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

Date: 2/23/22

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 2/23/22 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.

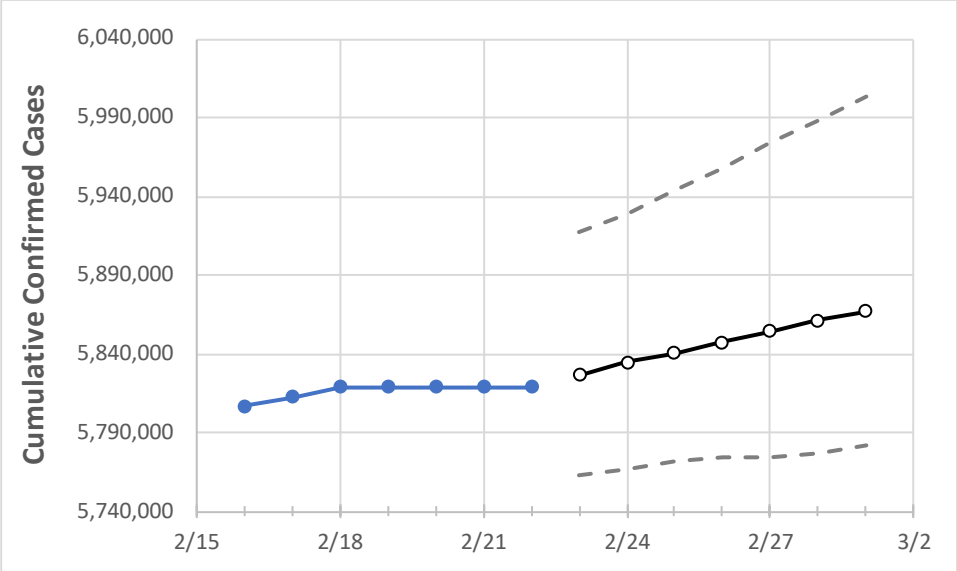
IEM's Modeling Lead

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:						
	2/19	2/20	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1
Florida	5,818,706	5,818,706	5,818,706	5,818,706	5,826,776	5,834,430	5,840,232	5,847,474	5,854,452	5,861,056	5,866,923

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:						
	2/19	2/20	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1
Alachua	66,948	66,948	66,948	66,948	67,020	67,087	67,149	67,208	67,265	67,320	67,369
Broward	597,048	597,048	597,048	597,048	597,429	597,847	598,162	598,518	598,878	599,139	599,470
Charlotte	35,010	35,010	35,010	35,010	35,069	35,122	35,173	35,228	35,274	35,320	35,364
Collier	83,659	83,659	83,659	83,659	83,731	83,800	83,866	83,931	83,988	84,048	84,103
Duval	251,211	251,211	251,211	251,211	251,413	251,626	251,807	251,981	252,151	252,330	252,470
Hillsborough	369,320	369,320	369,320	369,320	369,861	370,401	370,892	371,369	371,847	372,328	372,764
Lake	83,879	83,879	83,879	83,879	83,977	84,072	84,153	84,236	84,321	84,393	84,467
Lee	188,238	188,238	188,238	188,238	188,425	188,606	188,778	188,933	189,090	189,248	189,387
Manatee	94,765	94,765	94,765	94,765	94,866	94,955	95,041	95,115	95,198	95,283	95,346
Miami-Dade	1,173,497	1,173,497	1,173,497	1,173,497	1,174,194	1,175,008	1,175,658	1,176,282	1,176,920	1,177,516	1,177,995
Okaloosa	51,097	51,097	51,097	51,097	51,146	51,195	51,238	51,278	51,321	51,360	51,397
Orange	371,993	371,993	371,993	371,993	372,381	372,738	373,087	373,423	373,724	374,041	374,324
Osceola	112,450	112,450	112,450	112,450	112,552	112,657	112,751	112,846	112,933	113,019	113,103
Palm Beach	363,950	363,950	363,950	363,950	364,194	364,431	364,637	364,867	365,045	365,232	365,410
Pasco	120,471	120,471	120,471	120,471	120,599	120,727	120,844	120,955	121,064	121,167	121,273
Pinellas	206,855	206,855	206,855	206,855	207,113	207,351	207,590	207,823	208,029	208,249	208,427
Polk	197,889	197,889	197,889	197,889	198,075	198,244	198,394	198,553	198,700	198,844	198,977
Sarasota	89,232	89,232	89,232	89,232	89,375	89,509	89,638	89,763	89,878	90,003	90,110
Seminole	102,371	102,371	102,371	102,371	102,463	102,560	102,646	102,727	102,811	102,883	102,954
St. Johns	62,444	62,444	62,444	62,444	62,512	62,570	62,626	62,686	62,736	62,789	62,832
Sumter	21,255	21,255	21,255	21,255	21,296	21,335	21,373	21,411	21,447	21,481	21,514
Volusia	115,611	115,611	115,611	115,611	115,735	115,851	115,967	116,082	116,183	116,290	116,386

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:		
	2/19	2/20	2/21	2/22	2/24	2/26	2/28
Alachua	66,948	66,948	66,948	66,948	67,087 (13,417) [3,220] {1,610}	67,208 (13,442) [3,226] {1,613}	67,320 (13,464) [3,231] {1,616}
Broward	597,048	597,048	597,048	597,048	597,847 (119,569) [28,697] {14,348}	598,518 (119,704) [28,729] {14,364}	599,139 (119,828) [28,759] {14,379}
Charlotte	35,010	35,010	35,010	35,010	35,122 (7,024) [1,686] {843}	35,228 (7,046) [1,691] {845}	35,320 (7,064) [1,695] {848}
Collier	83,659	83,659	83,659	83,659	83,800 (16,760) [4,022] {2,011}	83,931 (16,786) [4,029] {2,014}	84,048 (16,810) [4,034] {2,017}
Duval	251,211	251,211	251,211	251,211	251,626 (50,325) [12,078] {6,039}	251,981 (50,396) [12,095] {6,048}	252,330 (50,466) [12,112] {6,056}
Hillsborough	369,320	369,320	369,320	369,320	370,401 (74,080) [17,779] {8,890}	371,369 (74,274) [17,826] {8,913}	372,328 (74,466) [17,872] {8,936}
Lake	83,879	83,879	83,879	83,879	84,072 (16,814) [4,035] {2,018}	84,236 (16,847) [4,043] {2,022}	84,393 (16,879) [4,051] {2,025}
Lee	188,238	188,238	188,238	188,238	188,606 (37,721) [9,053] {4,527}	188,933 (37,787) [9,069] {4,534}	189,248 (37,850) [9,084] {4,542}
Manatee	94,765	94,765	94,765	94,765	94,955 (18,991) [4,558] {2,279}	95,115 (19,023) [4,565] {2,283}	95,283 (19,057) [4,574] {2,287}
Miami-Dade	1,173,497	1,173,497	1,173,497	1,173,497	1,175,008 (235,002) [56,400] {28,200}	1,176,282 (235,256) [56,462] {28,231}	1,177,516 (235,503) [56,521] {28,260}
Okaloosa	51,097	51,097	51,097	51,097	51,195 (10,239) [2,457] {1,229}	51,278 (10,256) [2,461] {1,231}	51,360 (10,272) [2,465] {1,233}
Orange	371,993	371,993	371,993	371,993	372,738 (74,548) [17,891] {8,946}	373,423 (74,685) [17,924] {8,962}	374,041 (74,808) [17,954] {8,977}
Osceola	112,450	112,450	112,450	112,450	112,657 (22,531) [5,408] {2,704}	112,846 (22,569) [5,417] {2,708}	113,019 (22,604) [5,425] {2,712}
Palm Beach	363,950	363,950	363,950	363,950	364,431 (72,886) [17,493] {8,746}	364,867 (72,973) [17,514] {8,757}	365,232 (73,046) [17,531] {8,766}
Pasco	120,471	120,471	120,471	120,471	120,727 (24,145) [5,795] {2,897}	120,955 (24,191) [5,806] {2,903}	121,167 (24,233) [5,816] {2,908}
Pinellas	206,855	206,855	206,855	206,855	207,351 (41,470) [9,953] {4,976}	207,823 (41,565) [9,976] {4,988}	208,249 (41,650) [9,996] {4,998}
Polk	197,889	197,889	197,889	197,889	198,244 (39,649) [9,516] {4,758}	198,553 (39,711) [9,531] {4,765}	198,844 (39,769) [9,545] {4,772}
Sarasota	89,232	89,232	89,232	89,232	89,509 (17,902) [4,296] {2,148}	89,763 (17,953) [4,309] {2,154}	90,003 (18,001) [4,320] {2,160}
Seminole	102,371	102,371	102,371	102,371	102,560 (20,512) [4,923] {2,461}	102,727 (20,545) [4,931] {2,465}	102,883 (20,577) [4,938] {2,469}
St. Johns	62,444	62,444	62,444	62,444	62,570 (12,514) [3,003] {1,502}	62,686 (12,537) [3,009] {1,504}	62,789 (12,558) [3,014] {1,507}
Sumter	21,255	21,255	21,255	21,255	21,335 (4,267) [1,024] {512}	21,411 (4,282) [1,028] {514}	21,481 (4,296) [1,031] {516}
Volusia	115,611	115,611	115,611	115,611	115,851 (23,170) [5,561] {2,780}	116,082 (23,216) [5,572] {2,786}	116,290 (23,258) [5,582] {2,791}

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.