IEM's AI Modeling: Short-term COVID-19 Projections
Date: 4/30/21

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 4/30/21 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
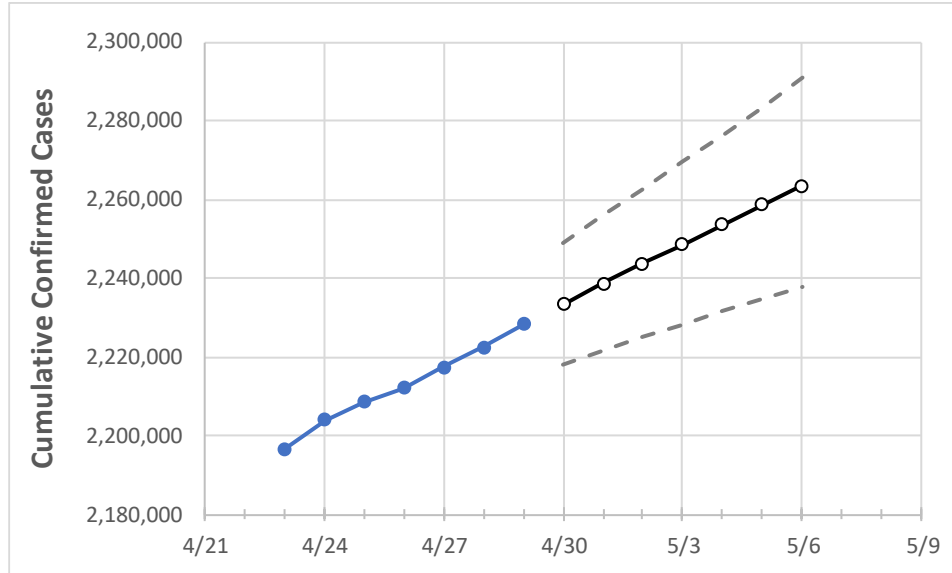
	Actual Confirmed Cases On:				Projected Cases For:						
	4/26	4/27	4/28	4/29	4/30	5/1	5/2	5/3	5/4	5/5	5/6
Florida	2,212,097	2,217,368	2,222,546	2,228,212	2,233,394	2,238,529	2,243,632	2,248,645	2,253,613	2,258,699	2,263,520

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:						
	4/26	4/27	4/28	4/29	4/30	5/1	5/2	5/3	5/4	5/5	5/6
Alachua	24,482	24,518	24,564	24,607	24,648	24,689	24,731	24,771	24,812	24,852	24,895
Broward	233,624	234,243	234,699	235,335	235,906	236,471	237,034	237,562	238,103	238,623	239,137
Charlotte	12,587	12,624	12,658	12,691	12,721	12,751	12,780	12,810	12,839	12,867	12,894
Collier	34,948	35,037	35,128	35,229	35,306	35,382	35,460	35,534	35,608	35,684	35,756
Duval	96,587	96,749	96,927	97,106	97,275	97,442	97,612	97,784	97,952	98,118	98,297
Hillsborough	133,429	133,855	134,284	134,761	135,187	135,611	136,035	136,469	136,897	137,308	137,736
Lake	28,949	29,027	29,140	29,228	29,308	29,388	29,468	29,546	29,623	29,701	29,777
Lee	68,360	68,621	68,885	69,161	69,413	69,665	69,919	70,176	70,439	70,701	70,961
Manatee	37,699	37,798	37,900	38,028	38,119	38,210	38,302	38,394	38,488	38,579	38,665
Miami-Dade	479,426	480,483	481,397	482,443	483,410	484,348	485,265	486,148	487,011	487,884	488,717
Okaloosa	20,305	20,327	20,355	20,391	20,412	20,434	20,455	20,475	20,497	20,517	20,538
Orange	134,777	135,128	135,544	135,932	136,298	136,665	137,021	137,380	137,745	138,097	138,443
Osceola	43,483	43,628	43,772	43,924	44,066	44,210	44,348	44,485	44,622	44,760	44,896
Palm Beach	141,747	142,053	142,456	142,829	143,180	143,534	143,878	144,220	144,575	144,917	145,252
Pasco	40,168	40,308	40,434	40,556	40,689	40,823	40,952	41,082	41,209	41,333	41,460
Pinellas	78,084	78,241	78,420	78,647	78,818	78,984	79,146	79,303	79,457	79,609	79,761
Polk	66,692	66,922	67,107	67,355	67,580	67,806	68,031	68,257	68,487	68,710	68,936
Sarasota	32,115	32,191	32,273	32,343	32,425	32,508	32,589	32,668	32,744	32,819	32,893
Seminole	33,255	33,365	33,457	33,583	33,691	33,798	33,901	34,007	34,107	34,207	34,306
St. Johns	22,254	22,294	22,323	22,357	22,391	22,426	22,460	22,492	22,525	22,557	22,588
Sumter	9,208	9,220	9,234	9,249	9,261	9,273	9,285	9,297	9,309	9,320	9,332
Volusia	42,292	42,377	42,503	42,617	42,722	42,827	42,927	43,024	43,120	43,212	43,301

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:		
	4/26	4/27	4/28	4/29	5/1	5/3	5/5
Alachua	24,482	24,518	24,564	24,607	24,689 (4,938) [1,185] {593}	24,771 (4,954) [1,189] {595}	24,852 (4,970) [1,193] {596}
Broward	233,624	234,243	234,699	235,335	236,471 (47,294) [11,351] {5,675}	237,562 (47,512) [11,403] {5,701}	238,623 (47,725) [11,454] {5,727}
Charlotte	12,587	12,624	12,658	12,691	12,751 (2,550) [612] {306}	12,810 (2,562) [615] {307}	12,867 (2,573) [618] {309}
Collier	34,948	35,037	35,128	35,229	35,382 (7,076) [1,698] {849}	35,534 (7,107) [1,706] {853}	35,684 (7,137) [1,713] {856}
Duval	96,587	96,749	96,927	97,106	97,442 (19,488) [4,677] {2,339}	97,784 (19,557) [4,694] {2,347}	98,118 (19,624) [4,710] {2,355}
Hillsborough	133,429	133,855	134,284	134,761	135,611 (27,122) [6,509] {3,255}	136,469 (27,294) [6,551] {3,275}	137,308 (27,462) [6,591] {3,295}
Lake	28,949	29,027	29,140	29,228	29,388 (5,878) [1,411] {705}	29,546 (5,909) [1,418] {709}	29,701 (5,940) [1,426] {713}
Lee	68,360	68,621	68,885	69,161	69,665 (13,933) [3,344] {1,672}	70,176 (14,035) [3,368] {1,684}	70,701 (14,140) [3,394] {1,697}
Manatee	37,699	37,798	37,900	38,028	38,210 (7,642) [1,834] {917}	38,394 (7,679) [1,843] {921}	38,579 (7,716) [1,852] {926}
Miami-Dade	479,426	480,483	481,397	482,443	484,348 (96,870) [23,249] {11,624}	486,148 (97,230) [23,335] {11,668}	487,884 (97,577) [23,418] {11,709}
Okaloosa	20,305	20,327	20,355	20,391	20,434 (4,087) [981] {490}	20,475 (4,095) [983] {491}	20,517 (4,103) [985] {492}
Orange	134,777	135,128	135,544	135,932	136,665 (27,333) [6,560] {3,280}	137,380 (27,476) [6,594] {3,297}	138,097 (27,619) [6,629] {3,314}
Osceola	43,483	43,628	43,772	43,924	44,210 (8,842) [2,122] {1,061}	44,485 (8,897) [2,135] {1,068}	44,760 (8,952) [2,148] {1,074}
Palm Beach	141,747	142,053	142,456	142,829	143,534 (28,707) [6,890] {3,445}	144,220 (28,844) [6,923] {3,461}	144,917 (28,983) [6,956] {3,478}
Pasco	40,168	40,308	40,434	40,556	40,823 (8,165) [1,959] {980}	41,082 (8,216) [1,972] {986}	41,333 (8,267) [1,984] {992}
Pinellas	78,084	78,241	78,420	78,647	78,984 (15,797) [3,791] {1,896}	79,303 (15,861) [3,807] {1,903}	79,609 (15,922) [3,821] {1,911}
Polk	66,692	66,922	67,107	67,355	67,806 (13,561) [3,255] {1,627}	68,257 (13,651) [3,276] {1,638}	68,710 (13,742) [3,298] {1,649}
Sarasota	32,115	32,191	32,273	32,343	32,508 (6,502) [1,560] {780}	32,668 (6,534) [1,568] {784}	32,819 (6,564) [1,575] {788}
Seminole	33,255	33,365	33,457	33,583	33,798 (6,760) [1,622] {811}	34,007 (6,801) [1,632] {816}	34,207 (6,841) [1,642] {821}
St. Johns	22,254	22,294	22,323	22,357	22,426 (4,485) [1,076] {538}	22,492 (4,498) [1,080] {540}	22,557 (4,511) [1,083] {541}
Sumter	9,208	9,220	9,234	9,249	9,273 (1,855) [445] {223}	9,297 (1,859) [446] {223}	9,320 (1,864) [447] {224}
Volusia	42,292	42,377	42,503	42,617	42,827 (8,565) [2,056] {1,028}	43,024 (8,605) [2,065] {1,033}	43,212 (8,642) [2,074] {1,037}

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.