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

Date: 7/2/21

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 7/2/21 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.

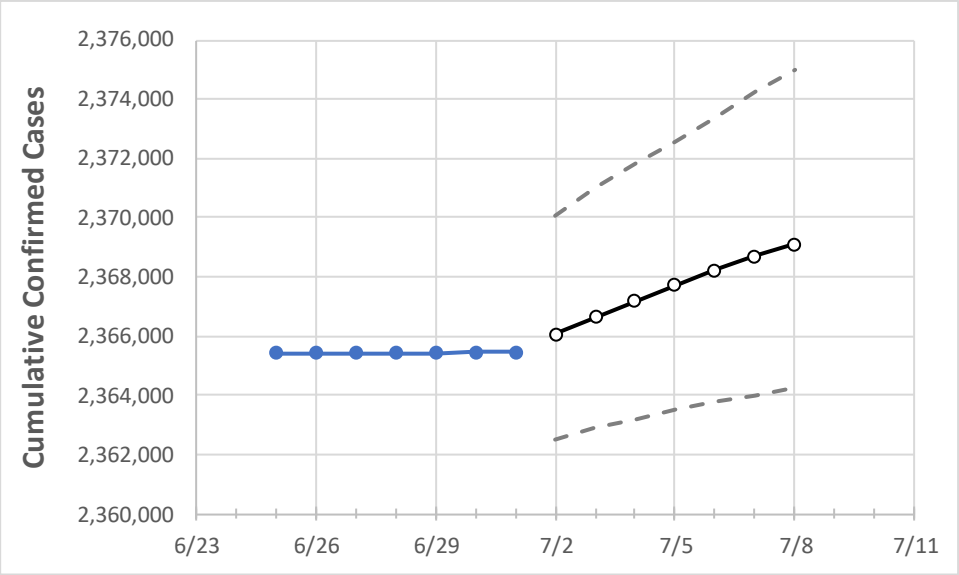
IEM's Modeling Lead

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:						
	6/28	6/29	6/30	7/1	7/2	7/3	7/4	7/5	7/6	7/7	7/8
Florida	2,365,464	2,365,464	2,365,464	2,365,464	2,366,065	2,366,631	2,367,178	2,367,711	2,368,214	2,368,686	2,369,109

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:						
	6/28	6/29	6/30	7/1	7/2	7/3	7/4	7/5	7/6	7/7	7/8
Alachua	25,741	25,741	25,741	25,741	25,744	25,748	25,751	25,754	25,756	25,759	25,761
Broward	248,830	248,830	248,830	248,830	248,887	248,941	248,992	249,042	249,088	249,133	249,174
Charlotte	13,644	13,644	13,644	13,644	13,647	13,651	13,654	13,657	13,659	13,662	13,664
Collier	37,773	37,773	37,773	37,773	37,782	37,790	37,798	37,806	37,813	37,819	37,824
Duval	103,256	103,256	103,256	103,256	103,302	103,345	103,387	103,427	103,466	103,504	103,541
Hillsborough	146,442	146,442	146,442	146,442	146,482	146,519	146,555	146,588	146,620	146,649	146,676
Lake	31,659	31,659	31,659	31,659	31,669	31,679	31,689	31,698	31,707	31,715	31,723
Lee	74,945	74,945	74,945	74,945	74,965	74,982	75,000	75,016	75,032	75,047	75,062
Manatee	40,454	40,454	40,454	40,454	40,460	40,466	40,472	40,477	40,482	40,486	40,490
Miami-Dade	508,464	508,464	508,464	508,464	508,569	508,673	508,771	508,867	508,952	509,031	509,110
Okaloosa	21,195	21,195	21,195	21,195	21,201	21,207	21,212	21,218	21,223	21,228	21,233
Orange	145,712	145,712	145,712	145,712	145,749	145,782	145,814	145,843	145,871	145,898	145,922
Osceola	47,253	47,253	47,253	47,253	47,265	47,275	47,285	47,295	47,304	47,312	47,319
Palm Beach	150,857	150,857	150,857	150,857	150,898	150,937	150,973	151,009	151,043	151,076	151,107
Pasco	43,521	43,521	43,521	43,521	43,525	43,529	43,532	43,535	43,538	43,541	43,543
Pinellas	82,576	82,576	82,576	82,576	82,596	82,616	82,634	82,651	82,668	82,685	82,700
Polk	72,452	72,452	72,452	72,452	72,474	72,496	72,517	72,537	72,555	72,573	72,590
Sarasota	34,091	34,091	34,091	34,091	34,095	34,098	34,102	34,105	34,107	34,110	34,112
Seminole	36,264	36,264	36,264	36,264	36,279	36,292	36,305	36,317	36,329	36,340	36,351
St. Johns	23,862	23,862	23,862	23,862	23,879	23,896	23,912	23,929	23,945	23,960	23,976
Sumter	9,626	9,626	9,626	9,626	9,629	9,631	9,633	9,636	9,638	9,640	9,642
Volusia	45,835	45,835	45,835	45,835	45,852	45,869	45,885	45,900	45,914	45,929	45,943

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:		
	6/28	6/29	6/30	7/1	7/3	7/5	7/7
Alachua	25,741	25,741	25,741	25,741	25,748 (5,150) [1,236] {618}	25,754 (5,151) [1,236] {618}	25,759 (5,152) [1,236] {618}
Broward	248,830	248,830	248,830	248,830	248,941 (49,788) [11,949] {5,975}	249,042 (49,808) [11,954] {5,977}	249,133 (49,827) [11,958] {5,979}
Charlotte	13,644	13,644	13,644	13,644	13,651 (2,730) [655] {328}	13,657 (2,731) [656] {328}	13,662 (2,732) [656] {328}
Collier	37,773	37,773	37,773	37,773	37,790 (7,558) [1,814] {907}	37,806 (7,561) [1,815] {907}	37,819 (7,564) [1,815] {908}
Duval	103,256	103,256	103,256	103,256	103,345 (20,669) [4,961] {2,480}	103,427 (20,685) [4,965] {2,482}	103,504 (20,701) [4,968] {2,484}
Hillsborough	146,442	146,442	146,442	146,442	146,519 (29,304) [7,033] {3,516}	146,588 (29,318) [7,036] {3,518}	146,649 (29,330) [7,039] {3,520}
Lake	31,659	31,659	31,659	31,659	31,679 (6,336) [1,521] {760}	31,698 (6,340) [1,522] {761}	31,715 (6,343) [1,522] {761}
Lee	74,945	74,945	74,945	74,945	74,982 (14,996) [3,599] {1,800}	75,016 (15,003) [3,601] {1,800}	75,047 (15,009) [3,602] {1,801}
Manatee	40,454	40,454	40,454	40,454	40,466 (8,093) [1,942] {971}	40,477 (8,095) [1,943] {971}	40,486 (8,097) [1,943] {972}
Miami-Dade	508,464	508,464	508,464	508,464	508,673 (101,735) [24,416] {12,208	508,867 (101,773) [24,426] {12,213	509,031 (101,806) [24,433] {12,217}
Okaloosa	21,195	21,195	21,195	21,195	21,207 (4,241) [1,018] {509}	21,218 (4,244) [1,018] {509}	21,228 (4,246) [1,019] {509}
Orange	145,712	145,712	145,712	145,712	145,782 (29,156) [6,998] {3,499}	145,843 (29,169) [7,000] {3,500}	145,898 (29,180) [7,003] {3,502}
Osceola	47,253	47,253	47,253	47,253	47,275 (9,455) [2,269] {1,135}	47,295 (9,459) [2,270] {1,135}	47,312 (9,462) [2,271] {1,135}
Palm Beach	150,857	150,857	150,857	150,857	150,937 (30,187) [7,245] {3,622}	151,009 (30,202) [7,248] {3,624}	151,076 (30,215) [7,252] {3,626}
Pasco	43,521	43,521	43,521	43,521	43,529 (8,706) [2,089] {1,045}	43,535 (8,707) [2,090] {1,045}	43,541 (8,708) [2,090] {1,045}
Pinellas	82,576	82,576	82,576	82,576	82,616 (16,523) [3,966] {1,983}	82,651 (16,530) [3,967] {1,984}	82,685 (16,537) [3,969] {1,984}
Polk	72,452	72,452	72,452	72,452	72,496 (14,499) [3,480] {1,740}	72,537 (14,507) [3,482] {1,741}	72,573 (14,515) [3,484] {1,742}
Sarasota	34,091	34,091	34,091	34,091	34,098 (6,820) [1,637] {818}	34,105 (6,821) [1,637] {819}	34,110 (6,822) [1,637] {819}
Seminole	36,264	36,264	36,264	36,264	36,292 (7,258) [1,742] {871}	36,317 (7,263) [1,743] {872}	36,340 (7,268) [1,744] {872}
St. Johns	23,862	23,862	23,862	23,862	23,896 (4,779) [1,147] {573}	23,929 (4,786) [1,149] {574}	23,960 (4,792) [1,150] {575}
Sumter	9,626	9,626	9,626	9,626	9,631 (1,926) [462] {231}	9,636 (1,927) [463] {231}	9,640 (1,928) [463] {231}
Volusia	45,835	45,835	45,835	45,835	45,869 (9,174) [2,202] {1,101}	45,900 (9,180) [2,203] {1,102}	45,929 (9,186) [2,205] {1,102}

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.