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

Date: 7/21/21

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 7/21/21 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.

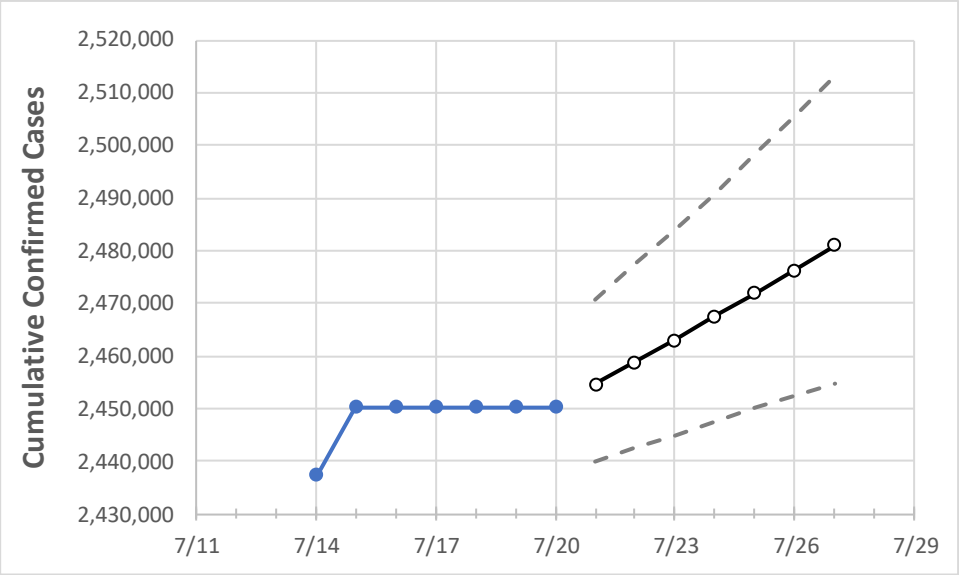
IEM's Modeling Lead

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:						
	7/17	7/18	7/19	7/20	7/21	7/22	7/23	7/24	7/25	7/26	7/27
Florida	2,450,344	2,450,344	2,450,344	2,450,344	2,454,581	2,458,804	2,463,063	2,467,478	2,471,876	2,476,360	2,480,961

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:						
	7/17	7/18	7/19	7/20	7/21	7/22	7/23	7/24	7/25	7/26	7/27
Alachua	26,337	26,337	26,337	26,337	26,370	26,403	26,438	26,473	26,509	26,549	26,588
Broward	256,264	256,264	256,264	256,264	256,625	256,989	257,362	257,750	258,152	258,547	258,953
Charlotte	13,953	13,953	13,953	13,953	13,968	13,983	13,998	14,013	14,029	14,045	14,061
Collier	39,048	39,048	39,048	39,048	39,107	39,168	39,231	39,295	39,358	39,422	39,487
Duval	111,236	111,236	111,236	111,236	111,626	112,047	112,464	112,892	113,340	113,785	114,254
Hillsborough	151,661	151,661	151,661	151,661	151,923	152,189	152,467	152,754	153,039	153,323	153,616
Lake	33,087	33,087	33,087	33,087	33,155	33,223	33,293	33,364	33,436	33,510	33,586
Lee	76,894	76,894	76,894	76,894	76,986	77,082	77,177	77,273	77,369	77,469	77,569
Manatee	41,491	41,491	41,491	41,491	41,550	41,610	41,672	41,735	41,802	41,869	41,938
Miami-Dade	522,734	522,734	522,734	522,734	523,386	524,041	524,718	525,396	526,069	526,743	527,438
Okaloosa	21,761	21,761	21,761	21,761	21,786	21,811	21,837	21,863	21,888	21,913	21,940
Orange	152,450	152,450	152,450	152,450	152,780	153,122	153,469	153,830	154,202	154,576	154,948
Osceola	49,191	49,191	49,191	49,191	49,285	49,381	49,477	49,576	49,678	49,779	49,881
Palm Beach	155,617	155,617	155,617	155,617	155,848	156,079	156,321	156,558	156,800	157,052	157,306
Pasco	45,066	45,066	45,066	45,066	45,145	45,226	45,310	45,394	45,481	45,570	45,661
Pinellas	84,898	84,898	84,898	84,898	85,023	85,152	85,282	85,414	85,550	85,687	85,827
Polk	75,088	75,088	75,088	75,088	75,223	75,361	75,495	75,632	75,774	75,920	76,073
Sarasota	34,963	34,963	34,963	34,963	35,009	35,057	35,107	35,157	35,208	35,261	35,314
Seminole	38,352	38,352	38,352	38,352	38,455	38,560	38,666	38,773	38,885	38,993	39,111
St. Johns	25,313	25,313	25,313	25,313	25,376	25,441	25,507	25,573	25,639	25,706	25,772
Sumter	9,889	9,889	9,889	9,889	9,901	9,913	9,925	9,938	9,950	9,962	9,974
Volusia	48,307	48,307	48,307	48,307	48,433	48,564	48,696	48,834	48,978	49,121	49,267

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:		
	7/17	7/18	7/19	7/20	7/22	7/24	7/26
Alachua	26,337	26,337	26,337	26,337	26,403 (5,281) [1,267] {634}	26,473 (5,295) [1,271] {635}	26,549 (5,310) [1,274] {637}
Broward	256,264	256,264	256,264	256,264	256,989 (51,398) [12,335] {6,168}	257,750 (51,550) [12,372] {6,186}	258,547 (51,709) [12,410] {6,205}
Charlotte	13,953	13,953	13,953	13,953	13,983 (2,797) [671] {336}	14,013 (2,803) [673] {336}	14,045 (2,809) [674] {337}
Collier	39,048	39,048	39,048	39,048	39,168 (7,834) [1,880] {940}	39,295 (7,859) [1,886] {943}	39,422 (7,884) [1,892] {946}
Duval	111,236	111,236	111,236	111,236	112,047 (22,409) [5,378] {2,689}	112,892 (22,578) [5,419] {2,709}	113,785 (22,757) [5,462] {2,731}
Hillsborough	151,661	151,661	151,661	151,661	152,189 (30,438) [7,305] {3,653}	152,754 (30,551) [7,332] {3,666}	153,323 (30,665) [7,360] {3,680}
Lake	33,087	33,087	33,087	33,087	33,223 (6,645) [1,595] {797}	33,364 (6,673) [1,601] {801}	33,510 (6,702) [1,608] {804}
Lee	76,894	76,894	76,894	76,894	77,082 (15,416) [3,700] {1,850}	77,273 (15,455) [3,709] {1,855}	77,469 (15,494) [3,718] {1,859}
Manatee	41,491	41,491	41,491	41,491	41,610 (8,322) [1,997] {999}	41,735 (8,347) [2,003] {1,002}	41,869 (8,374) [2,010] {1,005}
Miami-Dade	522,734	522,734	522,734	522,734	524,041 (104,808) [25,154] {12,577}	525,396 (105,079) [25,219] {12,609}	526,743 (105,349) [25,284] {12,642}
Okaloosa	21,761	21,761	21,761	21,761	21,811 (4,362) [1,047] {523}	21,863 (4,373) [1,049] {525}	21,913 (4,383) [1,052] {526}
Orange	152,450	152,450	152,450	152,450	153,122 (30,624) [7,350] {3,675}	153,830 (30,766) [7,384] {3,692}	154,576 (30,915) [7,420] {3,710}
Osceola	49,191	49,191	49,191	49,191	49,381 (9,876) [2,370] {1,185}	49,576 (9,915) [2,380] {1,190}	49,779 (9,956) [2,389] {1,195}
Palm Beach	155,617	155,617	155,617	155,617	156,079 (31,216) [7,492] {3,746}	156,558 (31,312) [7,515] {3,757}	157,052 (31,410) [7,538] {3,769}
Pasco	45,066	45,066	45,066	45,066	45,226 (9,045) [2,171] {1,085}	45,394 (9,079) [2,179] {1,089}	45,570 (9,114) [2,187] {1,094}
Pinellas	84,898	84,898	84,898	84,898	85,152 (17,030) [4,087] {2,044}	85,414 (17,083) [4,100] {2,050}	85,687 (17,137) [4,113] {2,056}
Polk	75,088	75,088	75,088	75,088	75,361 (15,072) [3,617] {1,809}	75,632 (15,126) [3,630] {1,815}	75,920 (15,184) [3,644] {1,822}
Sarasota	34,963	34,963	34,963	34,963	35,057 (7,011) [1,683] {841}	35,157 (7,031) [1,688] {844}	35,261 (7,052) [1,693] {846}
Seminole	38,352	38,352	38,352	38,352	38,560 (7,712) [1,851] {925}	38,773 (7,755) [1,861] {931}	38,993 (7,799) [1,872] {936}
St. Johns	25,313	25,313	25,313	25,313	25,441 (5,088) [1,221] {611}	25,573 (5,115) [1,228] {614}	25,706 (5,141) [1,234] {617}
Sumter	9,889	9,889	9,889	9,889	9,913 (1,983) [476] {238}	9,938 (1,988) [477] {239}	9,962 (1,992) [478] {239}
Volusia	48,307	48,307	48,307	48,307	48,564 (9,713) [2,331] {1,166}	48,834 (9,767) [2,344] {1,172}	49,121 (9,824) [2,358] {1,179}

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.