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

Date: 6/28/21

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 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 6/28/21 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.

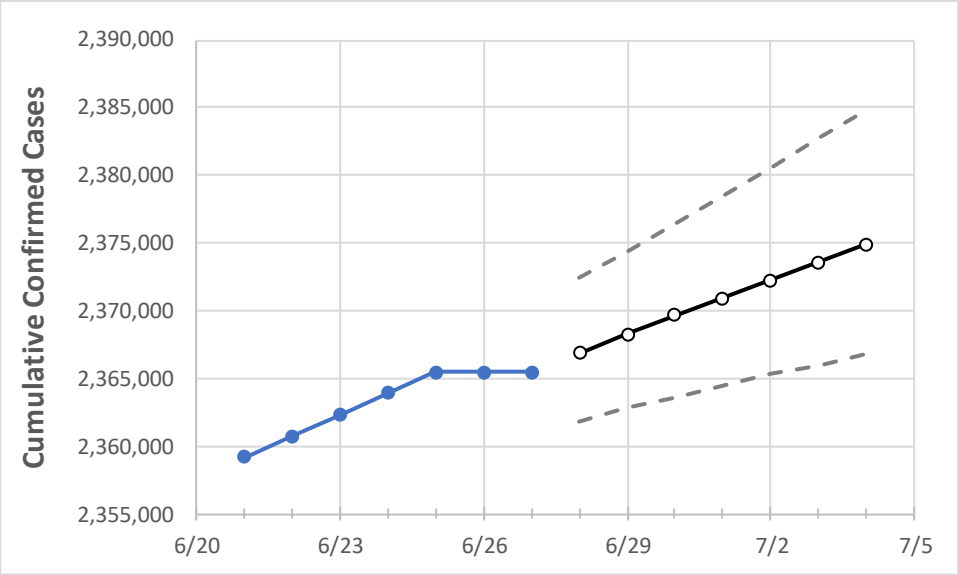
IEM's Modeling Lead

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:						
	6/24	6/25	6/26	6/27	6/28	6/29	6/30	7/1	7/2	7/3	7/4
Florida	2,363,886	2,365,464	2,365,464	2,365,464	2,366,853	2,368,279	2,369,635	2,370,958	2,372,279	2,373,597	2,374,879

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:						
	6/24	6/25	6/26	6/27	6/28	6/29	6/30	7/1	7/2	7/3	7/4
Alachua	25,731	25,741	25,741	25,741	25,749	25,757	25,765	25,773	25,781	25,789	25,797
Broward	248,675	248,830	248,830	248,830	248,964	249,100	249,229	249,358	249,484	249,614	249,738
Charlotte	13,635	13,644	13,644	13,644	13,652	13,660	13,668	13,677	13,685	13,693	13,700
Collier	37,749	37,773	37,773	37,773	37,792	37,811	37,829	37,847	37,865	37,882	37,899
Duval	103,140	103,256	103,256	103,256	103,367	103,475	103,589	103,703	103,815	103,931	104,046
Hillsborough	146,332	146,442	146,442	146,442	146,542	146,640	146,735	146,830	146,923	147,013	147,104
Lake	31,633	31,659	31,659	31,659	31,682	31,706	31,729	31,753	31,776	31,800	31,823
Lee	74,893	74,945	74,945	74,945	74,990	75,034	75,078	75,121	75,163	75,206	75,247
Manatee	40,437	40,454	40,454	40,454	40,469	40,484	40,499	40,513	40,527	40,540	40,554
Miami-Dade	508,173	508,464	508,464	508,464	508,718	508,967	509,217	509,458	509,698	509,933	510,162
Okaloosa	21,180	21,195	21,195	21,195	21,210	21,224	21,239	21,255	21,271	21,286	21,302
Orange	145,614	145,712	145,712	145,712	145,798	145,883	145,966	146,046	146,126	146,204	146,283
Osceola	47,220	47,253	47,253	47,253	47,281	47,309	47,335	47,360	47,385	47,410	47,434
Palm Beach	150,751	150,857	150,857	150,857	150,949	151,041	151,132	151,226	151,319	151,411	151,501
Pasco	43,507	43,521	43,521	43,521	43,531	43,541	43,550	43,558	43,567	43,574	43,582
Pinellas	82,527	82,576	82,576	82,576	82,622	82,669	82,716	82,763	82,810	82,856	82,902
Polk	72,396	72,452	72,452	72,452	72,505	72,559	72,612	72,665	72,718	72,771	72,825
Sarasota	34,079	34,091	34,091	34,091	34,099	34,108	34,116	34,123	34,131	34,138	34,145
Seminole	36,226	36,264	36,264	36,264	36,301	36,338	36,375	36,411	36,448	36,486	36,523
St. Johns	23,824	23,862	23,862	23,862	23,911	23,963	24,018	24,077	24,138	24,204	24,273
Sumter	9,620	9,626	9,626	9,626	9,633	9,639	9,646	9,653	9,660	9,667	9,675
Volusia	45,792	45,835	45,835	45,835	45,878	45,922	45,965	46,008	46,052	46,096	46,140

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:		
	6/24	6/25	6/26	6/27	6/29	7/1	7/3
Alachua	25,731	25,741	25,741	25,741	25,757 (5,151) [1,236] {618}	25,773 (5,155) [1,237] {619}	25,789 (5,158) [1,238] {619}
Broward	248,675	248,830	248,830	248,830	249,100 (49,820) [11,957] {5,978}	249,358 (49,872) [11,969] {5,985}	249,614 (49,923) [11,981] {5,991}
Charlotte	13,635	13,644	13,644	13,644	13,660 (2,732) [656] {328}	13,677 (2,735) [656] {328}	13,693 (2,739) [657] {329}
Collier	37,749	37,773	37,773	37,773	37,811 (7,562) [1,815] {907}	37,847 (7,569) [1,817] {908}	37,882 (7,576) [1,818] {909}
Duval	103,140	103,256	103,256	103,256	103,475 (20,695) [4,967] {2,483}	103,703 (20,741) [4,978] {2,489}	103,931 (20,786) [4,989] {2,494}
Hillsborough	146,332	146,442	146,442	146,442	146,640 (29,328) [7,039] {3,519}	146,830 (29,366) [7,048] {3,524}	147,013 (29,403) [7,057] {3,528}
Lake	31,633	31,659	31,659	31,659	31,706 (6,341) [1,522] {761}	31,753 (6,351) [1,524] {762}	31,800 (6,360) [1,526] {763}
Lee	74,893	74,945	74,945	74,945	75,034 (15,007) [3,602] {1,801}	75,121 (15,024) [3,606] {1,803}	75,206 (15,041) [3,610] {1,805}
Manatee	40,437	40,454	40,454	40,454	40,484 (8,097) [1,943] {972}	40,513 (8,103) [1,945] {972}	40,540 (8,108) [1,946] {973}
Miami-Dade	508,173	508,464	508,464	508,464	508,967 (101,793) [24,430] {12,215}	509,458 (101,892) [24,454] {12,227}	509,933 (101,987) [24,477] {12,238}
Okaloosa	21,180	21,195	21,195	21,195	21,224 (4,245) [1,019] {509}	21,255 (4,251) [1,020] {510}	21,286 (4,257) [1,022] {511}
Orange	145,614	145,712	145,712	145,712	145,883 (29,177) [7,002] {3,501}	146,046 (29,209) [7,010] {3,505}	146,204 (29,241) [7,018] {3,509}
Osceola	47,220	47,253	47,253	47,253	47,309 (9,462) [2,271] {1,135}	47,360 (9,472) [2,273] {1,137}	47,410 (9,482) [2,276] {1,138}
Palm Beach	150,751	150,857	150,857	150,857	151,041 (30,208) [7,250] {3,625}	151,226 (30,245) [7,259] {3,629}	151,411 (30,282) [7,268] {3,634}
Pasco	43,507	43,521	43,521	43,521	43,541 (8,708) [2,090] {1,045}	43,558 (8,712) [2,091] {1,045}	43,574 (8,715) [2,092] {1,046}
Pinellas	82,527	82,576	82,576	82,576	82,669 (16,534) [3,968] {1,984}	82,763 (16,553) [3,973] {1,986}	82,856 (16,571) [3,977] {1,989}
Polk	72,396	72,452	72,452	72,452	72,559 (14,512) [3,483] {1,741}	72,665 (14,533) [3,488] {1,744}	72,771 (14,554) [3,493] {1,747}
Sarasota	34,079	34,091	34,091	34,091	34,108 (6,822) [1,637] {819}	34,123 (6,825) [1,638] {819}	34,138 (6,828) [1,639] {819}
Seminole	36,226	36,264	36,264	36,264	36,338 (7,268) [1,744] {872}	36,411 (7,282) [1,748] {874}	36,486 (7,297) [1,751] {876}
St. Johns	23,824	23,862	23,862	23,862	23,963 (4,793) [1,150] {575}	24,077 (4,815) [1,156] {578}	24,204 (4,841) [1,162] {581}
Sumter	9,620	9,626	9,626	9,626	9,639 (1,928) [463] {231}	9,653 (1,931) [463] {232}	9,667 (1,933) [464] {232}
Volusia	45,792	45,835	45,835	45,835	45,922 (9,184) [2,204] {1,102}	46,008 (9,202) [2,208] {1,104}	46,096 (9,219) [2,213] {1,106}

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.