IEM's AI Modeling: Short-term COVID-19 Projections
Date: 4/28/21

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 4/28/21 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
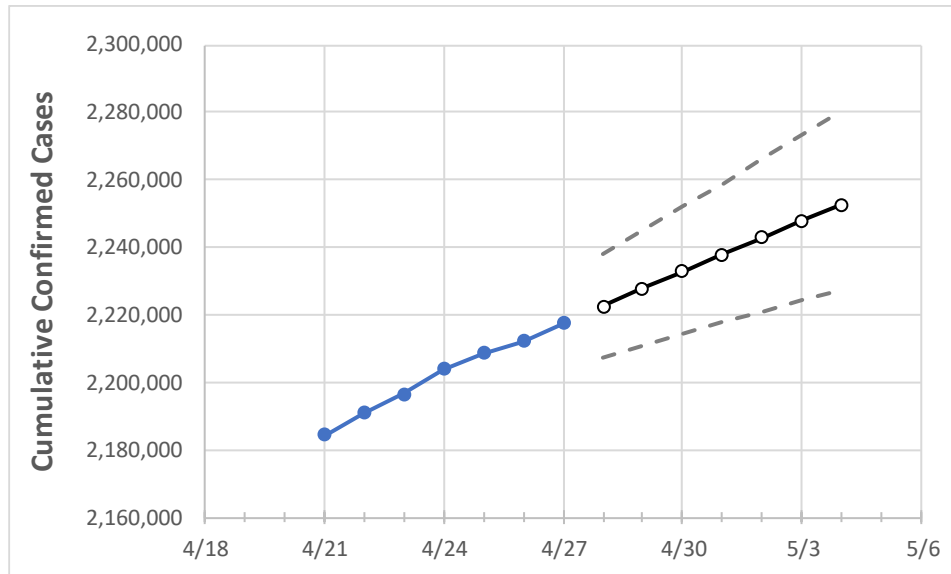
	Actual Confirmed Cases On:				Projected Cases For:						
	4/24	4/25	4/26	4/27	4/28	4/29	4/30	5/1	5/2	5/3	5/4
Florida	2,203,913	2,208,584	2,212,097	2,217,368	2,222,563	2,227,760	2,232,916	2,237,951	2,243,031	2,248,013	2,252,801

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

Florida Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	4/24	4/25	4/26	4/27	4/28	4/29	4/30	5/1	5/2	5/3	5/4
Alachua	24,441	24,466	24,482	24,518	24,559	24,599	24,640	24,679	24,721	24,763	24,804
Broward	232,598	233,165	233,624	234,243	234,848	235,440	236,015	236,601	237,189	237,772	238,322
Charlotte	12,536	12,564	12,587	12,624	12,654	12,683	12,712	12,740	12,768	12,796	12,822
Collier	34,821	34,898	34,948	35,037	35,112	35,187	35,259	35,332	35,404	35,473	35,541
Duval	96,340	96,470	96,587	96,749	96,912	97,076	97,241	97,402	97,569	97,735	97,900
Hillsborough	132,836	133,160	133,429	133,855	134,269	134,687	135,108	135,532	135,937	136,330	136,744
Lake	28,814	28,892	28,949	29,027	29,100	29,171	29,242	29,310	29,378	29,444	29,509
Lee	67,920	68,186	68,360	68,621	68,864	69,111	69,358	69,609	69,856	70,109	70,355
Manatee	37,553	37,641	37,699	37,798	37,894	37,989	38,082	38,176	38,271	38,362	38,452
Miami-Dade	477,782	478,660	479,426	480,483	481,524	482,547	483,577	484,560	485,535	486,466	487,393
Okaloosa	20,285	20,298	20,305	20,327	20,345	20,363	20,379	20,398	20,414	20,430	20,444
Orange	134,169	134,552	134,777	135,128	135,491	135,847	136,205	136,545	136,885	137,216	137,545
Osceola	43,243	43,380	43,483	43,628	43,771	43,912	44,051	44,189	44,327	44,462	44,596
Palm Beach	141,250	141,558	141,747	142,053	142,396	142,739	143,081	143,416	143,751	144,081	144,410
Pasco	39,990	40,085	40,168	40,308	40,446	40,583	40,719	40,853	40,983	41,119	41,251
Pinellas	77,813	77,954	78,084	78,241	78,407	78,572	78,731	78,887	79,042	79,192	79,337
Polk	66,312	66,558	66,692	66,922	67,153	67,384	67,614	67,847	68,082	68,323	68,559
Sarasota	31,971	32,048	32,115	32,191	32,280	32,369	32,454	32,536	32,618	32,700	32,779
Seminole	33,102	33,183	33,255	33,365	33,480	33,595	33,707	33,816	33,924	34,029	34,135
St. Johns	22,204	22,237	22,254	22,294	22,331	22,368	22,406	22,442	22,478	22,515	22,549
Sumter	9,196	9,205	9,208	9,220	9,232	9,244	9,256	9,267	9,278	9,290	9,300
Volusia	42,114	42,214	42,292	42,377	42,486	42,590	42,692	42,790	42,883	42,975	43,064

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:		
	4/24	4/25	4/26	4/27	4/29	5/1	5/3
Alachua	24,441	24,466	24,482	24,518	24,599 (4,920) [1,181] {590}	24,679 (4,936) [1,185] {592}	24,763 (4,953) [1,189] {594}
Broward	232,598	233,165	233,624	234,243	235,440 (47,088) [11,301] {5,651}	236,601 (47,320) [11,357] {5,678}	237,772 (47,554) [11,413] {5,707}
Charlotte	12,536	12,564	12,587	12,624	12,683 (2,537) [609] {304}	12,740 (2,548) [612] {306}	12,796 (2,559) [614] {307}
Collier	34,821	34,898	34,948	35,037	35,187 (7,037) [1,689] {844}	35,332 (7,066) [1,696] {848}	35,473 (7,095) [1,703] {851}
Duval	96,340	96,470	96,587	96,749	97,076 (19,415) [4,660] {2,330}	97,402 (19,480) [4,675] {2,338}	97,735 (19,547) [4,691] {2,346}
Hillsborough	132,836	133,160	133,429	133,855	134,687 (26,937) [6,465] {3,232}	135,532 (27,106) [6,506] {3,253}	136,330 (27,266) [6,544] {3,272}
Lake	28,814	28,892	28,949	29,027	29,171 (5,834) [1,400] {700}	29,310 (5,862) [1,407] {703}	29,444 (5,889) [1,413] {707}
Lee	67,920	68,186	68,360	68,621	69,111 (13,822) [3,317] {1,659}	69,609 (13,922) [3,341] {1,671}	70,109 (14,022) [3,365] {1,683}
Manatee	37,553	37,641	37,699	37,798	37,989 (7,598) [1,823] {912}	38,176 (7,635) [1,832] {916}	38,362 (7,672) [1,841] {921}
Miami-Dade	477,782	478,660	479,426	480,483	482,547 (96,509) [23,162] {11,581}	484,560 (96,912) [23,259] {11,629}	486,466 (97,293) [23,350] {11,675}
Okaloosa	20,285	20,298	20,305	20,327	20,363 (4,073) [977] {489}	20,398 (4,080) [979] {490}	20,430 (4,086) [981] {490}
Orange	134,169	134,552	134,777	135,128	135,847 (27,169) [6,521] {3,260}	136,545 (27,309) [6,554] {3,277}	137,216 (27,443) [6,586] {3,293}
Osceola	43,243	43,380	43,483	43,628	43,912 (8,782) [2,108] {1,054}	44,189 (8,838) [2,121] {1,061}	44,462 (8,892) [2,134] {1,067}
Palm Beach	141,250	141,558	141,747	142,053	142,739 (28,548) [6,851] {3,426}	143,416 (28,683) [6,884] {3,442}	144,081 (28,816) [6,916] {3,458}
Pasco	39,990	40,085	40,168	40,308	40,583 (8,117) [1,948] {974}	40,853 (8,171) [1,961] {980}	41,119 (8,224) [1,974] {987}
Pinellas	77,813	77,954	78,084	78,241	78,572 (15,714) [3,771] {1,886}	78,887 (15,777) [3,787] {1,893}	79,192 (15,838) [3,801] {1,901}
Polk	66,312	66,558	66,692	66,922	67,384 (13,477) [3,234] {1,617}	67,847 (13,569) [3,257] {1,628}	68,323 (13,665) [3,280] {1,640}
Sarasota	31,971	32,048	32,115	32,191	32,369 (6,474) [1,554] {777}	32,536 (6,507) [1,562] {781}	32,700 (6,540) [1,570] {785}
Seminole	33,102	33,183	33,255	33,365	33,595 (6,719) [1,613] {806}	33,816 (6,763) [1,623] {812}	34,029 (6,806) [1,633] {817}
St. Johns	22,204	22,237	22,254	22,294	22,368 (4,474) [1,074] {537}	22,442 (4,488) [1,077] {539}	22,515 (4,503) [1,081] {540}
Sumter	9,196	9,205	9,208	9,220	9,244 (1,849) [444] {222}	9,267 (1,853) [445] {222}	9,290 (1,858) [446] {223}
Volusia	42,114	42,214	42,292	42,377	42,590 (8,518) [2,044] {1,022}	42,790 (8,558) [2,054] {1,027}	42,975 (8,595) [2,063] {1,031}

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.