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

Date: 4/23/21

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 4/23/21 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.

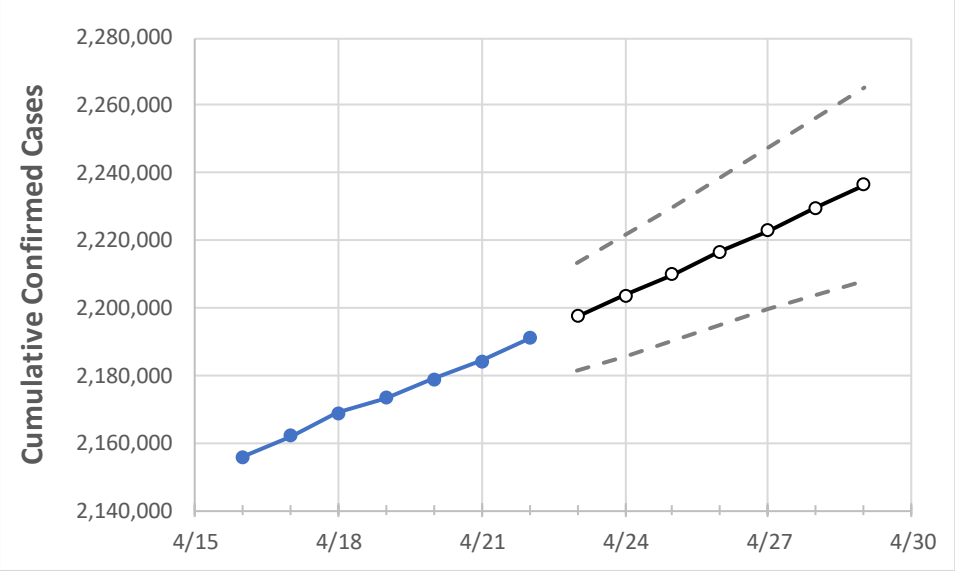
IEM's Modeling Lead

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:						
	4/19	4/20	4/21	4/22	4/23	4/24	4/25	4/26	4/27	4/28	4/29
Florida	2,173,138	2,178,783	2,184,354	2,191,038	2,197,370	2,203,763	2,210,050	2,216,574	2,223,039	2,229,676	2,236,371

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:						
	4/19	4/20	4/21	4/22	4/23	4/24	4/25	4/26	4/27	4/28	4/29
Alachua	24,184	24,234	24,279	24,340	24,387	24,433	24,481	24,528	24,577	24,627	24,676
Broward	229,073	229,641	230,312	231,050	231,757	232,471	233,179	233,890	234,608	235,314	236,025
Charlotte	12,358	12,391	12,426	12,463	12,496	12,530	12,563	12,595	12,627	12,657	12,689
Collier	34,370	34,447	34,546	34,634	34,726	34,817	34,909	35,002	35,093	35,183	35,274
Duval	95,425	95,569	95,738	95,943	96,128	96,317	96,511	96,709	96,910	97,111	97,315
Hillsborough	130,329	130,797	131,199	131,831	132,332	132,832	133,344	133,855	134,383	134,924	135,453
Lake	28,379	28,465	28,542	28,645	28,745	28,846	28,946	29,049	29,153	29,261	29,367
Lee	66,760	66,959	67,153	67,407	67,647	67,891	68,142	68,394	68,649	68,909	69,169
Manatee	36,938	37,088	37,193	37,304	37,423	37,548	37,671	37,793	37,920	38,047	38,176
Miami-Dade	471,595	472,941	474,069	475,231	476,591	477,991	479,338	480,699	482,070	483,460	484,841
Okaloosa	20,168	20,193	20,215	20,246	20,277	20,308	20,340	20,373	20,405	20,439	20,474
Orange	132,053	132,355	132,716	133,211	133,657	134,101	134,551	135,009	135,451	135,897	136,354
Osceola	42,430	42,584	42,717	42,927	43,109	43,297	43,484	43,681	43,879	44,077	44,282
Palm Beach	139,199	139,479	139,846	140,374	140,764	141,161	141,559	141,960	142,353	142,746	143,139
Pasco	39,145	39,315	39,466	39,628	39,795	39,968	40,142	40,315	40,495	40,674	40,853
Pinellas	76,792	76,960	77,141	77,394	77,615	77,836	78,052	78,269	78,485	78,696	78,904
Polk	65,084	65,317	65,521	65,791	66,053	66,318	66,588	66,861	67,144	67,427	67,722
Sarasota	31,472	31,567	31,673	31,771	31,884	31,996	32,109	32,223	32,338	32,451	32,565
Seminole	32,403	32,597	32,698	32,858	33,013	33,171	33,328	33,485	33,648	33,817	33,988
St. Johns	21,976	22,015	22,076	22,131	22,176	22,222	22,268	22,314	22,359	22,402	22,448
Sumter	9,101	9,116	9,136	9,163	9,177	9,191	9,205	9,218	9,231	9,246	9,258
Volusia	41,346	41,500	41,652	41,814	41,974	42,137	42,300	42,461	42,622	42,782	42,942

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:		
	4/19	4/20	4/21	4/22	4/24	4/26	4/28
Alachua	24,184	24,234	24,279	24,340	24,433 (4,887) [1,173] {586}	24,528 (4,906) [1,177] {589}	24,627 (4,925) [1,182] {591}
Broward	229,073	229,641	230,312	231,050	232,471 (46,494) [11,159] {5,579}	233,890 (46,778) [11,227] {5,613}	235,314 (47,063) [11,295] {5,648}
Charlotte	12,358	12,391	12,426	12,463	12,530 (2,506) [601] {301}	12,595 (2,519) [605] {302}	12,657 (2,531) [608] {304}
Collier	34,370	34,447	34,546	34,634	34,817 (6,963) [1,671] {836}	35,002 (7,000) [1,680] {840}	35,183 (7,037) [1,689] {844}
Duval	95,425	95,569	95,738	95,943	96,317 (19,263) [4,623] {2,312}	96,709 (19,342) [4,642] {2,321}	97,111 (19,422) [4,661] {2,331}
Hillsborough	130,329	130,797	131,199	131,831	132,832 (26,566) [6,376] {3,188}	133,855 (26,771) [6,425] {3,213}	134,924 (26,985) [6,476] {3,238}
Lake	28,379	28,465	28,542	28,645	28,846 (5,769) [1,385] {692}	29,049 (5,810) [1,394] {697}	29,261 (5,852) [1,405] {702}
Lee	66,760	66,959	67,153	67,407	67,891 (13,578) [3,259] {1,629}	68,394 (13,679) [3,283] {1,641}	68,909 (13,782) [3,308] {1,654}
Manatee	36,938	37,088	37,193	37,304	37,548 (7,510) [1,802] {901}	37,793 (7,559) [1,814] {907}	38,047 (7,609) [1,826] {913}
Miami-Dade	471,595	472,941	474,069	475,231	477,991 (95,598) [22,944] {11,472}	480,699 (96,140) [23,074] {11,537}	483,460 (96,692) [23,206] {11,603}
Okaloosa	20,168	20,193	20,215	20,246	20,308 (4,062) [975] {487}	20,373 (4,075) [978] {489}	20,439 (4,088) [981] {491}
Orange	132,053	132,355	132,716	133,211	134,101 (26,820) [6,437] {3,218}	135,009 (27,002) [6,480] {3,240}	135,897 (27,179) [6,523] {3,262}
Osceola	42,430	42,584	42,717	42,927	43,297 (8,659) [2,078] {1,039}	43,681 (8,736) [2,097] {1,048}	44,077 (8,815) [2,116] {1,058}
Palm Beach	139,199	139,479	139,846	140,374	141,161 (28,232) [6,776] {3,388}	141,960 (28,392) [6,814] {3,407}	142,746 (28,549) [6,852] {3,426}
Pasco	39,145	39,315	39,466	39,628	39,968 (7,994) [1,918] {959}	40,315 (8,063) [1,935] {968}	40,674 (8,135) [1,952] {976}
Pinellas	76,792	76,960	77,141	77,394	77,836 (15,567) [3,736] {1,868}	78,269 (15,654) [3,757] {1,878}	78,696 (15,739) [3,777] {1,889}
Polk	65,084	65,317	65,521	65,791	66,318 (13,264) [3,183] {1,592}	66,861 (13,372) [3,209] {1,605}	67,427 (13,485) [3,237] {1,618}
Sarasota	31,472	31,567	31,673	31,771	31,996 (6,399) [1,536] {768}	32,223 (6,445) [1,547] {773}	32,451 (6,490) [1,558] {779}
Seminole	32,403	32,597	32,698	32,858	33,171 (6,634) [1,592] {796}	33,485 (6,697) [1,607] {804}	33,817 (6,763) [1,623] {812}
St. Johns	21,976	22,015	22,076	22,131	22,222 (4,444) [1,067] {533}	22,314 (4,463) [1,071] {536}	22,402 (4,480) [1,075] {538}
Sumter	9,101	9,116	9,136	9,163	9,191 (1,838) [441] {221}	9,218 (1,844) [442] {221}	9,246 (1,849) [444] {222}
Volusia	41,346	41,500	41,652	41,814	42,137 (8,427) [2,023] {1,011}	42,461 (8,492) [2,038] {1,019}	42,782 (8,556) [2,054] {1,027}

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.