IEM's AI Modeling: Short-term COVID-19 Projections
Date: 9/3/20

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 <u>not</u> 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 20%, and are often within 10%, of actual confirmed cases.

The projections shown in this document are based on data pulled in as of 9/3/20 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
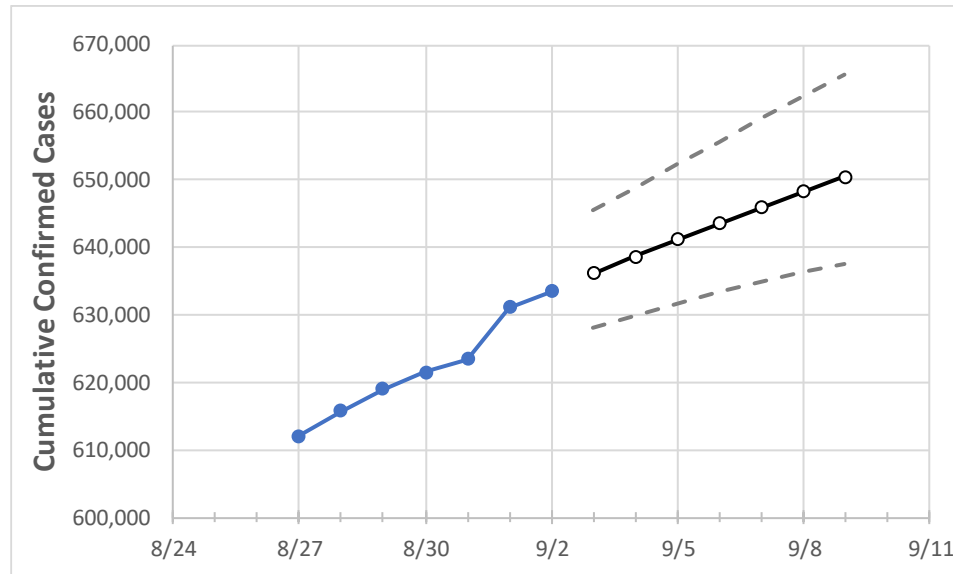
	Actual Confirmed Cases On:				Projected Cases For:						
	8/30	8/31	9/1	9/2	9/3	9/4	9/5	9/6	9/7	9/8	9/9
Florida	621,586	623,471	631,040	633,442	636,067	638,625	641,117	643,543	645,906	648,207	650,447

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:						
	8/30	8/31	9/1	9/2	9/3	9/4	9/5	9/6	9/7	9/8	9/9
Alachua	5,193	5,196	5,251	5,303	5,324	5,344	5,363	5,381	5,398	5,415	5,430
Broward	70,950	71,121	72,245	72,371	72,563	72,746	72,920	73,087	73,246	73,397	73,541
Charlotte	2,656	2,677	2,713	2,729	2,749	2,770	2,790	2,810	2,831	2,851	2,872
Collier	11,604	11,609	11,796	11,819	11,845	11,871	11,895	11,918	11,941	11,962	11,983
Duval	26,391	26,460	26,683	26,807	26,907	27,006	27,102	27,197	27,290	27,381	27,470
Hillsborough	37,013	37,136	37,458	37,668	37,844	38,019	38,192	38,364	38,535	38,704	38,871
Lake	6,385	6,396	6,538	6,581	6,623	6,665	6,706	6,747	6,787	6,827	6,867
Lee	18,634	18,673	18,824	18,878	18,946	19,012	19,077	19,141	19,204	19,266	19,327
Manatee	10,418	10,426	10,490	10,532	10,556	10,580	10,602	10,623	10,642	10,661	10,679
Miami-Dade	156,559	156,910	159,059	159,400	159,884	160,345	160,784	161,203	161,602	161,981	162,343
Okaloosa	4,134	4,154	4,199	4,245	4,267	4,289	4,311	4,332	4,353	4,373	4,393
Orange	35,770	35,902	36,400	36,488	36,632	36,773	36,912	37,048	37,183	37,315	37,445
Osceola	11,091	11,134	11,260	11,298	11,336	11,372	11,408	11,442	11,475	11,507	11,538
Palm Beach	41,865	41,965	42,387	42,518	42,638	42,753	42,863	42,969	43,071	43,168	43,262
Pasco	8,028	8,048	8,135	8,165	8,193	8,220	8,247	8,273	8,298	8,322	8,345
Pinellas	19,888	19,929	20,026	20,080	20,132	20,182	20,230	20,276	20,320	20,363	20,405
Polk	16,894	17,011	17,159	17,292	17,389	17,486	17,581	17,675	17,769	17,861	17,952
Sarasota	7,193	7,207	7,239	7,281	7,304	7,326	7,347	7,367	7,387	7,406	7,424
Seminole	8,006	8,029	8,173	8,198	8,231	8,263	8,295	8,327	8,359	8,390	8,420
St. Johns	4,321	4,332	4,389	4,413	4,431	4,449	4,467	4,484	4,501	4,518	4,534
Sumter	1,848	1,852	1,881	1,914	1,925	1,935	1,945	1,955	1,965	1,975	1,984
Volusia	9,244	9,283	9,417	9,483	9,525	9,565	9,605	9,643	9,681	9,717	9,753

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:		
	8/30	8/31	9/1	9/2	9/4	9/6	9/8
Alachua	5,193	5,196	5,251	5,303	5,344 (1,069) [257] {128}	5,381 (1,076) [258] {129}	5,415 (1,083) [260] {130}
Broward	70,950	71,121	72,245	72,371	72,746 (14,549) [3,492] {1,746}	73,087 (14,617) [3,508] {1,754}	73,397 (14,679) [3,523] {1,762}
Charlotte	2,656	2,677	2,713	2,729	2,770 (554) [133] {66}	2,810 (562) [135] {67}	2,851 (570) [137] {68}
Collier	11,604	11,609	11,796	11,819	11,871 (2,374) [570] {285}	11,918 (2,384) [572] {286}	11,962 (2,392) [574] {287}
Duval	26,391	26,460	26,683	26,807	27,006 (5,401) [1,296] {648}	27,197 (5,439) [1,305] {653}	27,381 (5,476) [1,314] {657}
Hillsborough	37,013	37,136	37,458	37,668	38,019 (7,604) [1,825] {912}	38,364 (7,673) [1,841] {921}	38,704 (7,741) [1,858] {929}
Lake	6,385	6,396	6,538	6,581	6,665 (1,333) [320] {160}	6,747 (1,349) [324] {162}	6,827 (1,365) [328] {164}
Lee	18,634	18,673	18,824	18,878	19,012 (3,802) [913] {456}	19,141 (3,828) [919] {459}	19,266 (3,853) [925] {462}
Manatee	10,418	10,426	10,490	10,532	10,580 (2,116) [508] {254}	10,623 (2,125) [510] {255}	10,661 (2,132) [512] {256}
Miami-Dade	156,559	156,910	159,059	159,400	160,345 (32,069) [7,697] {3,848}	161,203 (32,241) [7,738] {3,869}	161,981 (32,396) [7,775] {3,888}
Okaloosa	4,134	4,154	4,199	4,245	4,289 (858) [206] {103}	4,332 (866) [208] {104}	4,373 (875) [210] {105}
Orange	35,770	35,902	36,400	36,488	36,773 (7,355) [1,765] {883}	37,048 (7,410) [1,778] {889}	37,315 (7,463) [1,791] {896}
Osceola	11,091	11,134	11,260	11,298	11,372 (2,274) [546] {273}	11,442 (2,288) [549] {275}	11,507 (2,301) [552] {276}
Palm Beach	41,865	41,965	42,387	42,518	42,753 (8,551) [2,052] {1,026}	42,969 (8,594) [2,063] {1,031}	43,168 (8,634) [2,072] {1,036}
Pasco	8,028	8,048	8,135	8,165	8,220 (1,644) [395] {197}	8,273 (1,655) [397] {199}	8,322 (1,664) [399] {200}
Pinellas	19,888	19,929	20,026	20,080	20,182 (4,036) [969] {484}	20,276 (4,055) [973] {487}	20,363 (4,073) [977] {489}
Polk	16,894	17,011	17,159	17,292	17,486 (3,497) [839] {420}	17,675 (3,535) [848] {424}	17,861 (3,572) [857] {429}
Sarasota	7,193	7,207	7,239	7,281	7,326 (1,465) [352] {176}	7,367 (1,473) [354] {177}	7,406 (1,481) [355] {178}
Seminole	8,006	8,029	8,173	8,198	8,263 (1,653) [397] {198}	8,327 (1,665) [400] {200}	8,390 (1,678) [403] {201}
St. Johns	4,321	4,332	4,389	4,413	4,449 (890) [214] {107}	4,484 (897) [215] {108}	4,518 (904) [217] {108}
Sumter	1,848	1,852	1,881	1,914	1,935 (387) [93] {46}	1,955 (391) [94] {47}	1,975 (395) [95] {47}
Volusia	9,244	9,283	9,417	9,483	9,565 (1,913) [459] {230}	9,643 (1,929) [463] {231}	9,717 (1,943) [466] {233}

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.