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

Date: 7/14/21

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 7/14/21 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.

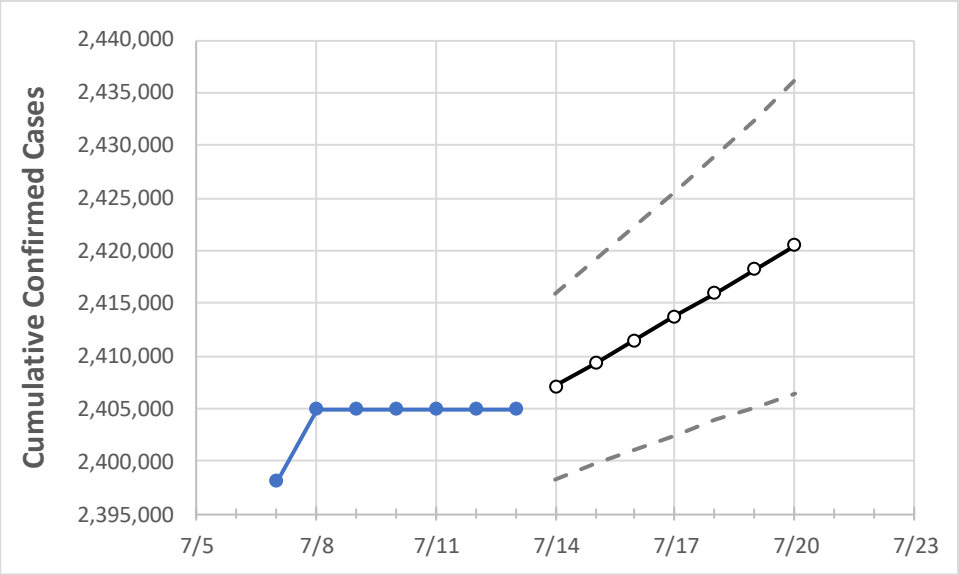
IEM's Modeling Lead

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:						
	7/10	7/11	7/12	7/13	7/14	7/15	7/16	7/17	7/18	7/19	7/20
Florida	2,404,895	2,404,895	2,404,895	2,404,895	2,407,118	2,409,308	2,411,512	2,413,749	2,415,957	2,418,205	2,420,506

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:						
	7/10	7/11	7/12	7/13	7/14	7/15	7/16	7/17	7/18	7/19	7/20
Alachua	25,964	25,964	25,964	25,964	25,976	25,988	25,999	26,011	26,023	26,035	26,046
Broward	252,436	252,436	252,436	252,436	252,629	252,823	253,017	253,215	253,411	253,611	253,800
Charlotte	13,792	13,792	13,792	13,792	13,799	13,806	13,814	13,821	13,828	13,835	13,841
Collier	38,392	38,392	38,392	38,392	38,427	38,461	38,495	38,530	38,565	38,600	38,635
Duval	106,798	106,798	106,798	106,798	107,009	107,223	107,442	107,659	107,885	108,116	108,356
Hillsborough	148,702	148,702	148,702	148,702	148,812	148,923	149,034	149,142	149,249	149,354	149,458
Lake	32,359	32,359	32,359	32,359	32,399	32,440	32,481	32,523	32,566	32,609	32,652
Lee	75,880	75,880	75,880	75,880	75,927	75,974	76,021	76,068	76,114	76,159	76,203
Manatee	40,836	40,836	40,836	40,836	40,856	40,876	40,896	40,915	40,934	40,954	40,973
Miami-Dade	515,765	515,765	515,765	515,765	516,183	516,595	517,015	517,446	517,870	518,308	518,735
Okaloosa	21,481	21,481	21,481	21,481	21,496	21,511	21,526	21,541	21,556	21,571	21,585
Orange	148,792	148,792	148,792	148,792	148,970	149,144	149,324	149,503	149,686	149,872	150,063
Osceola	48,189	48,189	48,189	48,189	48,243	48,296	48,349	48,402	48,457	48,512	48,566
Palm Beach	153,129	153,129	153,129	153,129	153,256	153,383	153,513	153,644	153,772	153,903	154,033
Pasco	44,186	44,186	44,186	44,186	44,224	44,263	44,301	44,339	44,377	44,416	44,455
Pinellas	83,540	83,540	83,540	83,540	83,590	83,640	83,689	83,738	83,787	83,836	83,884
Polk	73,643	73,643	73,643	73,643	73,707	73,771	73,834	73,897	73,961	74,023	74,085
Sarasota	34,461	34,461	34,461	34,461	34,482	34,504	34,526	34,547	34,569	34,591	34,613
Seminole	37,250	37,250	37,250	37,250	37,304	37,358	37,411	37,464	37,517	37,570	37,626
St. Johns	24,592	24,592	24,592	24,592	24,632	24,672	24,713	24,753	24,793	24,834	24,874
Sumter	9,759	9,759	9,759	9,759	9,766	9,773	9,781	9,788	9,795	9,802	9,809
Volusia	46,953	46,953	46,953	46,953	47,018	47,085	47,152	47,219	47,286	47,353	47,423

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:		
	7/10	7/11	7/12	7/13	7/15	7/17	7/19
Alachua	25,964	25,964	25,964	25,964	25,988 (5,198) [1,247] {624}	26,011 (5,202) [1,249] {624}	26,035 (5,207) [1,250] {625}
Broward	252,436	252,436	252,436	252,436	252,823 (50,565) [12,135] {6,068}	253,215 (50,643) [12,154] {6,077}	253,611 (50,722) [12,173] {6,087}
Charlotte	13,792	13,792	13,792	13,792	13,806 (2,761) [663] {331}	13,821 (2,764) [663] {332}	13,835 (2,767) [664] {332}
Collier	38,392	38,392	38,392	38,392	38,461 (7,692) [1,846] {923}	38,530 (7,706) [1,849] {925}	38,600 (7,720) [1,853] {926}
Duval	106,798	106,798	106,798	106,798	107,223 (21,445) [5,147] {2,573}	107,659 (21,532) [5,168] {2,584}	108,116 (21,623) [5,190] {2,595}
Hillsborough	148,702	148,702	148,702	148,702	148,923 (29,785) [7,148] {3,574}	149,142 (29,828) [7,159] {3,579}	149,354 (29,871) [7,169] {3,585}
Lake	32,359	32,359	32,359	32,359	32,440 (6,488) [1,557] {779}	32,523 (6,505) [1,561] {781}	32,609 (6,522) [1,565] {783}
Lee	75,880	75,880	75,880	75,880	75,974 (15,195) [3,647] {1,823}	76,068 (15,214) [3,651] {1,826}	76,159 (15,232) [3,656] {1,828}
Manatee	40,836	40,836	40,836	40,836	40,876 (8,175) [1,962] {981}	40,915 (8,183) [1,964] {982}	40,954 (8,191) [1,966] {983}
Miami-Dade	515,765	515,765	515,765	515,765	516,595 (103,319) [24,797] {12,398}	517,446 (103,489) [24,837] {12,419}	518,308 (103,662) [24,879] {12,439}
Okaloosa	21,481	21,481	21,481	21,481	21,511 (4,302) [1,033] {516}	21,541 (4,308) [1,034] {517}	21,571 (4,314) [1,035] {518}
Orange	148,792	148,792	148,792	148,792	149,144 (29,829) [7,159] {3,579}	149,503 (29,901) [7,176] {3,588}	149,872 (29,974) [7,194] {3,597}
Osceola	48,189	48,189	48,189	48,189	48,296 (9,659) [2,318] {1,159}	48,402 (9,680) [2,323] {1,162}	48,512 (9,702) [2,329] {1,164}
Palm Beach	153,129	153,129	153,129	153,129	153,383 (30,677) [7,362] {3,681}	153,644 (30,729) [7,375] {3,687}	153,903 (30,781) [7,387] {3,694}
Pasco	44,186	44,186	44,186	44,186	44,263 (8,853) [2,125] {1,062}	44,339 (8,868) [2,128] {1,064}	44,416 (8,883) [2,132] {1,066}
Pinellas	83,540	83,540	83,540	83,540	83,640 (16,728) [4,015] {2,007}	83,738 (16,748) [4,019] {2,010}	83,836 (16,767) [4,024] {2,012}
Polk	73,643	73,643	73,643	73,643	73,771 (14,754) [3,541] {1,771}	73,897 (14,779) [3,547] {1,774}	74,023 (14,805) [3,553] {1,777}
Sarasota	34,461	34,461	34,461	34,461	34,504 (6,901) [1,656] {828}	34,547 (6,909) [1,658] {829}	34,591 (6,918) [1,660] {830}
Seminole	37,250	37,250	37,250	37,250	37,358 (7,472) [1,793] {897}	37,464 (7,493) [1,798] {899}	37,570 (7,514) [1,803] {902}
St. Johns	24,592	24,592	24,592	24,592	24,672 (4,934) [1,184] {592}	24,753 (4,951) [1,188] {594}	24,834 (4,967) [1,192] {596}
Sumter	9,759	9,759	9,759	9,759	9,773 (1,955) [469] {235}	9,788 (1,958) [470] {235}	9,802 (1,960) [471] {235}
Volusia	46,953	46,953	46,953	46,953	47,085 (9,417) [2,260] {1,130}	47,219 (9,444) [2,267] {1,133}	47,353 (9,471) [2,273] {1,136}

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.