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

Date: 9/1/21

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 9/1/21 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.

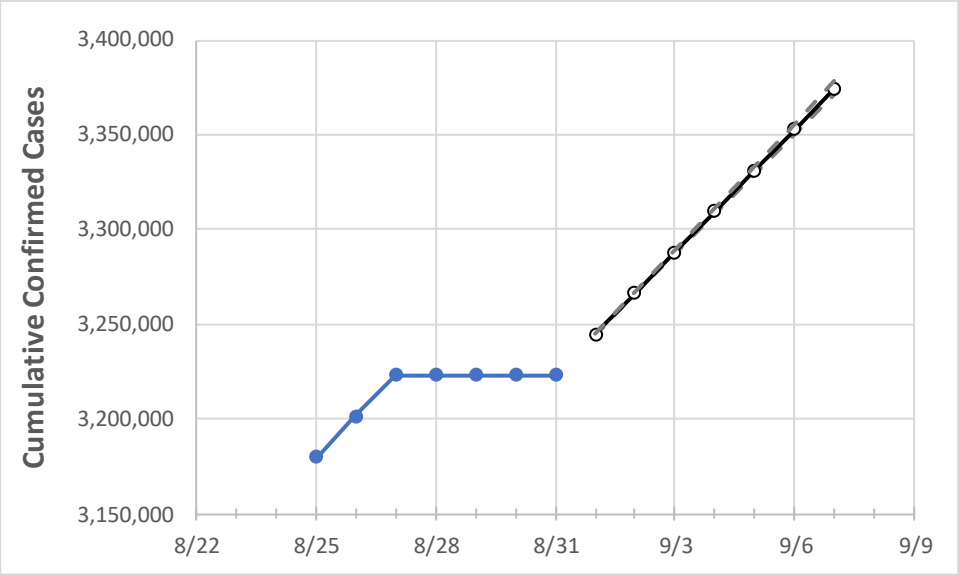
IEM's Modeling Lead

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:						
	8/28	8/29	8/30	8/31	9/1	9/2	9/3	9/4	9/5	9/6	9/7
Florida	3,223,249	3,223,249	3,223,249	3,223,249	3,244,877	3,266,507	3,288,132	3,309,767	3,331,403	3,353,037	3,374,708

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:						
	8/28	8/29	8/30	8/31	9/1	9/2	9/3	9/4	9/5	9/6	9/7
Alachua	34,171	34,171	34,171	34,171	34,395	34,619	34,844	35,070	35,296	35,522	35,749
Broward	323,839	323,839	323,839	323,839	325,366	326,884	328,378	329,853	331,332	332,781	334,236
Charlotte	18,845	18,845	18,845	18,845	19,053	19,264	19,477	19,697	19,919	20,148	20,383
Collier	50,028	50,028	50,028	50,028	50,342	50,654	50,966	51,279	51,591	51,906	52,222
Duval	150,755	150,755	150,755	150,755	151,430	152,103	152,770	153,437	154,101	154,756	155,405
Hillsborough	206,934	206,934	206,934	206,934	208,669	210,410	212,153	213,906	215,663	217,438	219,219
Lake	45,826	45,826	45,826	45,826	46,199	46,574	46,949	47,325	47,704	48,083	48,464
Lee	105,638	105,638	105,638	105,638	106,839	108,060	109,297	110,545	111,813	113,103	114,411
Manatee	55,494	55,494	55,494	55,494	55,980	56,467	56,959	57,460	57,975	58,503	59,049
Miami-Dade	627,423	627,423	627,423	627,423	629,598	631,735	633,853	635,932	638,009	640,045	642,076
Okaloosa	28,972	28,972	28,972	28,972	29,262	29,559	29,858	30,161	30,471	30,783	31,098
Orange	202,102	202,102	202,102	202,102	203,427	204,756	206,089	207,423	208,760	210,099	211,438
Osceola	63,483	63,483	63,483	63,483	63,831	64,177	64,520	64,861	65,203	65,541	65,880
Palm Beach	200,427	200,427	200,427	200,427	201,574	202,711	203,841	204,963	206,092	207,212	208,352
Pasco	65,503	65,503	65,503	65,503	66,123	66,742	67,361	67,985	68,613	69,246	69,883
Pinellas	116,302	116,302	116,302	116,302	117,333	118,376	119,426	120,486	121,551	122,627	123,703
Polk	108,366	108,366	108,366	108,366	109,479	110,594	111,716	112,846	113,981	115,126	116,272
Sarasota	47,810	47,810	47,810	47,810	48,347	48,887	49,437	49,996	50,565	51,144	51,733
Seminole	53,702	53,702	53,702	53,702	54,072	54,438	54,801	55,163	55,524	55,884	56,244
St. Johns	34,233	34,233	34,233	34,233	34,470	34,713	34,962	35,215	35,469	35,726	35,987
Sumter	12,422	12,422	12,422	12,422	12,511	12,600	12,690	12,781	12,873	12,966	13,061
Volusia	65,970	65,970	65,970	65,970	66,336	66,700	67,063	67,425	67,786	68,145	68,499

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:		
	8/28	8/29	8/30	8/31	9/2	9/4	9/6
Alachua	34,171	34,171	34,171	34,171	34,619 (6,924) [1,662] {831}	35,070 (7,014) [1,683] {842}	35,522 (7,104) [1,705] {853}
Broward	323,839	323,839	323,839	323,839	326,884 (65,377) [15,690] {7,845}	329,853 (65,971) [15,833] {7,916}	332,781 (66,556) [15,973] {7,987}
Charlotte	18,845	18,845	18,845	18,845	19,264 (3,853) [925] {462}	19,697 (3,939) [945] {473}	20,148 (4,030) [967] {484}
Collier	50,028	50,028	50,028	50,028	50,654 (10,131) [2,431] {1,216}	51,279 (10,256) [2,461] {1,231}	51,906 (10,381) [2,491] {1,246}
Duval	150,755	150,755	150,755	150,755	152,103 (30,421) [7,301] {3,650}	153,437 (30,687) [7,365] {3,682}	154,756 (30,951) [7,428] {3,714}
Hillsborough	206,934	206,934	206,934	206,934	210,410 (42,082) [10,100] {5,050}	213,906 (42,781) [10,268] {5,134}	217,438 (43,488) [10,437] {5,219}
Lake	45,826	45,826	45,826	45,826	46,574 (9,315) [2,236] {1,118}	47,325 (9,465) [2,272] {1,136}	48,083 (9,617) [2,308] {1,154}
Lee	105,638	105,638	105,638	105,638	108,060 (21,612) [5,187] {2,593}	110,545 (22,109) [5,306] {2,653}	113,103 (22,621) [5,429] {2,714}
Manatee	55,494	55,494	55,494	55,494	56,467 (11,293) [2,710] {1,355}	57,460 (11,492) [2,758] {1,379}	58,503 (11,701) [2,808] {1,404}
Miami-Dade	627,423	627,423	627,423	627,423	631,735 (126,347) [30,323] {15,162}	635,932 (127,186) [30,525] {15,262}	640,045 (128,009) [30,722] {15,361}
Okaloosa	28,972	28,972	28,972	28,972	29,559 (5,912) [1,419] {709}	30,161 (6,032) [1,448] {724}	30,783 (6,157) [1,478] {739}
Orange	202,102	202,102	202,102	202,102	204,756 (40,951) [9,828] {4,914}	207,423 (41,485) [9,956] {4,978}	210,099 (42,020) [10,085] {5,042}
Osceola	63,483	63,483	63,483	63,483	64,177 (12,835) [3,080] {1,540}	64,861 (12,972) [3,113] {1,557}	65,541 (13,108) [3,146] {1,573}
Palm Beach	200,427	200,427	200,427	200,427	202,711 (40,542) [9,730] {4,865}	204,963 (40,993) [9,838] {4,919}	207,212 (41,442) [9,946] {4,973}
Pasco	65,503	65,503	65,503	65,503	66,742 (13,348) [3,204] {1,602}	67,985 (13,597) [3,263] {1,632}	69,246 (13,849) [3,324] {1,662}
Pinellas	116,302	116,302	116,302	116,302	118,376 (23,675) [5,682] {2,841}	120,486 (24,097) [5,783] {2,892}	122,627 (24,525) [5,886] {2,943}
Polk	108,366	108,366	108,366	108,366	110,594 (22,119) [5,309] {2,654}	112,846 (22,569) [5,417] {2,708}	115,126 (23,025) [5,526] {2,763}
Sarasota	47,810	47,810	47,810	47,810	48,887 (9,777) [2,347] {1,173}	49,996 (9,999) [2,400] {1,200}	51,144 (10,229) [2,455] {1,227}
Seminole	53,702	53,702	53,702	53,702	54,438 (10,888) [2,613] {1,307}	55,163 (11,033) [2,648] {1,324}	55,884 (11,177) [2,682] {1,341}
St. Johns	34,233	34,233	34,233	34,233	34,713 (6,943) [1,666] {833}	35,215 (7,043) [1,690] {845}	35,726 (7,145) [1,715] {857}
Sumter	12,422	12,422	12,422	12,422	12,600 (2,520) [605] {302}	12,781 (2,556) [613] {307}	12,966 (2,593) [622] {311}
Volusia	65,970	65,970	65,970	65,970	66,700 (13,340) [3,202] {1,601}	67,425 (13,485) [3,236] {1,618}	68,145 (13,629) [3,271] {1,635}

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.