IEM's AI Modeling: Short-term COVID-19 Projections
Date: 12/2/20

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 <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 10%, and are often within 5%, of actual confirmed cases.

The projections shown in this document are based on data pulled in as of 12/2/20 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
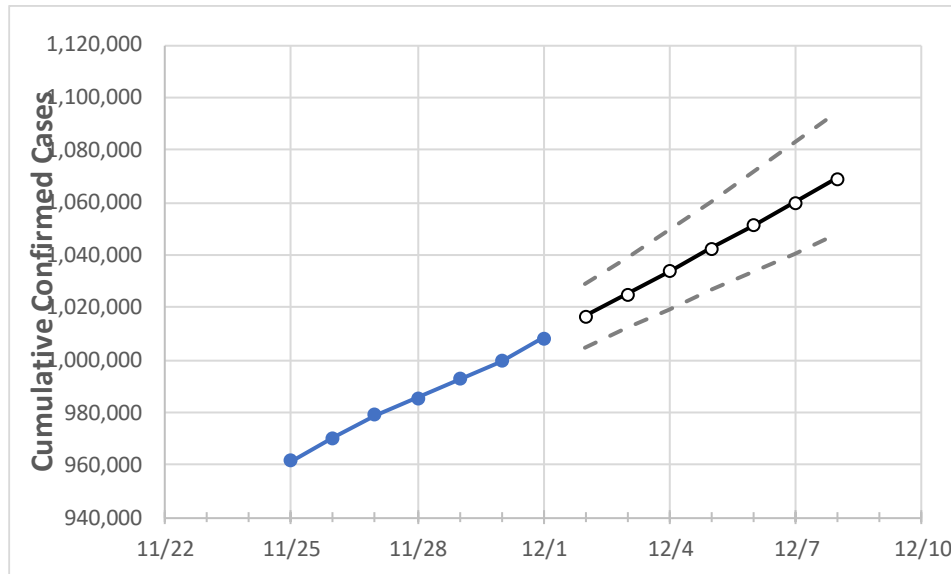
	Actual Confirmed Cases On:				Projected Cases For:							
	11/28	11/29	11/30	12/1	12/2	12/3	12/4	12/5	12/6	12/7	12/8
Florida	985,297	992,660	999,319	1,008,166	1,016,581	1,025,085	1,033,679	1,042,365	1,051,146	1,060,021	1,068,993

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:						
	11/28	11/29	11/30	12/1	12/2	12/3	12/4	12/5	12/6	12/7	12/8
Alachua	12,769	12,813	12,864	12,911	12,975	13,039	13,102	13,165	13,228	13,290	13,352
Broward	105,877	106,698	107,524	108,325	109,198	110,079	110,968	111,866	112,773	113,687	114,610
Charlotte	5,003	5,052	5,087	5,150	5,208	5,266	5,325	5,385	5,445	5,506	5,568
Collier	17,647	17,693	17,757	17,911	18,029	18,147	18,266	18,386	18,506	18,627	18,748
Duval	43,241	43,599	43,978	44,450	44,955	45,483	46,033	46,608	47,208	47,835	48,488
Hillsborough	57,728	58,092	58,293	58,749	59,131	59,517	59,906	60,300	60,698	61,100	61,506
Lake	10,531	10,623	10,671	10,743	10,820	10,899	10,978	11,059	11,141	11,224	11,308
Lee	29,613	29,868	30,113	30,457	30,744	31,035	31,329	31,627	31,930	32,236	32,546
Manatee	16,570	16,703	16,860	17,006	17,169	17,337	17,509	17,685	17,867	18,053	18,244
Miami-Dade	225,632	227,656	229,618	231,761	233,919	236,123	238,373	240,671	243,016	245,411	247,854
Okaloosa	8,793	8,865	8,885	8,993	9,059	9,124	9,189	9,253	9,317	9,381	9,444
Orange	57,321	57,805	58,325	58,862	59,345	59,832	60,325	60,824	61,328	61,837	62,351
Osceola	18,047	18,248	18,354	18,598	18,768	18,940	19,115	19,292	19,472	19,654	19,839
Palm Beach	64,670	65,011	65,372	65,936	66,414	66,892	67,371	67,852	68,333	68,815	69,298
Pasco	14,619	14,783	14,899	15,041	15,208	15,375	15,545	15,715	15,888	16,061	16,236
Pinellas	32,630	32,808	33,058	33,246	33,513	33,780	34,047	34,314	34,582	34,850	35,118
Polk	27,300	27,481	27,611	27,822	27,991	28,162	28,334	28,507	28,682	28,858	29,035
Sarasota	13,453	13,647	13,763	13,917	14,113	14,315	14,524	14,740	14,962	15,192	15,429
Seminole	12,740	12,871	12,940	13,072	13,174	13,276	13,380	13,486	13,592	13,700	13,809
St. Johns	8,649	8,727	8,832	8,931	9,046	9,164	9,287	9,413	9,544	9,680	9,820
Sumter	3,428	3,442	3,467	3,503	3,531	3,559	3,589	3,621	3,653	3,687	3,723
Volusia	16,255	16,358	16,506	16,633	16,808	16,988	17,175	17,368	17,568	17,775	17,989

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:		
	11/28	11/29	11/30	12/1	12/3	12/5	12/7
Alachua	12,769	12,813	12,864	12,911	13,039 (2,608) [626] {313}	13,165 (2,633) [632] {316}	13,290 (2,658) [638] {319}
Broward	105,877	106,698	107,524	108,325	110,079 (22,016) [5,284] {2,642}	111,866 (22,373) [5,370] {2,685}	113,687 (22,737) [5,457] {2,728}
Charlotte	5,003	5,052	5,087	5,150	5,266 (1,053) [253] {126}	5,385 (1,077) [258] {129}	5,506 (1,101) [264] {132}
Collier	17,647	17,693	17,757	17,911	18,147 (3,629) [871] {436}	18,386 (3,677) [883] {441}	18,627 (3,725) [894] {447}
Duval	43,241	43,599	43,978	44,450	45,483 (9,097) [2,183] {1,092}	46,608 (9,322) [2,237] {1,119}	47,835 (9,567) [2,296] {1,148}
Hillsborough	57,728	58,092	58,293	58,749	59,517 (11,903) [2,857] {1,428}	60,300 (12,060) [2,894] {1,447}	61,100 (12,220) [2,933] {1,466}
Lake	10,531	10,623	10,671	10,743	10,899 (2,180) [523] {262}	11,059 (2,212) [531] {265}	11,224 (2,245) [539] {269}
Lee	29,613	29,868	30,113	30,457	31,035 (6,207) [1,490] {745}	31,627 (6,325) [1,518] {759}	32,236 (6,447) [1,547] {774}
Manatee	16,570	16,703	16,860	17,006	17,337 (3,467) [832] {416}	17,685 (3,537) [849] {424}	18,053 (3,611) [867] {433}
Miami-Dade	225,632	227,656	229,618	231,761	236,123 (47,225) [11,334] {5,667}	240,671 (48,134) [11,552] {5,776}	245,411 (49,082) [11,780] {5,890}
Okaloosa	8,793	8,865	8,885	8,993	9,124 (1,825) [438] {219}	9,253 (1,851) [444] {222}	9,381 (1,876) [450] {225}
Orange	57,321	57,805	58,325	58,862	59,832 (11,966) [2,872] {1,436}	60,824 (12,165) [2,920] {1,460}	61,837 (12,367) [2,968] {1,484}
Osceola	18,047	18,248	18,354	18,598	18,940 (3,788) [909] {455}	19,292 (3,858) [926] {463}	19,654 (3,931) [943] {472}
Palm Beach	64,670	65,011	65,372	65,936	66,892 (13,378) [3,211] {1,605}	67,852 (13,570) [3,257] {1,628}	68,815 (13,763) [3,303] {1,652}
Pasco	14,619	14,783	14,899	15,041	15,375 (3,075) [738] {369}	15,715 (3,143) [754] {377}	16,061 (3,212) [771] {385}
Pinellas	32,630	32,808	33,058	33,246	33,780 (6,756) [1,621] {811}	34,314 (6,863) [1,647] {824}	34,850 (6,970) [1,673] {836}
Polk	27,300	27,481	27,611	27,822	28,162 (5,632) [1,352] {676}	28,507 (5,701) [1,368] {684}	28,858 (5,772) [1,385] {693}
Sarasota	13,453	13,647	13,763	13,917	14,315 (2,863) [687] {344}	14,740 (2,948) [708] {354}	15,192 (3,038) [729] {365}
Seminole	12,740	12,871	12,940	13,072	13,276 (2,655) [637] {319}	13,486 (2,697) [647] {324}	13,700 (2,740) [658] {329}
St. Johns	8,649	8,727	8,832	8,931	9,164 (1,833) [440] {220}	9,413 (1,883) [452] {226}	9,680 (1,936) [465] {232}
Sumter	3,428	3,442	3,467	3,503	3,559 (712) [171] {85}	3,621 (724) [174] {87}	3,687 (737) [177] {88}
Volusia	16,255	16,358	16,506	16,633	16,988 (3,398) [815] {408}	17,368 (3,474) [834] {417}	17,775 (3,555) [853] {427}

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.