IEM's AI Modeling: Short-term COVID-19 Projections
Date: 10/26/20

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 10/26/20 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
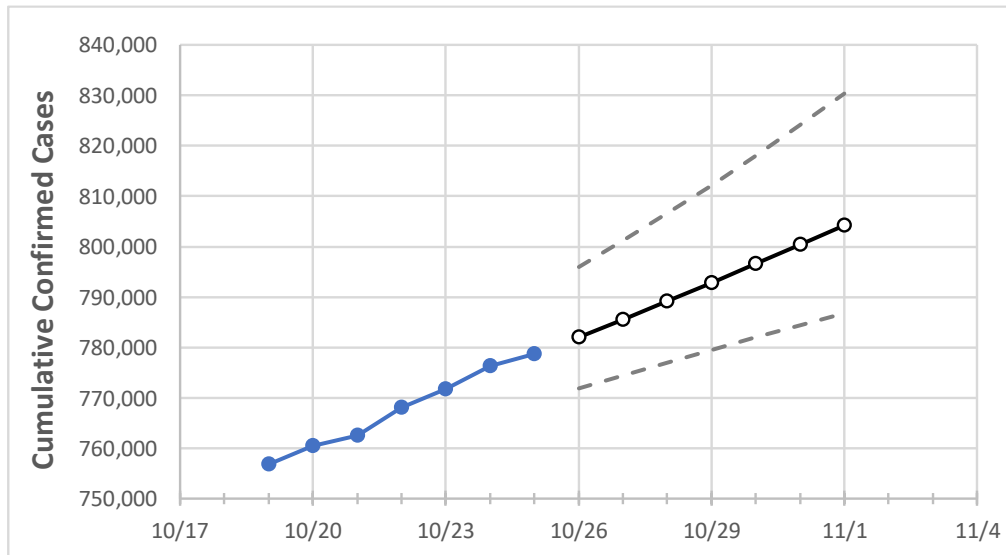
Cumulative Confirmed Cases

	Actual Confirmed Cases On:				Projected Cases For:						
	10/22	10/23	10/24	10/25	10/26	10/27	10/28	10/29	10/30	10/31	11/1
Florida	768,091	771,780	776,251	778,636	782,064	785,566	789,143	792,798	796,532	800,346	804,242

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:						
	10/22	10/23	10/24	10/25	10/26	10/27	10/28	10/29	10/30	10/31	11/1
Alachua	9,807	9,895	9,989	10,044	10,122	10,202	10,282	10,364	10,448	10,532	10,618
Broward	82,250	82,706	83,165	83,450	83,821	84,209	84,614	85,038	85,480	85,943	86,427
Charlotte	3,440	3,463	3,487	3,509	3,528	3,549	3,569	3,591	3,613	3,636	3,659
Collier	13,864	13,927	14,025	14,087	14,159	14,235	14,313	14,394	14,477	14,564	14,655
Duval	33,676	33,946	34,177	34,260	34,419	34,581	34,746	34,915	35,086	35,262	35,440
Hillsborough	46,300	46,518	46,790	46,907	47,108	47,311	47,518	47,727	47,939	48,155	48,374
Lake	8,336	8,387	8,415	8,445	8,485	8,526	8,568	8,611	8,654	8,698	8,742
Lee	22,341	22,480	22,619	22,711	22,832	22,959	23,089	23,225	23,366	23,512	23,664
Manatee	12,761	12,842	12,930	12,971	13,033	13,097	13,161	13,228	13,295	13,364	13,435
Miami-Dade	180,497	181,017	181,633	181,942	182,484	183,037	183,601	184,177	184,764	185,362	185,973
Okaloosa	5,977	6,032	6,098	6,146	6,208	6,272	6,339	6,408	6,480	6,555	6,632
Orange	44,435	44,605	44,921	45,042	45,278	45,519	45,767	46,020	46,280	46,545	46,818
Osceola	13,703	13,778	13,852	13,905	13,967	14,030	14,094	14,160	14,227	14,295	14,364
Palm Beach	49,759	49,988	50,316	50,525	50,711	50,903	51,100	51,304	51,513	51,729	51,951
Pasco	10,406	10,465	10,539	10,600	10,655	10,711	10,768	10,826	10,884	10,943	11,003
Pinellas	24,650	24,789	24,986	25,130	25,299	25,475	25,659	25,850	26,049	26,257	26,473
Polk	22,256	22,332	22,481	22,541	22,640	22,740	22,841	22,943	23,046	23,150	23,256
Sarasota	9,235	9,280	9,340	9,392	9,455	9,520	9,587	9,655	9,725	9,797	9,871
Seminole	9,894	9,928	10,009	10,044	10,090	10,136	10,184	10,233	10,284	10,335	10,388
St. Johns	6,150	6,193	6,236	6,280	6,327	6,375	6,425	6,476	6,528	6,582	6,638
Sumter	2,802	2,826	2,844	2,849	2,862	2,876	2,889	2,903	2,917	2,930	2,944
Volusia	12,180	12,288	12,399	12,453	12,530	12,609	12,691	12,774	12,860	12,949	13,040

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:		
	10/22	10/23	10/24	10/25	10/27	10/29	10/31
Alachua	9,807	9,895	9,989	10,044	10,202 (2,040) [490] {245}	10,364 (2,073) [497] {249}	10,532 (2,106) [506] {253}
Broward	82,250	82,706	83,165	83,450	84,209 (16,842) [4,042] {2,021}	85,038 (17,008) [4,082] {2,041}	85,943 (17,189) [4,125] {2,063}
Charlotte	3,440	3,463	3,487	3,509	3,549 (710) [170] {85}	3,591 (718) [172] {86}	3,636 (727) [175] {87}
Collier	13,864	13,927	14,025	14,087	14,235 (2,847) [683] {342}	14,394 (2,879) [691] {345}	14,564 (2,913) [699] {350}
Duval	33,676	33,946	34,177	34,260	34,581 (6,916) [1,660] {830}	34,915 (6,983) [1,676] {838}	35,262 (7,052) [1,693] {846}
Hillsborough	46,300	46,518	46,790	46,907	47,311 (9,462) [2,271] {1,135}	47,727 (9,545) [2,291] {1,145}	48,155 (9,631) [2,311] {1,156}
Lake	8,336	8,387	8,415	8,445	8,526 (1,705) [409] {205}	8,611 (1,722) [413] {207}	8,698 (1,740) [417] {209}
Lee	22,341	22,480	22,619	22,711	22,959 (4,592) [1,102] {551}	23,225 (4,645) [1,115] {557}	23,512 (4,702) [1,129] {564}
Manatee	12,761	12,842	12,930	12,971	13,097 (2,619) [629] {314}	13,228 (2,646) [635] {317}	13,364 (2,673) [641] {321}
Miami-Dade	180,497	181,017	181,633	181,942	183,037 (36,607) [8,786] {4,393}	184,177 (36,835) [8,840] {4,420}	185,362 (37,072) [8,897] {4,449}
Okaloosa	5,977	6,032	6,098	6,146	6,272 (1,254) [301] {151}	6,408 (1,282) [308] {154}	6,555 (1,311) [315] {157}
Orange	44,435	44,605	44,921	45,042	45,519 (9,104) [2,185] {1,092}	46,020 (9,204) [2,209] {1,104}	46,545 (9,309) [2,234] {1,117}
Osceola	13,703	13,778	13,852	13,905	14,030 (2,806) [673] {337}	14,160 (2,832) [680] {340}	14,295 (2,859) [686] {343}
Palm Beach	49,759	49,988	50,316	50,525	50,903 (10,181) [2,443] {1,222}	51,304 (10,261) [2,463] {1,231}	51,729 (10,346) [2,483] {1,241}
Pasco	10,406	10,465	10,539	10,600	10,711 (2,142) [514] {257}	10,826 (2,165) [520] {260}	10,943 (2,189) [525] {263}
Pinellas	24,650	24,789	24,986	25,130	25,475 (5,095) [1,223] {611}	25,850 (5,170) [1,241] {620}	26,257 (5,251) [1,260] {630}
Polk	22,256	22,332	22,481	22,541	22,740 (4,548) [1,092] {546}	22,943 (4,589) [1,101] {551}	23,150 (4,630) [1,111] {556}
Sarasota	9,235	9,280	9,340	9,392	9,520 (1,904) [457] {228}	9,655 (1,931) [463] {232}	9,797 (1,959) [470] {235}
Seminole	9,894	9,928	10,009	10,044	10,136 (2,027) [487] {243}	10,233 (2,047) [491] {246}	10,335 (2,067) [496] {248}
St. Johns	6,150	6,193	6,236	6,280	6,375 (1,275) [306] {153}	6,476 (1,295) [311] {155}	6,582 (1,316) [316] {158}
Sumter	2,802	2,826	2,844	2,849	2,876 (575) [138] {69}	2,903 (581) [139] {70}	2,930 (586) [141] {70}
Volusia	12,180	12,288	12,399	12,453	12,609 (2,522) [605] {303}	12,774 (2,555) [613] {307}	12,949 (2,590) [622] {311}

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.