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

Date: 7/19/21

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 7/19/21 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.

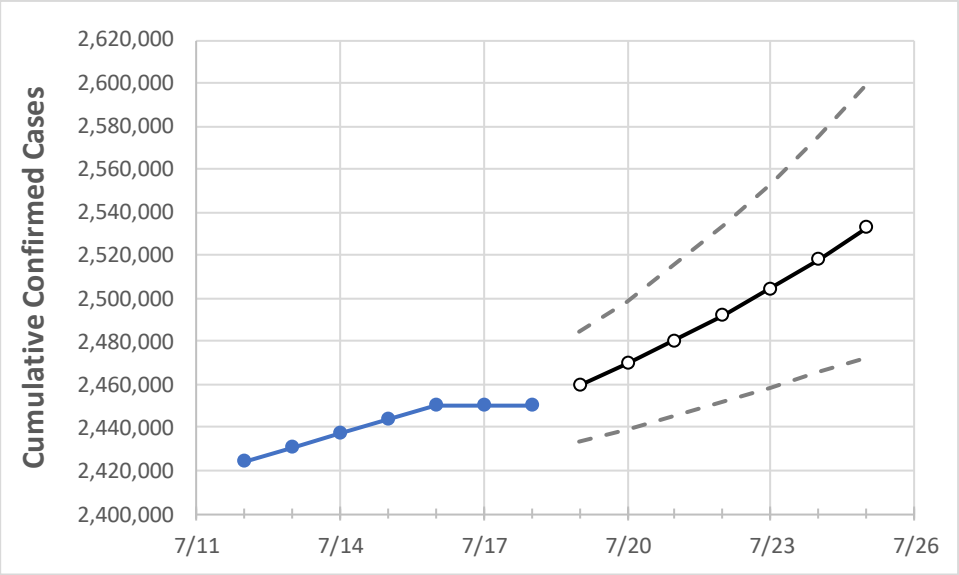
IEM's Modeling Lead

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:						
	7/15	7/16	7/17	7/18	7/19	7/20	7/21	7/22	7/23	7/24	7/25
Florida	2,443,851	2,450,344	2,450,344	2,450,344	2,459,717	2,469,785	2,480,651	2,492,216	2,504,696	2,518,129	2,532,881

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:						
	7/15	7/16	7/17	7/18	7/19	7/20	7/21	7/22	7/23	7/24	7/25
Alachua	26,284	26,337	26,337	26,337	26,417	26,505	26,603	26,711	26,829	26,958	27,101
Broward	255,717	256,264	256,264	256,264	257,022	257,833	258,690	259,613	260,600	261,657	262,767
Charlotte	13,930	13,953	13,953	13,953	13,984	14,017	14,052	14,090	14,131	14,173	14,218
Collier	38,954	39,048	39,048	39,048	39,177	39,315	39,462	39,617	39,782	39,956	40,147
Duval	110,602	111,236	111,236	111,236	112,181	113,214	114,330	115,561	116,863	118,279	119,830
Hillsborough	151,238	151,661	151,661	151,661	152,245	152,875	153,536	154,258	155,035	155,859	156,763
Lake	32,983	33,087	33,087	33,087	33,229	33,382	33,547	33,724	33,915	34,113	34,328
Lee	76,749	76,894	76,894	76,894	77,087	77,294	77,516	77,753	78,006	78,277	78,559
Manatee	41,397	41,491	41,491	41,491	41,636	41,793	41,965	42,155	42,360	42,588	42,841
Miami-Dade	521,738	522,734	522,734	522,734	524,073	525,468	526,963	528,533	530,195	531,933	533,775
Okaloosa	21,721	21,761	21,761	21,761	21,812	21,867	21,925	21,985	22,050	22,118	22,191
Orange	151,927	152,450	152,450	152,450	153,209	154,034	154,945	155,930	156,973	158,113	159,339
Osceola	49,048	49,191	49,191	49,191	49,387	49,600	49,821	50,059	50,313	50,579	50,871
Palm Beach	155,262	155,617	155,617	155,617	156,105	156,642	157,209	157,810	158,463	159,167	159,935
Pasco	44,940	45,066	45,066	45,066	45,257	45,461	45,689	45,931	46,203	46,489	46,807
Pinellas	84,704	84,898	84,898	84,898	85,179	85,490	85,823	86,185	86,575	87,005	87,475
Polk	74,882	75,088	75,088	75,088	75,377	75,683	76,022	76,380	76,763	77,182	77,629
Sarasota	34,891	34,963	34,963	34,963	35,073	35,195	35,325	35,465	35,625	35,795	35,984
Seminole	38,195	38,352	38,352	38,352	38,572	38,808	39,060	39,333	39,629	39,946	40,281
St. Johns	25,210	25,313	25,313	25,313	25,448	25,589	25,743	25,906	26,078	26,261	26,454
Sumter	9,870	9,889	9,889	9,889	9,914	9,941	9,969	9,999	10,031	10,063	10,099
Volusia	48,114	48,307	48,307	48,307	48,600	48,918	49,264	49,628	50,031	50,462	50,944

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:		
	7/15	7/16	7/17	7/18	7/20	7/22	7/24
Alachua	26,284	26,337	26,337	26,337	26,505 (5,301) [1,272] {636}	26,711 (5,342) [1,282] {641}	26,958 (5,392) [1,294] {647}
Broward	255,717	256,264	256,264	256,264	257,833 (51,567) [12,376] {6,188}	259,613 (51,923) [12,461] {6,231}	261,657 (52,331) [12,560] {6,280}
Charlotte	13,930	13,953	13,953	13,953	14,017 (2,803) [673] {336}	14,090 (2,818) [676] {338}	14,173 (2,835) [680] {340}
Collier	38,954	39,048	39,048	39,048	39,315 (7,863) [1,887] {944}	39,617 (7,923) [1,902] {951}	39,956 (7,991) [1,918] {959}
Duval	110,602	111,236	111,236	111,236	113,214 (22,643) [5,434] {2,717}	115,561 (23,112) [5,547] {2,773}	118,279 (23,656) [5,677] {2,839}
Hillsborough	151,238	151,661	151,661	151,661	152,875 (30,575) [7,338] {3,669}	154,258 (30,852) [7,404] {3,702}	155,859 (31,172) [7,481] {3,741}
Lake	32,983	33,087	33,087	33,087	33,382 (6,676) [1,602] {801}	33,724 (6,745) [1,619] {809}	34,113 (6,823) [1,637] {819}
Lee	76,749	76,894	76,894	76,894	77,294 (15,459) [3,710] {1,855}	77,753 (15,551) [3,732] {1,866}	78,277 (15,655) [3,757] {1,879}
Manatee	41,397	41,491	41,491	41,491	41,793 (8,359) [2,006] {1,003}	42,155 (8,431) [2,023] {1,012}	42,588 (8,518) [2,044] {1,022}
Miami-Dade	521,738	522,734	522,734	522,734	525,468 (105,094) [25,222] {12,611}	528,533 (105,707) [25,370] {12,685}	531,933 (106,387) [25,533] {12,766}
Okaloosa	21,721	21,761	21,761	21,761	21,867 (4,373) [1,050] {525}	21,985 (4,397) [1,055] {528}	22,118 (4,424) [1,062] {531}
Orange	151,927	152,450	152,450	152,450	154,034 (30,807) [7,394] {3,697}	155,930 (31,186) [7,485] {3,742}	158,113 (31,623) [7,589] {3,795}
Osceola	49,048	49,191	49,191	49,191	49,600 (9,920) [2,381] {1,190}	50,059 (10,012) [2,403] {1,201}	50,579 (10,116) [2,428] {1,214}
Palm Beach	155,262	155,617	155,617	155,617	156,642 (31,328) [7,519] {3,759}	157,810 (31,562) [7,575] {3,787}	159,167 (31,833) [7,640] {3,820}
Pasco	44,940	45,066	45,066	45,066	45,461 (9,092) [2,182] {1,091}	45,931 (9,186) [2,205] {1,102}	46,489 (9,298) [2,231] {1,116}
Pinellas	84,704	84,898	84,898	84,898	85,490 (17,098) [4,104] {2,052}	86,185 (17,237) [4,137] {2,068}	87,005 (17,401) [4,176] {2,088}
Polk	74,882	75,088	75,088	75,088	75,683 (15,137) [3,633] {1,816}	76,380 (15,276) [3,666] {1,833}	77,182 (15,436) [3,705] {1,852}
Sarasota	34,891	34,963	34,963	34,963	35,195 (7,039) [1,689] {845}	35,465 (7,093) [1,702] {851}	35,795 (7,159) [1,718] {859}
Seminole	38,195	38,352	38,352	38,352	38,808 (7,762) [1,863] {931}	39,333 (7,867) [1,888] {944}	39,946 (7,989) [1,917] {959}
St. Johns	25,210	25,313	25,313	25,313	25,589 (5,118) [1,228] {614}	25,906 (5,181) [1,243] {622}	26,261 (5,252) [1,261] {630}
Sumter	9,870	9,889	9,889	9,889	9,941 (1,988) [477] {239}	9,999 (2,000) [480] {240}	10,063 (2,013) [483] {242}
Volusia	48,114	48,307	48,307	48,307	48,918 (9,784) [2,348] {1,174}	49,628 (9,926) [2,382] {1,191}	50,462 (10,092) [2,422] {1,211}

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.