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

Date: 1/7/22

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 1/7/22 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.

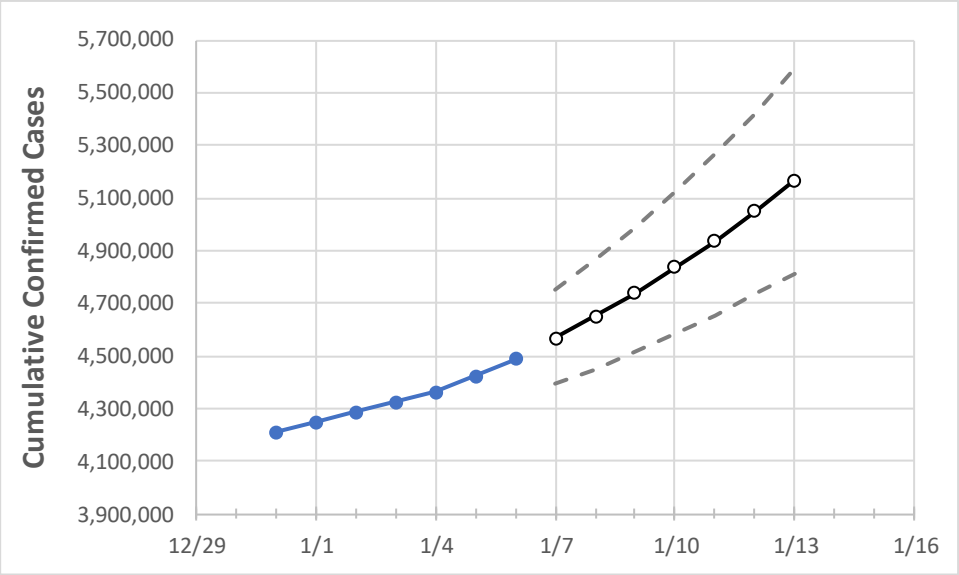
IEM's Modeling Lead

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:						
	1/3	1/4	1/5	1/6	1/7	1/8	1/9	1/10	1/11	1/12	1/13
Florida	4,322,615	4,360,178	4,423,227	4,486,276	4,565,658	4,649,069	4,739,254	4,836,180	4,936,815	5,049,307	5,168,140

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:						
	1/3	1/4	1/5	1/6	1/7	1/8	1/9	1/10	1/11	1/12	1/13
Alachua	43,595	43,595	43,595	43,595	44,206	44,865	45,560	46,317	47,123	47,996	48,921
Broward	442,977	442,977	442,977	442,977	456,179	470,053	484,385	499,559	515,906	533,078	551,089
Charlotte	24,996	24,996	24,996	24,996	25,163	25,336	25,520	25,716	25,921	26,139	26,376
Collier	63,519	63,519	63,519	63,519	64,338	65,204	66,125	67,125	68,187	69,318	70,528
Duval	178,482	178,482	178,482	178,482	181,114	183,969	187,038	190,347	193,877	197,826	201,993
Hillsborough	269,732	269,732	269,732	269,732	274,141	278,874	283,933	289,299	295,098	301,255	307,939
Lake	60,138	60,138	60,138	60,138	60,957	61,856	62,794	63,805	64,876	66,071	67,288
Lee	137,699	137,699	137,699	137,699	139,451	141,307	143,294	145,435	147,725	150,178	152,825
Manatee	70,594	70,594	70,594	70,594	71,429	72,329	73,286	74,333	75,452	76,652	77,943
Miami-Dade	854,670	854,670	854,670	854,670	879,792	905,594	932,208	960,659	989,605	########	########
Okaloosa	36,397	36,397	36,397	36,397	36,636	36,892	37,161	37,454	37,762	38,104	38,461
Orange	263,427	263,427	263,427	263,427	269,786	276,614	283,908	291,631	300,027	308,946	318,555
Osceola	81,952	81,952	81,952	81,952	83,670	85,525	87,463	89,563	91,792	94,169	96,695
Palm Beach	270,915	270,915	270,915	270,915	277,928	285,465	293,382	301,853	310,859	320,424	330,429
Pasco	85,590	85,590	85,590	85,590	86,563	87,620	88,739	89,932	91,218	92,610	94,094
Pinellas	147,850	147,850	147,850	147,850	149,829	151,936	154,209	156,655	159,241	162,056	165,087
Polk	140,899	140,899	140,899	140,899	143,256	145,704	148,374	151,260	154,366	157,678	161,199
Sarasota	62,021	62,021	62,021	62,021	62,790	63,626	64,502	65,455	66,482	67,573	68,720
Seminole	71,274	71,274	71,274	71,274	72,891	74,581	76,444	78,391	80,538	82,809	85,192
St. Johns	44,321	44,321	44,321	44,321	44,843	45,392	45,987	46,627	47,308	48,051	48,829
Sumter	15,516	15,516	15,516	15,516	15,622	15,737	15,853	15,985	16,122	16,270	16,434
Volusia	83,732	83,732	83,732	83,732	84,882	86,140	87,461	88,903	90,447	92,095	93,900

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:		
	1/3	1/4	1/5	1/6	1/8	1/10	1/12
Alachua	43,595	43,595	43,595	43,595	44,865 (8,973) [2,153] {1,077}	46,317 (9,263) [2,223] {1,112}	47,996 (9,599) [2,304] {1,152}
Broward	442,977	442,977	442,977	442,977	470,053 (94,011) [22,563] {11,281}	499,559 (99,912) [23,979] {11,989}	533,078 (106,616) [25,588] {12,794}
Charlotte	24,996	24,996	24,996	24,996	25,336 (5,067) [1,216] {608}	25,716 (5,143) [1,234] {617}	26,139 (5,228) [1,255] {627}
Collier	63,519	63,519	63,519	63,519	65,204 (13,041) [3,130] {1,565}	67,125 (13,425) [3,222] {1,611}	69,318 (13,864) [3,327] {1,664}
Duval	178,482	178,482	178,482	178,482	183,969 (36,794) [8,830] {4,415}	190,347 (38,069) [9,137] {4,568}	197,826 (39,565) [9,496] {4,748}
Hillsborough	269,732	269,732	269,732	269,732	278,874 (55,775) [13,386] {6,693}	289,299 (57,860) [13,886] {6,943}	301,255 (60,251) [14,460] {7,230}
Lake	60,138	60,138	60,138	60,138	61,856 (12,371) [2,969] {1,485}	63,805 (12,761) [3,063] {1,531}	66,071 (13,214) [3,171] {1,586}
Lee	137,699	137,699	137,699	137,699	141,307 (28,261) [6,783] {3,391}	145,435 (29,087) [6,981] {3,490}	150,178 (30,036) [7,209] {3,604}
Manatee	70,594	70,594	70,594	70,594	72,329 (14,466) [3,472] {1,736}	74,333 (14,867) [3,568] {1,784}	76,652 (15,330) [3,679] {1,840}
Miami-Dade	854,670	854,670	854,670	854,670	905,594 (181,119) [43,469] {21,734}	960,659 (192,132) [46,112] {23,056}	1,020,212 (204,042) [48,970] {24,485}
Okaloosa	36,397	36,397	36,397	36,397	36,892 (7,378) [1,771] {885}	37,454 (7,491) [1,798] {899}	38,104 (7,621) [1,829] {915}
Orange	263,427	263,427	263,427	263,427	276,614 (55,323) [13,277] {6,639}	291,631 (58,326) [13,998] {6,999}	308,946 (61,789) [14,829] {7,415}
Osceola	81,952	81,952	81,952	81,952	85,525 (17,105) [4,105] {2,053}	89,563 (17,913) [4,299] {2,150}	94,169 (18,834) [4,520] {2,260}
Palm Beach	270,915	270,915	270,915	270,915	285,465 (57,093) [13,702] {6,851}	301,853 (60,371) [14,489] {7,244}	320,424 (64,085) [15,380] {7,690}
Pasco	85,590	85,590	85,590	85,590	87,620 (17,524) [4,206] {2,103}	89,932 (17,986) [4,317] {2,158}	92,610 (18,522) [4,445] {2,223}
Pinellas	147,850	147,850	147,850	147,850	151,936 (30,387) [7,293] {3,646}	156,655 (31,331) [7,519] {3,760}	162,056 (32,411) [7,779] {3,889}
Polk	140,899	140,899	140,899	140,899	145,704 (29,141) [6,994] {3,497}	151,260 (30,252) [7,260] {3,630}	157,678 (31,536) [7,569] {3,784}
Sarasota	62,021	62,021	62,021	62,021	63,626 (12,725) [3,054] {1,527}	65,455 (13,091) [3,142] {1,571}	67,573 (13,515) [3,244] {1,622}
Seminole	71,274	71,274	71,274	71,274	74,581 (14,916) [3,580] {1,790}	78,391 (15,678) [3,763] {1,881}	82,809 (16,562) [3,975] {1,987}
St. Johns	44,321	44,321	44,321	44,321	45,392 (9,078) [2,179] {1,089}	46,627 (9,325) [2,238] {1,119}	48,051 (9,610) [2,306] {1,153}
Sumter	15,516	15,516	15,516	15,516	15,737 (3,147) [755] {378}	15,985 (3,197) [767] {384}	16,270 (3,254) [781] {390}
Volusia	83,732	83,732	83,732	83,732	86,140 (17,228) [4,135] {2,067}	88,903 (17,781) [4,267] {2,134}	92,095 (18,419) [4,421] {2,210}

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.