IEM's AI Modeling: Short-term COVID-19 Projections
Date: 7/24/20

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 7/24/20 11 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
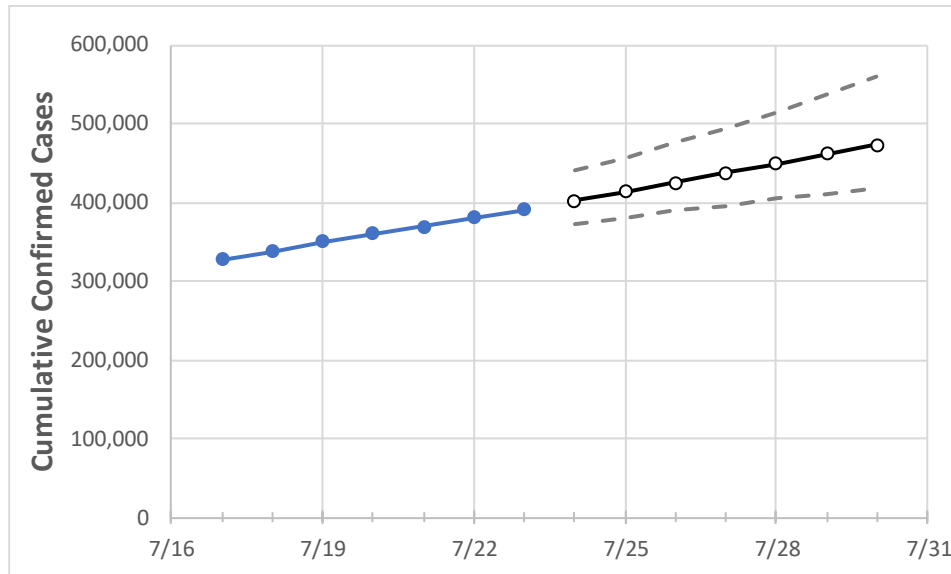
	Actual Confirmed Cases On:				Projected Cases For:						
	7/20	7/21	7/22	7/23	7/24	7/25	7/26	7/27	7/28	7/29	7/30
Florida	360,394	369,834	380,193	390,420	401,876	413,475	425,213	437,089	449,102	461,252	473,536

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:						
	7/20	7/21	7/22	7/23	7/24	7/25	7/26	7/27	7/28	7/29	7/30
Alachua	2,683	2,737	2,809	2,890	2,963	3,038	3,114	3,191	3,270	3,350	3,431
Broward	40,976	42,577	43,747	45,010	46,474	47,971	49,504	51,071	52,674	54,314	55,991
Charlotte	1,470	1,500	1,536	1,560	1,601	1,644	1,688	1,733	1,780	1,828	1,878
Collier	7,934	8,076	8,249	8,401	8,591	8,782	8,977	9,174	9,373	9,575	9,779
Duval	17,245	17,544	17,979	18,357	18,824	19,292	19,763	20,235	20,709	21,185	21,662
Hillsborough	24,135	24,550	24,891	25,432	25,884	26,328	26,763	27,190	27,609	28,020	28,423
Lake	3,391	3,473	3,594	3,757	3,872	3,989	4,109	4,231	4,357	4,484	4,615
Lee	12,906	13,125	13,395	13,768	14,094	14,424	14,759	15,099	15,442	15,790	16,143
Manatee	6,738	6,871	7,078	7,252	7,460	7,673	7,892	8,116	8,346	8,581	8,823
Miami-Dade	87,035	89,557	92,345	95,068	98,041	101,085	104,201	107,389	110,651	113,988	117,401
Okaloosa	1,973	2,062	2,104	2,134	2,209	2,286	2,365	2,447	2,532	2,619	2,710
Orange	23,584	24,011	24,700	25,254	25,859	26,471	27,090	27,717	28,351	28,992	29,642
Osceola	6,268	6,479	6,687	6,844	7,101	7,366	7,641	7,926	8,221	8,526	8,842
Palm Beach	26,426	26,951	27,506	28,267	28,952	29,650	30,361	31,086	31,825	32,579	33,347
Pasco	5,050	5,161	5,260	5,363	5,484	5,605	5,726	5,847	5,967	6,087	6,207
Pinellas	13,705	13,925	14,191	14,371	14,619	14,863	15,104	15,341	15,574	15,804	16,031
Polk	9,877	10,072	10,309	10,545	10,825	11,107	11,392	11,680	11,971	12,264	12,560
Sarasota	4,338	4,432	4,567	4,644	4,783	4,926	5,071	5,219	5,371	5,526	5,684
Seminole	5,411	5,519	5,633	5,736	5,852	5,969	6,086	6,202	6,319	6,436	6,552
St. Johns	2,541	2,612	2,670	2,708	2,779	2,852	2,925	3,000	3,075	3,152	3,230
Sumter	843	859	941	941	970	1,001	1,034	1,069	1,105	1,143	1,183
Volusia	5,297	5,530	5,657	5,803	5,995	6,194	6,398	6,609	6,826	7,050	7,281

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:		
	7/20	7/21	7/22	7/23	7/25	7/27	7/29
Alachua	2,683	2,737	2,809	2,890	3,038 (608) [146] {73}	3,191 (638) [153] {77}	3,350 (670) [161] {80}
Broward	40,976	42,577	43,747	45,010	47,971 (9,594) [2,303] {1,151}	51,071 (10,214) [2,451] {1,226}	54,314 (10,863) [2,607] {1,304}
Charlotte	1,470	1,500	1,536	1,560	1,644 (329) [79] {39}	1,733 (347) [83] {42}	1,828 (366) [88] {44}
Collier	7,934	8,076	8,249	8,401	8,782 (1,756) [422] {211}	9,174 (1,835) [440] {220}	9,575 (1,915) [460] {230}
Duval	17,245	17,544	17,979	18,357	19,292 (3,858) [926] {463}	20,235 (4,047) [971] {486}	21,185 (4,237) [1,017] {508}
Hillsborough	24,135	24,550	24,891	25,432	26,328 (5,266) [1,264] {632}	27,190 (5,438) [1,305] {653}	28,020 (5,604) [1,345] {672}
Lake	3,391	3,473	3,594	3,757	3,989 (798) [191] {96}	4,231 (846) [203] {102}	4,484 (897) [215] {108}
Lee	12,906	13,125	13,395	13,768	14,424 (2,885) [692] {346}	15,099 (3,020) [725] {362}	15,790 (3,158) [758] {379}
Manatee	6,738	6,871	7,078	7,252	7,673 (1,535) [368] {184}	8,116 (1,623) [390] {195}	8,581 (1,716) [412] {206}
Miami-Dade	87,035	89,557	92,345	95,068	101,085 (20,217) [4,852] {2,426}	107,389 (21,478) [5,155] {2,577}	113,988 (22,798) [5,471] {2,736}
Okaloosa	1,973	2,062	2,104	2,134	2,286 (457) [110] {55}	2,447 (489) [117] {59}	2,619 (524) [126] {63}
Orange	23,584	24,011	24,700	25,254	26,471 (5,294) [1,271] {635}	27,717 (5,543) [1,330] {665}	28,992 (5,798) [1,392] {696}
Osceola	6,268	6,479	6,687	6,844	7,366 (1,473) [354] {177}	7,926 (1,585) [380] {190}	8,526 (1,705) [409] {205}
Palm Beach	26,426	26,951	27,506	28,267	29,650 (5,930) [1,423] {712}	31,086 (6,217) [1,492] {746}	32,579 (6,516) [1,564] {782}
Pasco	5,050	5,161	5,260	5,363	5,605 (1,121) [269] {135}	5,847 (1,169) [281] {140}	6,087 (1,217) [292] {146}
Pinellas	13,705	13,925	14,191	14,371	14,863 (2,973) [713] {357}	15,341 (3,068) [736] {368}	15,804 (3,161) [759] {379}
Polk	9,877	10,072	10,309	10,545	11,107 (2,221) [533] {267}	11,680 (2,336) [561] {280}	12,264 (2,453) [589] {294}
Sarasota	4,338	4,432	4,567	4,644	4,926 (985) [236] {118}	5,219 (1,044) [251] {125}	5,526 (1,105) [265] {133}
Seminole	5,411	5,519	5,633	5,736	5,969 (1,194) [287] {143}	6,202 (1,240) [298] {149}	6,436 (1,287) [309] {154}
St. Johns	2,541	2,612	2,670	2,708	2,852 (570) [137] {68}	3,000 (600) [144] {72}	3,152 (630) [151] {76}
Sumter	843	859	941	941	1,001 (200) [48] {24}	1,069 (214) [51] {26}	1,143 (229) [55] {27}
Volusia	5,297	5,530	5,657	5,803	6,194 (1,239) [297] {149}	6,609 (1,322) [317] {159}	7,050 (1,410) [338] {169}

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.