IEM's AI Modeling: Short-term COVID-19 Projections

Date: 5/25/21

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 not 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 5/25/21 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.

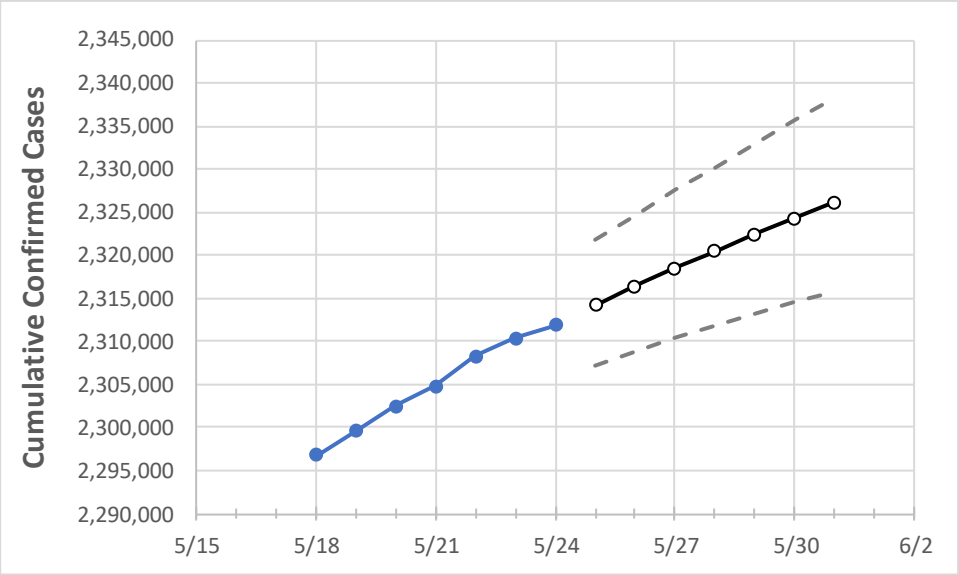
IEM's Modeling Lead

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:						
	5/21	5/22	5/23	5/24	5/25	5/26	5/27	5/28	5/29	5/30	5/31
Florida	2,304,860	2,308,266	2,310,335	2,311,941	2,314,196	2,316,365	2,318,475	2,320,517	2,322,467	2,324,356	2,326,213

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:						
	5/21	5/22	5/23	5/24	5/25	5/26	5/27	5/28	5/29	5/30	5/31
Alachua	25,231	25,264	25,286	25,304	25,329	25,353	25,377	25,402	25,426	25,450	25,474
Broward	243,045	243,396	243,625	243,788	243,976	244,160	244,337	244,506	244,665	244,819	244,965
Charlotte	13,237	13,265	13,278	13,289	13,309	13,328	13,347	13,365	13,383	13,402	13,420
Collier	36,715	36,761	36,805	36,842	36,889	36,934	36,979	37,024	37,067	37,109	37,153
Duval	99,827	99,961	100,050	100,131	100,223	100,312	100,401	100,485	100,570	100,655	100,735
Hillsborough	141,330	141,599	141,736	141,833	142,037	142,235	142,428	142,614	142,800	142,979	143,156
Lake	30,622	30,676	30,726	30,759	30,814	30,869	30,923	30,977	31,028	31,080	31,132
Lee	72,854	72,973	73,083	73,148	73,258	73,365	73,469	73,569	73,665	73,758	73,851
Manatee	39,514	39,570	39,606	39,626	39,665	39,703	39,740	39,775	39,812	39,844	39,876
Miami-Dade	497,371	498,094	498,557	498,953	499,408	499,855	500,283	500,705	501,113	501,514	501,903
Okaloosa	20,772	20,789	20,805	20,814	20,826	20,838	20,850	20,862	20,874	20,885	20,896
Orange	141,375	141,618	141,737	141,856	142,003	142,147	142,283	142,419	142,550	142,677	142,798
Osceola	45,663	45,733	45,781	45,808	45,849	45,888	45,927	45,965	45,999	46,032	46,064
Palm Beach	147,408	147,609	147,733	147,786	147,909	148,030	148,147	148,262	148,372	148,477	148,583
Pasco	42,391	42,452	42,506	42,542	42,587	42,631	42,672	42,712	42,751	42,788	42,823
Pinellas	80,898	80,986	81,042	81,077	81,139	81,197	81,253	81,307	81,361	81,409	81,457
Polk	70,301	70,419	70,483	70,544	70,617	70,690	70,757	70,822	70,885	70,943	71,001
Sarasota	33,395	33,428	33,459	33,483	33,512	33,540	33,566	33,592	33,617	33,642	33,666
Seminole	34,927	35,000	35,023	35,056	35,100	35,142	35,184	35,224	35,264	35,303	35,341
St. Johns	23,068	23,106	23,127	23,144	23,170	23,196	23,223	23,249	23,274	23,301	23,327
Sumter	9,431	9,439	9,450	9,456	9,463	9,470	9,476	9,483	9,490	9,496	9,503
Volusia	44,378	44,440	44,479	44,511	44,568	44,625	44,679	44,734	44,786	44,835	44,888

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:		
	5/21	5/22	5/23	5/24	5/26	5/28	5/30
Alachua	25,231	25,264	25,286	25,304	25,353 (5,071) [1,217] {608}	25,402 (5,080) [1,219] {610}	25,450 (5,090) [1,222] {611}
Broward	243,045	243,396	243,625	243,788	244,160 (48,832) [11,720] {5,860}	244,506 (48,901) [11,736] {5,868}	244,819 (48,964) [11,751] {5,876}
Charlotte	13,237	13,265	13,278	13,289	13,328 (2,666) [640] {320}	13,365 (2,673) [642] {321}	13,402 (2,680) [643] {322}
Collier	36,715	36,761	36,805	36,842	36,934 (7,387) [1,773] {886}	37,024 (7,405) [1,777] {889}	37,109 (7,422) [1,781] {891}
Duval	99,827	99,961	100,050	100,131	100,312 (20,062) [4,815] {2,407}	100,485 (20,097) [4,823] {2,412}	100,655 (20,131) [4,831] {2,416}
Hillsborough	141,330	141,599	141,736	141,833	142,235 (28,447) [6,827] {3,414}	142,614 (28,523) [6,845] {3,423}	142,979 (28,596) [6,863] {3,431}
Lake	30,622	30,676	30,726	30,759	30,869 (6,174) [1,482] {741}	30,977 (6,195) [1,487] {743}	31,080 (6,216) [1,492] {746}
Lee	72,854	72,973	73,083	73,148	73,365 (14,673) [3,522] {1,761}	73,569 (14,714) [3,531] {1,766}	73,758 (14,752) [3,540] {1,770}
Manatee	39,514	39,570	39,606	39,626	39,703 (7,941) [1,906] {953}	39,775 (7,955) [1,909] {955}	39,844 (7,969) [1,913] {956}
Miami-Dade	497,371	498,094	498,557	498,953	499,855 (99,971) [23,993] {11,997}	500,705 (100,141) [24,034] {12,017}	501,514 (100,303) [24,073] {12,036}
Okaloosa	20,772	20,789	20,805	20,814	20,838 (4,168) [1,000] {500}	20,862 (4,172) [1,001] {501}	20,885 (4,177) [1,002] {501}
Orange	141,375	141,618	141,737	141,856	142,147 (28,429) [6,823] {3,412}	142,419 (28,484) [6,836] {3,418}	142,677 (28,535) [6,849] {3,424}
Osceola	45,663	45,733	45,781	45,808	45,888 (9,178) [2,203] {1,101}	45,965 (9,193) [2,206] {1,103}	46,032 (9,206) [2,210] {1,105}
Palm Beach	147,408	147,609	147,733	147,786	148,030 (29,606) [7,105] {3,553}	148,262 (29,652) [7,117] {3,558}	148,477 (29,695) [7,127] {3,563}
Pasco	42,391	42,452	42,506	42,542	42,631 (8,526) [2,046] {1,023}	42,712 (8,542) [2,050] {1,025}	42,788 (8,558) [2,054] {1,027}
Pinellas	80,898	80,986	81,042	81,077	81,197 (16,239) [3,897] {1,949}	81,307 (16,261) [3,903] {1,951}	81,409 (16,282) [3,908] {1,954}
Polk	70,301	70,419	70,483	70,544	70,690 (14,138) [3,393] {1,697}	70,822 (14,164) [3,399] {1,700}	70,943 (14,189) [3,405] {1,703}
Sarasota	33,395	33,428	33,459	33,483	33,540 (6,708) [1,610] {805}	33,592 (6,718) [1,612] {806}	33,642 (6,728) [1,615] {807}
Seminole	34,927	35,000	35,023	35,056	35,142 (7,028) [1,687] {843}	35,224 (7,045) [1,691] {845}	35,303 (7,061) [1,695] {847}
St. Johns	23,068	23,106	23,127	23,144	23,196 (4,639) [1,113] {557}	23,249 (4,650) [1,116] {558}	23,301 (4,660) [1,118] {559}
Sumter	9,431	9,439	9,450	9,456	9,470 (1,894) [455] {227}	9,483 (1,897) [455] {228}	9,496 (1,899) [456] {228}
Volusia	44,378	44,440	44,479	44,511	44,625 (8,925) [2,142] {1,071}	44,734 (8,947) [2,147] {1,074}	44,835 (8,967) [2,152] {1,076}

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.