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

Date: 2/11/22

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 2/11/22 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.

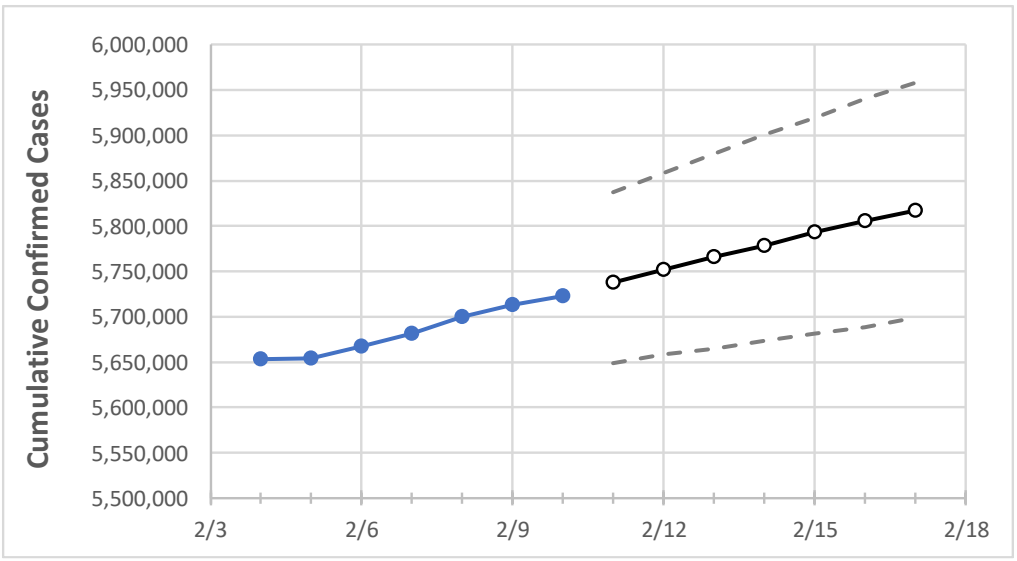
IEM's Modeling Lead

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:						
	2/7	2/8	2/9	2/10	2/11	2/12	2/13	2/14	2/15	2/16	2/17
Florida	5,680,958	5,700,264	5,713,185	5,723,066	5,737,385	5,751,922	5,765,745	5,778,207	5,793,082	5,805,587	5,817,278

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:						
	2/7	2/8	2/9	2/10	2/11	2/12	2/13	2/14	2/15	2/16	2/17
Alachua	64,760	64,760	64,760	64,760	65,002	65,232	65,453	65,661	65,873	66,064	66,254
Broward	584,108	584,108	584,108	584,108	584,808	585,481	586,109	586,709	587,300	587,843	588,372
Charlotte	33,494	33,494	33,494	33,494	33,632	33,767	33,898	34,026	34,153	34,274	34,394
Collier	81,750	81,750	81,750	81,750	81,938	82,123	82,300	82,474	82,641	82,802	82,960
Duval	244,427	244,427	244,427	244,427	245,122	245,790	246,424	247,061	247,650	248,237	248,789
Hillsborough	356,575	356,575	356,575	356,575	357,424	358,283	359,068	359,865	360,625	361,351	362,040
Lake	81,099	81,099	81,099	81,099	81,367	81,625	81,877	82,123	82,362	82,593	82,812
Lee	182,945	182,945	182,945	182,945	183,452	183,934	184,400	184,855	185,299	185,725	186,133
Manatee	91,723	91,723	91,723	91,723	92,052	92,373	92,682	92,993	93,288	93,577	93,864
Miami-Dade	1,144,618	1,144,618	1,144,618	1,144,618	1,146,068	1,147,417	1,148,750	1,149,941	1,151,138	1,152,275	1,153,358
Okaloosa	49,537	49,537	49,537	49,537	49,723	49,907	50,079	50,251	50,417	50,576	50,733
Orange	361,276	361,276	361,276	361,276	362,026	362,772	363,478	364,153	364,806	365,458	366,060
Osceola	109,897	109,897	109,897	109,897	110,092	110,266	110,441	110,614	110,766	110,923	111,071
Palm Beach	356,472	356,472	356,472	356,472	357,013	357,546	358,074	358,541	359,012	359,481	359,884
Pasco	116,429	116,429	116,429	116,429	116,834	117,206	117,568	117,922	118,272	118,608	118,935
Pinellas	199,851	199,851	199,851	199,851	200,444	201,022	201,576	202,116	202,650	203,152	203,633
Polk	192,230	192,230	192,230	192,230	192,766	193,293	193,789	194,278	194,744	195,209	195,648
Sarasota	85,657	85,657	85,657	85,657	86,062	86,460	86,849	87,237	87,613	87,987	88,355
Seminole	99,459	99,459	99,459	99,459	99,746	100,019	100,288	100,539	100,782	101,023	101,257
St. Johns	60,125	60,125	60,125	60,125	60,412	60,692	60,966	61,228	61,495	61,749	61,997
Sumter	20,336	20,336	20,336	20,336	20,424	20,508	20,594	20,676	20,756	20,836	20,915
Volusia	111,722	111,722	111,722	111,722	112,099	112,460	112,812	113,153	113,479	113,807	114,112

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:		
	2/7	2/8	2/9	2/10	2/12	2/14	2/16
Alachua	64,760	64,760	64,760	64,760	65,232 (13,046) [3,131] {1,566}	65,661 (13,132) [3,152] {1,576}	66,064 (13,213) [3,171] {1,586}
Broward	584,108	584,108	584,108	584,108	585,481 (117,096) [28,103] {14,052}	586,709 (117,342) [28,162] {14,081}	587,843 (117,569) [28,216] {14,108}
Charlotte	33,494	33,494	33,494	33,494	33,767 (6,753) [1,621] {810}	34,026 (6,805) [1,633] {817}	34,274 (6,855) [1,645] {823}
Collier	81,750	81,750	81,750	81,750	82,123 (16,425) [3,942] {1,971}	82,474 (16,495) [3,959] {1,979}	82,802 (16,560) [3,974] {1,987}
Duval	244,427	244,427	244,427	244,427	245,790 (49,158) [11,798] {5,899}	247,061 (49,412) [11,859] {5,929}	248,237 (49,647) [11,915] {5,958}
Hillsborough	356,575	356,575	356,575	356,575	358,283 (71,657) [17,198] {8,599}	359,865 (71,973) [17,274] {8,637}	361,351 (72,270) [17,345] {8,672}
Lake	81,099	81,099	81,099	81,099	81,625 (16,325) [3,918] {1,959}	82,123 (16,425) [3,942] {1,971}	82,593 (16,519) [3,964] {1,982}
Lee	182,945	182,945	182,945	182,945	183,934 (36,787) [8,829] {4,414}	184,855 (36,971) [8,873] {4,437}	185,725 (37,145) [8,915] {4,457}
Manatee	91,723	91,723	91,723	91,723	92,373 (18,475) [4,434] {2,217}	92,993 (18,599) [4,464] {2,232}	93,577 (18,715) [4,492] {2,246}
Miami-Dade	1,144,618	1,144,618	1,144,618	1,144,618	1,147,417 (229,483) [55,076] {27,538}	1,149,941 (229,988) [55,197] {27,599}	1,152,275 (230,455) [55,309] {27,655}
Okaloosa	49,537	49,537	49,537	49,537	49,907 (9,981) [2,396] {1,198}	50,251 (10,050) [2,412] {1,206}	50,576 (10,115) [2,428] {1,214}
Orange	361,276	361,276	361,276	361,276	362,772 (72,554) [17,413] {8,707}	364,153 (72,831) [17,479] {8,740}	365,458 (73,092) [17,542] {8,771}
Osceola	109,897	109,897	109,897	109,897	110,266 (22,053) [5,293] {2,646}	110,614 (22,123) [5,309] {2,655}	110,923 (22,185) [5,324] {2,662}
Palm Beach	356,472	356,472	356,472	356,472	357,546 (71,509) [17,162] {8,581}	358,541 (71,708) [17,210] {8,605}	359,481 (71,896) [17,255] {8,628}
Pasco	116,429	116,429	116,429	116,429	117,206 (23,441) [5,626] {2,813}	117,922 (23,584) [5,660] {2,830}	118,608 (23,722) [5,693] {2,847}
Pinellas	199,851	199,851	199,851	199,851	201,022 (40,204) [9,649] {4,825}	202,116 (40,423) [9,702] {4,851}	203,152 (40,630) [9,751] {4,876}
Polk	192,230	192,230	192,230	192,230	193,293 (38,659) [9,278] {4,639}	194,278 (38,856) [9,325] {4,663}	195,209 (39,042) [9,370] {4,685}
Sarasota	85,657	85,657	85,657	85,657	86,460 (17,292) [4,150] {2,075}	87,237 (17,447) [4,187] {2,094}	87,987 (17,597) [4,223] {2,112}
Seminole	99,459	99,459	99,459	99,459	100,019 (20,004) [4,801] {2,400}	100,539 (20,108) [4,826] {2,413}	101,023 (20,205) [4,849] {2,425}
St. Johns	60,125	60,125	60,125	60,125	60,692 (12,138) [2,913] {1,457}	61,228 (12,246) [2,939] {1,469}	61,749 (12,350) [2,964] {1,482}
Sumter	20,336	20,336	20,336	20,336	20,508 (4,102) [984] {492}	20,676 (4,135) [992] {496}	20,836 (4,167) [1,000] {500}
Volusia	111,722	111,722	111,722	111,722	112,460 (22,492) [5,398] {2,699}	113,153 (22,631) [5,431] {2,716}	113,807 (22,761) [5,463] {2,731}

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.