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

Date: 7/23/21

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 7/23/21 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.

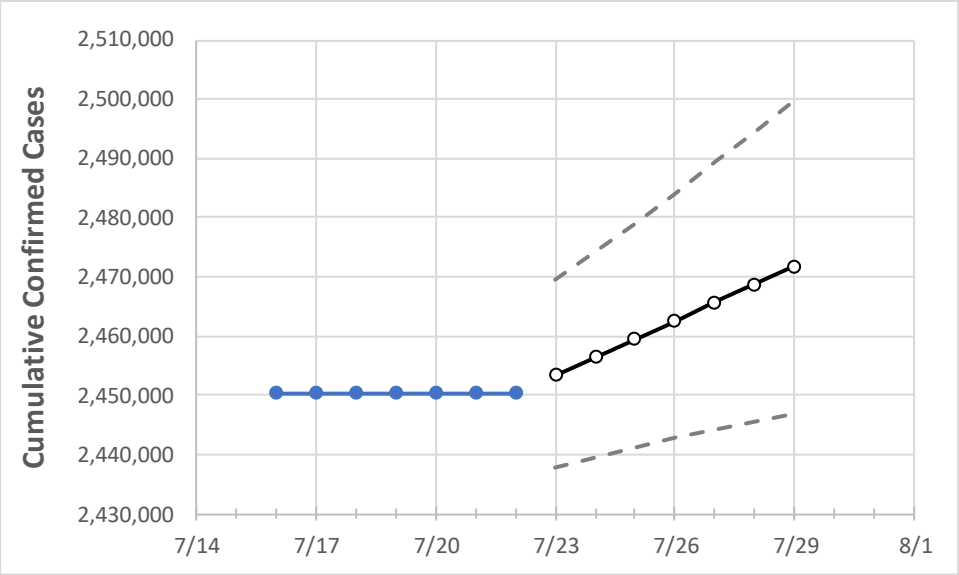
IEM's Modeling Lead

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:						
	7/19	7/20	7/21	7/22	7/23	7/24	7/25	7/26	7/27	7/28	7/29
Florida	2,450,344	2,450,344	2,450,344	2,450,344	2,453,380	2,456,427	2,459,452	2,462,495	2,465,650	2,468,818	2,471,837

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:						
	7/19	7/20	7/21	7/22	7/23	7/24	7/25	7/26	7/27	7/28	7/29
Alachua	26,337	26,337	26,337	26,337	26,363	26,389	26,415	26,440	26,467	26,493	26,520
Broward	256,264	256,264	256,264	256,264	256,516	256,772	257,020	257,275	257,535	257,786	258,032
Charlotte	13,953	13,953	13,953	13,953	13,964	13,975	13,985	13,996	14,007	14,017	14,028
Collier	39,048	39,048	39,048	39,048	39,091	39,134	39,178	39,220	39,263	39,305	39,349
Duval	111,236	111,236	111,236	111,236	111,529	111,817	112,115	112,412	112,697	112,995	113,291
Hillsborough	151,661	151,661	151,661	151,661	151,849	152,036	152,228	152,418	152,602	152,796	152,987
Lake	33,087	33,087	33,087	33,087	33,136	33,187	33,238	33,288	33,337	33,387	33,436
Lee	76,894	76,894	76,894	76,894	76,961	77,028	77,094	77,159	77,226	77,292	77,358
Manatee	41,491	41,491	41,491	41,491	41,536	41,581	41,627	41,672	41,718	41,765	41,811
Miami-Dade	522,734	522,734	522,734	522,734	523,206	523,716	524,177	524,649	525,134	525,606	526,080
Okaloosa	21,761	21,761	21,761	21,761	21,779	21,798	21,815	21,833	21,852	21,869	21,887
Orange	152,450	152,450	152,450	152,450	152,692	152,934	153,181	153,440	153,687	153,951	154,209
Osceola	49,191	49,191	49,191	49,191	49,258	49,326	49,394	49,462	49,528	49,594	49,660
Palm Beach	155,617	155,617	155,617	155,617	155,783	155,954	156,123	156,292	156,460	156,630	156,798
Pasco	45,066	45,066	45,066	45,066	45,125	45,185	45,245	45,305	45,362	45,421	45,480
Pinellas	84,898	84,898	84,898	84,898	84,988	85,078	85,168	85,256	85,345	85,432	85,525
Polk	75,088	75,088	75,088	75,088	75,180	75,275	75,368	75,459	75,552	75,644	75,732
Sarasota	34,963	34,963	34,963	34,963	34,998	35,032	35,067	35,101	35,136	35,170	35,206
Seminole	38,352	38,352	38,352	38,352	38,425	38,498	38,572	38,644	38,717	38,791	38,864
St. Johns	25,313	25,313	25,313	25,313	25,360	25,407	25,454	25,498	25,544	25,589	25,634
Sumter	9,889	9,889	9,889	9,889	9,898	9,907	9,915	9,923	9,932	9,940	9,948
Volusia	48,307	48,307	48,307	48,307	48,401	48,493	48,589	48,684	48,777	48,867	48,964

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:		
	7/19	7/20	7/21	7/22	7/24	7/26	7/28
Alachua	26,337	26,337	26,337	26,337	26,389 (5,278) [1,267] {633}	26,440 (5,288) [1,269] {635}	26,493 (5,299) [1,272] {636}
Broward	256,264	256,264	256,264	256,264	256,772 (51,354) [12,325] {6,163}	257,275 (51,455) [12,349] {6,175}	257,786 (51,557) [12,374] {6,187}
Charlotte	13,953	13,953	13,953	13,953	13,975 (2,795) [671] {335}	13,996 (2,799) [672] {336}	14,017 (2,803) [673] {336}
Collier	39,048	39,048	39,048	39,048	39,134 (7,827) [1,878] {939}	39,220 (7,844) [1,883] {941}	39,305 (7,861) [1,887] {943}
Duval	111,236	111,236	111,236	111,236	111,817 (22,363) [5,367] {2,684}	112,412 (22,482) [5,396] {2,698}	112,995 (22,599) [5,424] {2,712}
Hillsborough	151,661	151,661	151,661	151,661	152,036 (30,407) [7,298] {3,649}	152,418 (30,484) [7,316] {3,658}	152,796 (30,559) [7,334] {3,667}
Lake	33,087	33,087	33,087	33,087	33,187 (6,637) [1,593] {796}	33,288 (6,658) [1,598] {799}	33,387 (6,677) [1,603] {801}
Lee	76,894	76,894	76,894	76,894	77,028 (15,406) [3,697] {1,849}	77,159 (15,432) [3,704] {1,852}	77,292 (15,458) [3,710] {1,855}
Manatee	41,491	41,491	41,491	41,491	41,581 (8,316) [1,996] {998}	41,672 (8,334) [2,000] {1,000}	41,765 (8,353) [2,005] {1,002}
Miami-Dade	522,734	522,734	522,734	522,734	523,716 (104,743) [25,138] {12,569}	524,649 (104,930) [25,183] {12,592}	525,606 (105,121) [25,229] {12,615}
Okaloosa	21,761	21,761	21,761	21,761	21,798 (4,360) [1,046] {523}	21,833 (4,367) [1,048] {524}	21,869 (4,374) [1,050] {525}
Orange	152,450	152,450	152,450	152,450	152,934 (30,587) [7,341] {3,670}	153,440 (30,688) [7,365] {3,683}	153,951 (30,790) [7,390] {3,695}
Osceola	49,191	49,191	49,191	49,191	49,326 (9,865) [2,368] {1,184}	49,462 (9,892) [2,374] {1,187}	49,594 (9,919) [2,381] {1,190}
Palm Beach	155,617	155,617	155,617	155,617	155,954 (31,191) [7,486] {3,743}	156,292 (31,258) [7,502] {3,751}	156,630 (31,326) [7,518] {3,759}
Pasco	45,066	45,066	45,066	45,066	45,185 (9,037) [2,169] {1,084}	45,305 (9,061) [2,175] {1,087}	45,421 (9,084) [2,180] {1,090}
Pinellas	84,898	84,898	84,898	84,898	85,078 (17,016) [4,084] {2,042}	85,256 (17,051) [4,092] {2,046}	85,432 (17,086) [4,101] {2,050}
Polk	75,088	75,088	75,088	75,088	75,275 (15,055) [3,613] {1,807}	75,459 (15,092) [3,622] {1,811}	75,644 (15,129) [3,631] {1,815}
Sarasota	34,963	34,963	34,963	34,963	35,032 (7,006) [1,682] {841}	35,101 (7,020) [1,685] {842}	35,170 (7,034) [1,688] {844}
Seminole	38,352	38,352	38,352	38,352	38,498 (7,700) [1,848] {924}	38,644 (7,729) [1,855] {927}	38,791 (7,758) [1,862] {931}
St. Johns	25,313	25,313	25,313	25,313	25,407 (5,081) [1,220] {610}	25,498 (5,100) [1,224] {612}	25,589 (5,118) [1,228] {614}
Sumter	9,889	9,889	9,889	9,889	9,907 (1,981) [476] {238}	9,923 (1,985) [476] {238}	9,940 (1,988) [477] {239}
Volusia	48,307	48,307	48,307	48,307	48,493 (9,699) [2,328] {1,164}	48,684 (9,737) [2,337] {1,168}	48,867 (9,773) [2,346] {1,173}

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.