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

Date: 1/24/22

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 1/24/22 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.

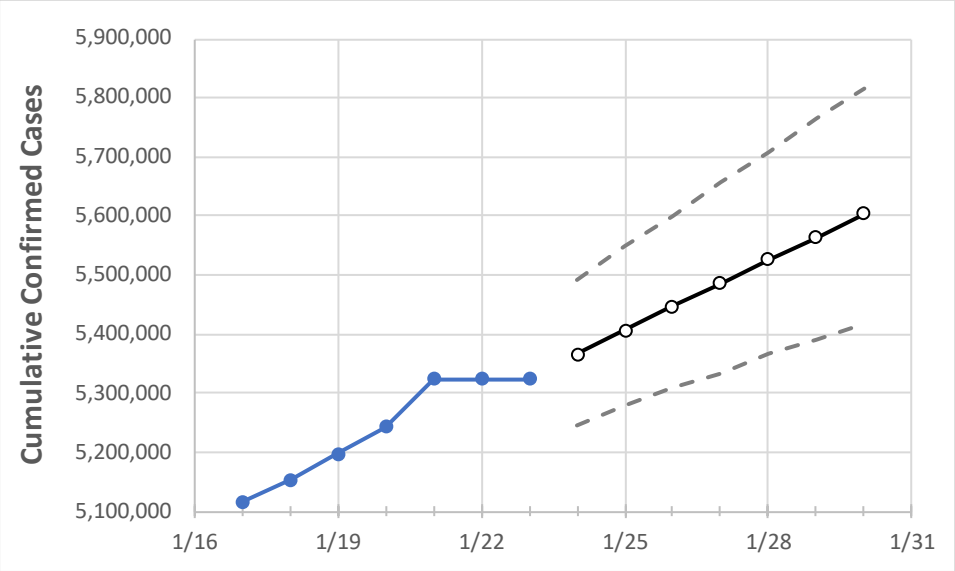
IEM's Modeling Lead

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:						
	1/20	1/21	1/22	1/23	1/24	1/25	1/26	1/27	1/28	1/29	1/30
Florida	5,242,386	5,323,337	5,324,438	5,324,438	5,365,556	5,406,322	5,447,787	5,486,060	5,527,160	5,564,445	5,604,443

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:						
	1/20	1/21	1/22	1/23	1/24	1/25	1/26	1/27	1/28	1/29	1/30
Alachua	58,028	58,853	58,853	58,853	59,678	60,503	61,334	62,183	63,048	63,935	64,842
Broward	560,553	564,397	564,397	564,397	568,149	571,774	575,233	578,625	581,904	585,070	588,240
Charlotte	30,300	30,627	30,627	30,627	30,990	31,357	31,735	32,122	32,513	32,915	33,327
Collier	76,991	77,641	77,641	77,641	78,269	78,893	79,514	80,133	80,753	81,373	81,996
Duval	224,355	226,792	226,792	226,792	229,187	231,577	233,966	236,360	238,756	241,158	243,587
Hillsborough	331,438	334,482	334,482	334,482	337,491	340,493	343,489	346,477	349,461	352,445	355,428
Lake	74,289	75,015	75,015	75,015	75,758	76,502	77,242	77,989	78,744	79,507	80,283
Lee	169,610	171,307	171,307	171,307	173,043	174,785	176,537	178,294	180,059	181,834	183,607
Manatee	84,320	85,070	85,070	85,070	85,860	86,654	87,458	88,266	89,082	89,905	90,729
Miami-Dade	1,097,565	1,105,391	1,105,391	1,105,391	1,112,260	1,118,937	1,125,282	1,131,632	1,137,405	1,143,237	1,148,751
Okaloosa	44,470	45,031	45,031	45,031	45,675	46,336	47,018	47,714	48,434	49,173	49,928
Orange	337,723	340,846	340,846	340,846	343,810	346,724	349,601	352,400	355,191	357,939	360,693
Osceola	103,580	104,506	104,506	104,506	105,377	106,240	107,072	107,908	108,724	109,538	110,346
Palm Beach	339,491	342,003	342,003	342,003	344,305	346,559	348,722	350,849	352,948	355,036	357,006
Pasco	105,994	107,177	107,177	107,177	108,428	109,695	110,977	112,268	113,582	114,908	116,251
Pinellas	183,212	185,177	185,177	185,177	187,221	189,289	191,366	193,464	195,578	197,714	199,863
Polk	177,280	179,085	179,085	179,085	180,821	182,545	184,259	185,967	187,675	189,377	191,080
Sarasota	77,693	78,606	78,606	78,606	79,586	80,581	81,593	82,620	83,658	84,717	85,781
Seminole	91,443	92,415	92,415	92,415	93,344	94,264	95,178	96,089	97,001	97,908	98,816
St. Johns	53,883	54,465	54,465	54,465	55,099	55,750	56,418	57,087	57,778	58,482	59,193
Sumter	18,440	18,611	18,611	18,611	18,787	18,966	19,145	19,328	19,514	19,702	19,894
Volusia	102,429	103,387	103,387	103,387	104,348	105,311	106,274	107,240	108,209	109,181	110,155

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:		
	1/20	1/21	1/22	1/23	1/25	1/27	1/29
Alachua	58,028	58,853	58,853	58,853	60,503 (12,101) [2,904] {1,452}	62,183 (12,437) [2,985] {1,492}	63,935 (12,787) [3,069] {1,534}
Broward	560,553	564,397	564,397	564,397	571,774 (114,355) [27,445] {13,723}	578,625 (115,725) [27,774] {13,887}	585,070 (117,014) [28,083] {14,042}
Charlotte	30,300	30,627	30,627	30,627	31,357 (6,271) [1,505] {753}	32,122 (6,424) [1,542] {771}	32,915 (6,583) [1,580] {790}
Collier	76,991	77,641	77,641	77,641	78,893 (15,779) [3,787] {1,893}	80,133 (16,027) [3,846] {1,923}	81,373 (16,275) [3,906] {1,953}
Duval	224,355	226,792	226,792	226,792	231,577 (46,315) [11,116] {5,558}	236,360 (47,272) [11,345] {5,673}	241,158 (48,232) [11,576] {5,788}
Hillsborough	331,438	334,482	334,482	334,482	340,493 (68,099) [16,344] {8,172}	346,477 (69,295) [16,631] {8,315}	352,445 (70,489) [16,917] {8,459}
Lake	74,289	75,015	75,015	75,015	76,502 (15,300) [3,672] {1,836}	77,989 (15,598) [3,743] {1,872}	79,507 (15,901) [3,816] {1,908}
Lee	169,610	171,307	171,307	171,307	174,785 (34,957) [8,390] {4,195}	178,294 (35,659) [8,558] {4,279}	181,834 (36,367) [8,728] {4,364}
Manatee	84,320	85,070	85,070	85,070	86,654 (17,331) [4,159] {2,080}	88,266 (17,653) [4,237] {2,118}	89,905 (17,981) [4,315] {2,158}
Miami-Dade	1,097,565	1,105,391	1,105,391	1,105,391	1,118,937 (223,787) [53,709] {26,854}	1,131,632 (226,326) [54,318] {27,159}	1,143,237 (228,647) [54,875] {27,438}
Okaloosa	44,470	45,031	45,031	45,031	46,336 (9,267) [2,224] {1,112}	47,714 (9,543) [2,290] {1,145}	49,173 (9,835) [2,360] {1,180}
Orange	337,723	340,846	340,846	340,846	346,724 (69,345) [16,643] {8,321}	352,400 (70,480) [16,915] {8,458}	357,939 (71,588) [17,181] {8,591}
Osceola	103,580	104,506	104,506	104,506	106,240 (21,248) [5,100] {2,550}	107,908 (21,582) [5,180] {2,590}	109,538 (21,908) [5,258] {2,629}
Palm Beach	339,491	342,003	342,003	342,003	346,559 (69,312) [16,635] {8,317}	350,849 (70,170) [16,841] {8,420}	355,036 (71,007) [17,042] {8,521}
Pasco	105,994	107,177	107,177	107,177	109,695 (21,939) [5,265] {2,633}	112,268 (22,454) [5,389] {2,694}	114,908 (22,982) [5,516] {2,758}
Pinellas	183,212	185,177	185,177	185,177	189,289 (37,858) [9,086] {4,543}	193,464 (38,693) [9,286] {4,643}	197,714 (39,543) [9,490] {4,745}
Polk	177,280	179,085	179,085	179,085	182,545 (36,509) [8,762] {4,381}	185,967 (37,193) [8,926] {4,463}	189,377 (37,875) [9,090] {4,545}
Sarasota	77,693	78,606	78,606	78,606	80,581 (16,116) [3,868] {1,934}	82,620 (16,524) [3,966] {1,983}	84,717 (16,943) [4,066] {2,033}
Seminole	91,443	92,415	92,415	92,415	94,264 (18,853) [4,525] {2,262}	96,089 (19,218) [4,612] {2,306}	97,908 (19,582) [4,700] {2,350}
St. Johns	53,883	54,465	54,465	54,465	55,750 (11,150) [2,676] {1,338}	57,087 (11,417) [2,740] {1,370}	58,482 (11,696) [2,807] {1,404}
Sumter	18,440	18,611	18,611	18,611	18,966 (3,793) [910] {455}	19,328 (3,866) [928] {464}	19,702 (3,940) [946] {473}
Volusia	102,429	103,387	103,387	103,387	105,311 (21,062) [5,055] {2,527}	107,240 (21,448) [5,148] {2,574}	109,181 (21,836) [5,241] {2,620}

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.