IEM's AI Modeling: Short-term COVID-19 Projections
Date: 8/24/20

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 8/24/20 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
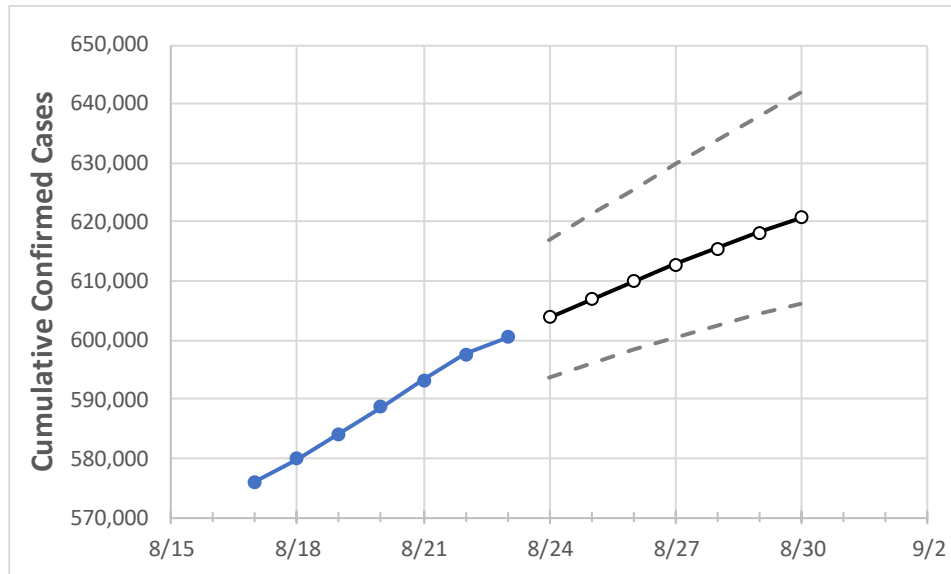
	Actual Confirmed Cases On:				Projected Cases For:						
	8/20	8/21	8/22	8/23	8/24	8/25	8/26	8/27	8/28	8/29	8/30
Florida	588,602	593,286	597,596	600,571	603,806	606,912	609,894	612,757	615,504	618,141	620,672

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:						
	8/20	8/21	8/22	8/23	8/24	8/25	8/26	8/27	8/28	8/29	8/30
Alachua	4,813	4,865	4,919	4,950	4,993	5,035	5,076	5,117	5,157	5,197	5,236
Broward	68,068	68,542	68,891	69,136	69,439	69,729	70,006	70,270	70,522	70,762	70,992
Charlotte	2,435	2,462	2,493	2,519	2,533	2,546	2,559	2,571	2,583	2,595	2,606
Collier	11,095	11,144	11,201	11,245	11,285	11,323	11,360	11,395	11,429	11,462	11,493
Duval	25,117	25,316	25,454	25,558	25,661	25,761	25,858	25,951	26,041	26,127	26,211
Hillsborough	35,061	35,293	35,574	35,721	35,878	36,029	36,176	36,318	36,456	36,588	36,717
Lake	5,852	5,947	6,004	6,046	6,094	6,143	6,191	6,239	6,286	6,334	6,382
Lee	17,730	17,816	17,956	18,009	18,077	18,142	18,205	18,266	18,325	18,382	18,437
Manatee	9,997	10,059	10,123	10,170	10,212	10,252	10,292	10,329	10,366	10,401	10,434
Miami-Dade	149,162	150,305	151,214	151,986	152,816	153,618	154,392	155,138	155,858	156,552	157,222
Okaloosa	3,847	3,878	3,921	3,955	3,978	3,999	4,020	4,041	4,060	4,079	4,098
Orange	34,135	34,321	34,538	34,662	34,809	34,952	35,091	35,227	35,359	35,487	35,611
Osceola	10,551	10,619	10,681	10,732	10,784	10,834	10,882	10,929	10,974	11,018	11,060
Palm Beach	39,886	40,157	40,387	40,570	40,737	40,898	41,053	41,202	41,344	41,482	41,614
Pasco	7,608	7,651	7,693	7,758	7,790	7,822	7,852	7,881	7,909	7,935	7,961
Pinellas	19,087	19,247	19,352	19,431	19,506	19,578	19,647	19,714	19,779	19,841	19,902
Polk	15,887	16,015	16,158	16,251	16,348	16,443	16,534	16,623	16,709	16,793	16,875
Sarasota	6,850	6,905	6,980	7,021	7,058	7,095	7,130	7,164	7,197	7,230	7,261
Seminole	7,641	7,673	7,735	7,756	7,785	7,814	7,841	7,868	7,893	7,918	7,942
St. Johns	4,075	4,106	4,137	4,153	4,174	4,195	4,215	4,234	4,253	4,272	4,289
Sumter	1,628	1,680	1,704	1,717	1,742	1,767	1,794	1,820	1,847	1,875	1,903
Volusia	8,666	8,761	8,867	8,914	8,964	9,013	9,060	9,106	9,150	9,193	9,235

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:		
	8/20	8/21	8/22	8/23	8/25	8/27	8/29
Alachua	4,813	4,865	4,919	4,950	5,035 (1,007) [242] {121}	5,117 (1,023) [246] {123}	5,197 (1,039) [249] {125}
Broward	68,068	68,542	68,891	69,136	69,729 (13,946) [3,347] {1,673}	70,270 (14,054) [3,373] {1,686}	70,762 (14,152) [3,397] {1,698}
Charlotte	2,435	2,462	2,493	2,519	2,546 (509) [122] {61}	2,571 (514) [123] {62}	2,595 (519) [125] {62}
Collier	11,095	11,144	11,201	11,245	11,323 (2,265) [544] {272}	11,395 (2,279) [547] {273}	11,462 (2,292) [550] {275}
Duval	25,117	25,316	25,454	25,558	25,761 (5,152) [1,237] {618}	25,951 (5,190) [1,246] {623}	26,127 (5,225) [1,254] {627}
Hillsborough	35,061	35,293	35,574	35,721	36,029 (7,206) [1,729] {865}	36,318 (7,264) [1,743] {872}	36,588 (7,318) [1,756] {878}
Lake	5,852	5,947	6,004	6,046	6,143 (1,229) [295] {147}	6,239 (1,248) [299] {150}	6,334 (1,267) [304] {152}
Lee	17,730	17,816	17,956	18,009	18,142 (3,628) [871] {435}	18,266 (3,653) [877] {438}	18,382 (3,676) [882] {441}
Manatee	9,997	10,059	10,123	10,170	10,252 (2,050) [492] {246}	10,329 (2,066) [496] {248}	10,401 (2,080) [499] {250}
Miami-Dade	149,162	150,305	151,214	151,986	153,618 (30,724) [7,374] {3,687}	155,138 (31,028) [7,447] {3,723}	156,552 (31,310) [7,515] {3,757}
Okaloosa	3,847	3,878	3,921	3,955	3,999 (800) [192] {96}	4,041 (808) [194] {97}	4,079 (816) [196] {98}
Orange	34,135	34,321	34,538	34,662	34,952 (6,990) [1,678] {839}	35,227 (7,045) [1,691] {845}	35,487 (7,097) [1,703] {852}
Osceola	10,551	10,619	10,681	10,732	10,834 (2,167) [520] {260}	10,929 (2,186) [525] {262}	11,018 (2,204) [529] {264}
Palm Beach	39,886	40,157	40,387	40,570	40,898 (8,180) [1,963] {982}	41,202 (8,240) [1,978] {989}	41,482 (8,296) [1,991] {996}
Pasco	7,608	7,651	7,693	7,758	7,822 (1,564) [375] {188}	7,881 (1,576) [378] {189}	7,935 (1,587) [381] {190}
Pinellas	19,087	19,247	19,352	19,431	19,578 (3,916) [940] {470}	19,714 (3,943) [946] {473}	19,841 (3,968) [952] {476}
Polk	15,887	16,015	16,158	16,251	16,443 (3,289) [789] {395}	16,623 (3,325) [798] {399}	16,793 (3,359) [806] {403}
Sarasota	6,850	6,905	6,980	7,021	7,095 (1,419) [341] {170}	7,164 (1,433) [344] {172}	7,230 (1,446) [347] {174}
Seminole	7,641	7,673	7,735	7,756	7,814 (1,563) [375] {188}	7,868 (1,574) [378] {189}	7,918 (1,584) [380] {190}
St. Johns	4,075	4,106	4,137	4,153	4,195 (839) [201] {101}	4,234 (847) [203] {102}	4,272 (854) [205] {103}
Sumter	1,628	1,680	1,704	1,717	1,767 (353) [85] {42}	1,820 (364) [87] {44}	1,875 (375) [90] {45}
Volusia	8,666	8,761	8,867	8,914	9,013 (1,803) [433] {216}	9,106 (1,821) [437] {219}	9,193 (1,839) [441] {221}

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.