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

Date: 7/28/21

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 7/28/21 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.

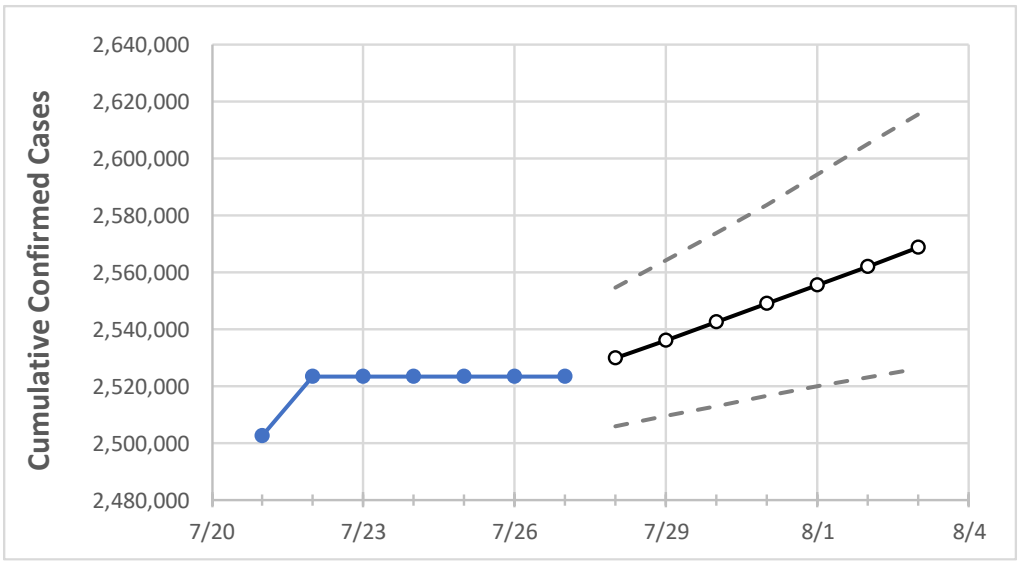
IEM's Modeling Lead

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:						
	7/24	7/25	7/26	7/27	7/28	7/29	7/30	7/31	8/1	8/2	8/3
Florida	2,523,510	2,523,510	2,523,510	2,523,510	2,529,763	2,536,069	2,542,443	2,548,905	2,555,478	2,562,115	2,568,790

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:						
	7/24	7/25	7/26	7/27	7/28	7/29	7/30	7/31	8/1	8/2	8/3
Alachua	26,999	26,999	26,999	26,999	27,055	27,114	27,172	27,231	27,288	27,350	27,412
Broward	262,319	262,319	262,319	262,319	262,846	263,370	263,893	264,419	264,950	265,477	265,999
Charlotte	14,279	14,279	14,279	14,279	14,308	14,338	14,368	14,399	14,431	14,463	14,495
Collier	39,914	39,914	39,914	39,914	39,989	40,065	40,140	40,216	40,288	40,360	40,430
Duval	117,661	117,661	117,661	117,661	118,242	118,819	119,410	120,002	120,580	121,170	121,764
Hillsborough	156,969	156,969	156,969	156,969	157,451	157,930	158,405	158,898	159,407	159,900	160,384
Lake	34,252	34,252	34,252	34,252	34,351	34,450	34,550	34,651	34,754	34,855	34,961
Lee	78,540	78,540	78,540	78,540	78,686	78,834	78,980	79,130	79,278	79,428	79,584
Manatee	42,482	42,482	42,482	42,482	42,566	42,649	42,735	42,819	42,905	42,991	43,078
Miami-Dade	533,821	533,821	533,821	533,821	534,788	535,802	536,771	537,737	538,719	539,727	540,695
Okaloosa	22,219	22,219	22,219	22,219	22,258	22,298	22,338	22,379	22,420	22,460	22,501
Orange	157,801	157,801	157,801	157,801	158,259	158,722	159,188	159,661	160,130	160,601	161,062
Osceola	50,668	50,668	50,668	50,668	50,800	50,930	51,059	51,190	51,323	51,455	51,585
Palm Beach	159,598	159,598	159,598	159,598	159,936	160,280	160,620	160,968	161,313	161,661	162,004
Pasco	46,702	46,702	46,702	46,702	46,843	46,979	47,121	47,264	47,409	47,554	47,708
Pinellas	87,572	87,572	87,572	87,572	87,803	88,035	88,271	88,519	88,772	89,041	89,298
Polk	77,504	77,504	77,504	77,504	77,718	77,942	78,162	78,383	78,613	78,841	79,065
Sarasota	35,856	35,856	35,856	35,856	35,940	36,025	36,108	36,196	36,284	36,371	36,460
Seminole	39,931	39,931	39,931	39,931	40,071	40,211	40,350	40,486	40,626	40,765	40,905
St. Johns	26,592	26,592	26,592	26,592	26,701	26,810	26,924	27,037	27,147	27,259	27,370
Sumter	10,086	10,086	10,086	10,086	10,103	10,119	10,136	10,152	10,169	10,185	10,202
Volusia	50,476	50,476	50,476	50,476	50,671	50,863	51,055	51,250	51,452	51,654	51,854

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:		
	7/24	7/25	7/26	7/27	7/29	7/31	8/2
Alachua	26,999	26,999	26,999	26,999	27,114 (5,423) [1,301] {651}	27,231 (5,446) [1,307] {654}	27,350 (5,470) [1,313] {656}
Broward	262,319	262,319	262,319	262,319	263,370 (52,674) [12,642] {6,321}	264,419 (52,884) [12,692] {6,346}	265,477 (53,095) [12,743] {6,371}
Charlotte	14,279	14,279	14,279	14,279	14,338 (2,868) [688] {344}	14,399 (2,880) [691] {346}	14,463 (2,893) [694] {347}
Collier	39,914	39,914	39,914	39,914	40,065 (8,013) [1,923] {962}	40,216 (8,043) [1,930] {965}	40,360 (8,072) [1,937] {969}
Duval	117,661	117,661	117,661	117,661	118,819 (23,764) [5,703] {2,852}	120,002 (24,000) [5,760] {2,880}	121,170 (24,234) [5,816] {2,908}
Hillsborough	156,969	156,969	156,969	156,969	157,930 (31,586) [7,581] {3,790}	158,898 (31,780) [7,627] {3,814}	159,900 (31,980) [7,675] {3,838}
Lake	34,252	34,252	34,252	34,252	34,450 (6,890) [1,654] {827}	34,651 (6,930) [1,663] {832}	34,855 (6,971) [1,673] {837}
Lee	78,540	78,540	78,540	78,540	78,834 (15,767) [3,784] {1,892}	79,130 (15,826) [3,798] {1,899}	79,428 (15,886) [3,813] {1,906}
Manatee	42,482	42,482	42,482	42,482	42,649 (8,530) [2,047] {1,024}	42,819 (8,564) [2,055] {1,028}	42,991 (8,598) [2,064] {1,032}
Miami-Dade	533,821	533,821	533,821	533,821	535,802 (107,160) [25,719] {12,859}	537,737 (107,547) [25,811] {12,906}	539,727 (107,945) [25,907] {12,953}
Okaloosa	22,219	22,219	22,219	22,219	22,298 (4,460) [1,070] {535}	22,379 (4,476) [1,074] {537}	22,460 (4,492) [1,078] {539}
Orange	157,801	157,801	157,801	157,801	158,722 (31,744) [7,619] {3,809}	159,661 (31,932) [7,664] {3,832}	160,601 (32,120) [7,709] {3,854}
Osceola	50,668	50,668	50,668	50,668	50,930 (10,186) [2,445] {1,222}	51,190 (10,238) [2,457] {1,229}	51,455 (10,291) [2,470] {1,235}
Palm Beach	159,598	159,598	159,598	159,598	160,280 (32,056) [7,693] {3,847}	160,968 (32,194) [7,726] {3,863}	161,661 (32,332) [7,760] {3,880}
Pasco	46,702	46,702	46,702	46,702	46,979 (9,396) [2,255] {1,128}	47,264 (9,453) [2,269] {1,134}	47,554 (9,511) [2,283] {1,141}
Pinellas	87,572	87,572	87,572	87,572	88,035 (17,607) [4,226] {2,113}	88,519 (17,704) [4,249] {2,124}	89,041 (17,808) [4,274] {2,137}
Polk	77,504	77,504	77,504	77,504	77,942 (15,588) [3,741] {1,871}	78,383 (15,677) [3,762] {1,881}	78,841 (15,768) [3,784] {1,892}
Sarasota	35,856	35,856	35,856	35,856	36,025 (7,205) [1,729] {865}	36,196 (7,239) [1,737] {869}	36,371 (7,274) [1,746] {873}
Seminole	39,931	39,931	39,931	39,931	40,211 (8,042) [1,930] {965}	40,486 (8,097) [1,943] {972}	40,765 (8,153) [1,957] {978}
St. Johns	26,592	26,592	26,592	26,592	26,810 (5,362) [1,287] {643}	27,037 (5,407) [1,298] {649}	27,259 (5,452) [1,308] {654}
Sumter	10,086	10,086	10,086	10,086	10,119 (2,024) [486] {243}	10,152 (2,030) [487] {244}	10,185 (2,037) [489] {244}
Volusia	50,476	50,476	50,476	50,476	50,863 (10,173) [2,441] {1,221}	51,250 (10,250) [2,460] {1,230}	51,654 (10,331) [2,479] {1,240}

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.