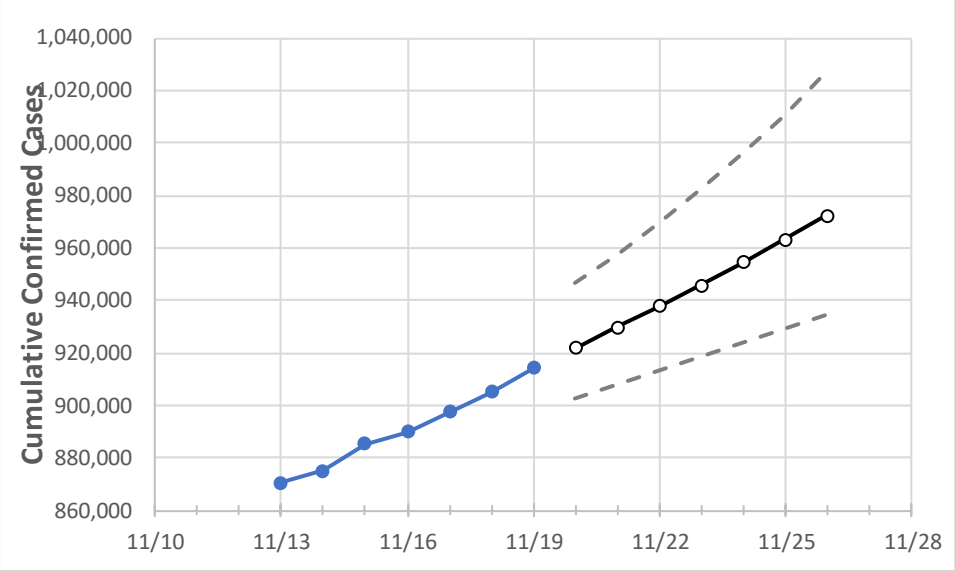
IEM's Modeling Lead

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:						
	11/16	11/17	11/18	11/19	11/20	11/21	11/22	11/23	11/24	11/25	11/26
Florida	889,864	897,323	905,248	914,333	921,828	929,570	937,567	945,826	954,356	963,163	972,258

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:						
	11/16	11/17	11/18	11/19	11/20	11/21	11/22	11/23	11/24	11/25	11/26
Alachua	11,807	11,854	11,994	12,113	12,189	12,266	12,343	12,422	12,502	12,583	12,664
Broward	95,734	96,700	97,475	98,377	99,108	99,861	100,639	101,441	102,269	103,122	104,002
Charlotte	4,333	4,383	4,425	4,503	4,556	4,611	4,668	4,727	4,787	4,849	4,913
Collier	16,019	16,117	16,308	16,447	16,565	16,687	16,812	16,941	17,074	17,210	17,351
Duval	38,677	39,052	39,305	39,745	39,998	40,261	40,532	40,814	41,105	41,406	41,718
Hillsborough	53,187	53,432	53,900	54,326	54,672	55,024	55,381	55,744	56,112	56,487	56,867
Lake	9,665	9,721	9,815	9,872	9,936	10,000	10,066	10,133	10,201	10,270	10,340
Lee	26,438	26,702	26,989	27,275	27,546	27,829	28,124	28,432	28,753	29,088	29,437
Manatee	14,855	15,040	15,147	15,343	15,446	15,551	15,659	15,770	15,883	16,000	16,119
Miami-Dade	203,654	205,536	207,221	209,166	210,768	212,450	214,217	216,071	218,017	220,060	222,203
Okaloosa	7,669	7,757	7,864	7,980	8,074	8,170	8,269	8,370	8,474	8,580	8,689
Orange	51,888	52,298	52,862	53,384	53,886	54,413	54,965	55,544	56,151	56,788	57,456
Osceola	16,158	16,266	16,491	16,693	16,865	17,045	17,233	17,431	17,637	17,854	18,080
Palm Beach	58,754	59,154	59,656	60,219	60,712	61,217	61,735	62,265	62,809	63,365	63,935
Pasco	12,666	12,771	12,968	13,156	13,310	13,470	13,635	13,807	13,986	14,171	14,363
Pinellas	29,297	29,509	29,737	30,006	30,238	30,474	30,713	30,954	31,199	31,447	31,699
Polk	25,379	25,531	25,696	25,897	26,074	26,257	26,444	26,637	26,836	27,040	27,250
Sarasota	11,274	11,528	11,620	11,905	12,045	12,192	12,346	12,508	12,678	12,856	13,043
Seminole	11,575	11,666	11,786	11,887	11,991	12,098	12,209	12,323	12,441	12,563	12,689
St. Johns	7,569	7,644	7,699	7,786	7,855	7,925	7,997	8,070	8,145	8,222	8,300
Sumter	3,164	3,184	3,212	3,230	3,240	3,249	3,259	3,268	3,277	3,287	3,296
Volusia	14,303	14,460	14,563	14,681	14,770	14,859	14,949	15,040	15,131	15,223	15,315

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:		
	11/16	11/17	11/18	11/19	11/21	11/23	11/25
Alachua	11,807	11,854	11,994	12,113	12,266 (2,453) [589] {294}	12,422 (2,484) [596] {298}	12,583 (2,517) [604] {302}
Broward	95,734	96,700	97,475	98,377	99,861 (19,972) [4,793] {2,397}	101,441 (20,288) [4,869] {2,435}	103,122 (20,624) [4,950] {2,475}
Charlotte	4,333	4,383	4,425	4,503	4,611 (922) [221] {111}	4,727 (945) [227] {113}	4,849 (970) [233] {116}
Collier	16,019	16,117	16,308	16,447	16,687 (3,337) [801] {400}	16,941 (3,388) [813] {407}	17,210 (3,442) [826] {413}
Duval	38,677	39,052	39,305	39,745	40,261 (8,052) [1,933] {966}	40,814 (8,163) [1,959] {980}	41,406 (8,281) [1,987] {994}
Hillsborough	53,187	53,432	53,900	54,326	55,024 (11,005) [2,641] {1,321}	55,744 (11,149) [2,676] {1,338}	56,487 (11,297) [2,711] {1,356}
Lake	9,665	9,721	9,815	9,872	10,000 (2,000) [480] {240}	10,133 (2,027) [486] {243}	10,270 (2,054) [493] {246}
Lee	26,438	26,702	26,989	27,275	27,829 (5,566) [1,336] {668}	28,432 (5,686) [1,365] {682}	29,088 (5,818) [1,396] {698}
Manatee	14,855	15,040	15,147	15,343	15,551 (3,110) [746] {373}	15,770 (3,154) [757] {378}	16,000 (3,200) [768] {384}
Miami-Dade	203,654	205,536	207,221	209,166	212,450 (42,490) [10,198] {5,099}	216,071 (43,214) [10,371] {5,186}	220,060 (44,012) [10,563] {5,281}
Okaloosa	7,669	7,757	7,864	7,980	8,170 (1,634) [392] {196}	8,370 (1,674) [402] {201}	8,580 (1,716) [412] {206}
Orange	51,888	52,298	52,862	53,384	54,413 (10,883) [2,612] {1,306}	55,544 (11,109) [2,666] {1,333}	56,788 (11,358) [2,726] {1,363}
Osceola	16,158	16,266	16,491	16,693	17,045 (3,409) [818] {409}	17,431 (3,486) [837] {418}	17,854 (3,571) [857] {428}
Palm Beach	58,754	59,154	59,656	60,219	61,217 (12,243) [2,938] {1,469}	62,265 (12,453) [2,989] {1,494}	63,365 (12,673) [3,042] {1,521}
Pasco	12,666	12,771	12,968	13,156	13,470 (2,694) [647] {323}	13,807 (2,761) [663] {331}	14,171 (2,834) [680] {340}
Pinellas	29,297	29,509	29,737	30,006	30,474 (6,095) [1,463] {731}	30,954 (6,191) [1,486] {743}	31,447 (6,289) [1,509] {755}
Polk	25,379	25,531	25,696	25,897	26,257 (5,251) [1,260] {630}	26,637 (5,327) [1,279] {639}	27,040 (5,408) [1,298] {649}
Sarasota	11,274	11,528	11,620	11,905	12,192 (2,438) [585] {293}	12,508 (2,502) [600] {300}	12,856 (2,571) [617] {309}
Seminole	11,575	11,666	11,786	11,887	12,098 (2,420) [581] {290}	12,323 (2,465) [592] {296}	12,563 (2,513) [603] {302}
St. Johns	7,569	7,644	7,699	7,786	7,925 (1,585) [380] {190}	8,070 (1,614) [387] {194}	8,222 (1,644) [395] {197}
Sumter	3,164	3,184	3,212	3,230	3,249 (650) [156] {78}	3,268 (654) [157] {78}	3,287 (657) [158] {79}
Volusia	14,303	14,460	14,563	14,681	14,859 (2,972) [713] {357}	15,040 (3,008) [722] {361}	15,223 (3,045) [731] {365}

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.