IEM's AI Modeling: Short-term COVID-19 Projections
Date: 11/12/21

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 <u>not</u> 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 11/12/21 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.

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Florida State Projections
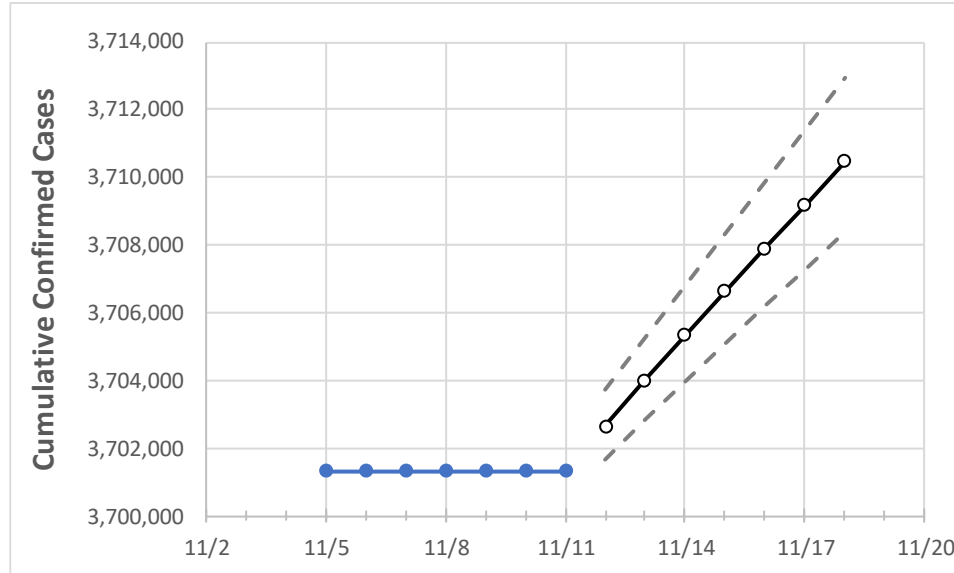
	Actual Confirmed Cases On:				Projected Cases For:						
	11/8	11/9	11/10	11/11	11/12	11/13	11/14	11/15	11/16	11/17	11/18
Florida	3,701,310	3,701,310	3,701,310	3,701,310	3,702,656	3,703,998	3,705,322	3,706,623	3,707,914	3,709,188	3,710,469

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.

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Florida Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	11/8	11/9	11/10	11/11	11/12	11/13	11/14	11/15	11/16	11/17	11/18
Alachua	39,960	39,960	39,960	39,960	39,972	39,983	39,994	40,005	40,016	40,026	40,036
Broward	360,798	360,798	360,798	360,798	360,935	361,072	361,206	361,341	361,473	361,605	361,738
Charlotte	23,533	23,533	23,533	23,533	23,541	23,548	23,556	23,563	23,570	23,577	23,583
Collier	58,317	58,317	58,317	58,317	58,333	58,348	58,363	58,378	58,393	58,407	58,421
Duval	166,387	166,387	166,387	166,387	166,417	166,447	166,476	166,503	166,530	166,558	166,584
Hillsborough	243,577	243,577	243,577	243,577	243,714	243,852	243,992	244,134	244,275	244,417	244,559
Lake	55,261	55,261	55,261	55,261	55,292	55,323	55,353	55,383	55,413	55,442	55,471
Lee	127,606	127,606	127,606	127,606	127,647	127,688	127,726	127,766	127,804	127,842	127,878
Manatee	65,864	65,864	65,864	65,864	65,882	65,900	65,917	65,934	65,951	65,967	65,983
Miami-Dade	680,807	680,807	680,807	680,807	681,085	681,366	681,645	681,927	682,207	682,487	682,768
Okaloosa	34,767	34,767	34,767	34,767	34,788	34,809	34,831	34,852	34,875	34,897	34,919
Orange	231,067	231,067	231,067	231,067	231,161	231,254	231,347	231,439	231,531	231,621	231,710
Osceola	72,617	72,617	72,617	72,617	72,643	72,669	72,694	72,718	72,743	72,767	72,789
Palm Beach	228,398	228,398	228,398	228,398	228,496	228,596	228,694	228,792	228,890	228,986	229,083
Pasco	79,725	79,725	79,725	79,725	79,758	79,791	79,825	79,858	79,892	79,925	79,958
Pinellas	136,755	136,755	136,755	136,755	136,805	136,855	136,905	136,955	137,005	137,055	137,103
Polk	129,243	129,243	129,243	129,243	129,283	129,322	129,360	129,398	129,435	129,472	129,507
Sarasota	56,984	56,984	56,984	56,984	57,007	57,029	57,052	57,075	57,098	57,121	57,144
Seminole	62,599	62,599	62,599	62,599	62,643	62,688	62,732	62,778	62,824	62,871	62,918
St. Johns	41,125	41,125	41,125	41,125	41,142	41,158	41,173	41,189	41,205	41,220	41,235
Sumter	14,713	14,713	14,713	14,713	14,723	14,732	14,742	14,751	14,761	14,770	14,780
Volusia	76,868	76,868	76,868	76,868	76,915	76,962	77,009	77,055	77,099	77,144	77,188

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:		
	11/8	11/9	11/10	11/11	11/13	11/15	11/17
Alachua	39,960	39,960	39,960	39,960	39,983 (7,997) [1,919] {960}	40,005 (8,001) [1,920] {960}	40,026 (8,005) [1,921] {961}
Broward	360,798	360,798	360,798	360,798	361,072 (72,214) [17,331] {8,666}	361,341 (72,268) [17,344] {8,672}	361,605 (72,321) [17,357] {8,679}
Charlotte	23,533	23,533	23,533	23,533	23,548 (4,710) [1,130] {565}	23,563 (4,713) [1,131] {566}	23,577 (4,715) [1,132] {566}
Collier	58,317	58,317	58,317	58,317	58,348 (11,670) [2,801] {1,400}	58,378 (11,676) [2,802] {1,401}	58,407 (11,681) [2,804] {1,402}
Duval	166,387	166,387	166,387	166,387	166,447 (33,289) [7,989] {3,995}	166,503 (33,301) [7,992] {3,996}	166,558 (33,312) [7,995] {3,997}
Hillsborough	243,577	243,577	243,577	243,577	243,852 (48,770) [11,705] {5,852}	244,134 (48,827) [11,718] {5,859}	244,417 (48,883) [11,732] {5,866}
Lake	55,261	55,261	55,261	55,261	55,323 (11,065) [2,656] {1,328}	55,383 (11,077) [2,658] {1,329}	55,442 (11,088) [2,661] {1,331}
Lee	127,606	127,606	127,606	127,606	127,688 (25,538) [6,129] {3,065}	127,766 (25,553) [6,133] {3,066}	127,842 (25,568) [6,136] {3,068}
Manatee	65,864	65,864	65,864	65,864	65,900 (13,180) [3,163] {1,582}	65,934 (13,187) [3,165] {1,582}	65,967 (13,193) [3,166] {1,583}
Miami-Dade	680,807	680,807	680,807	680,807	681,366 (136,273) [32,706] {16,353}	681,927 (136,385) [32,732] {16,366}	682,487 (136,497) [32,759] {16,380}
Okaloosa	34,767	34,767	34,767	34,767	34,809 (6,962) [1,671] {835}	34,852 (6,970) [1,673] {836}	34,897 (6,979) [1,675] {838}
Orange	231,067	231,067	231,067	231,067	231,254 (46,251) [11,100] {5,550}	231,439 (46,288) [11,109] {5,555}	231,621 (46,324) [11,118] {5,559}
Osceola	72,617	72,617	72,617	72,617	72,669 (14,534) [3,488] {1,744}	72,718 (14,544) [3,490] {1,745}	72,767 (14,553) [3,493] {1,746}
Palm Beach	228,398	228,398	228,398	228,398	228,596 (45,719) [10,973] {5,486}	228,792 (45,758) [10,982] {5,491}	228,986 (45,797) [10,991] {5,496}
Pasco	79,725	79,725	79,725	79,725	79,791 (15,958) [3,830] {1,915}	79,858 (15,972) [3,833] {1,917}	79,925 (15,985) [3,836] {1,918}
Pinellas	136,755	136,755	136,755	136,755	136,855 (27,371) [6,569] {3,285}	136,955 (27,391) [6,574] {3,287}	137,055 (27,411) [6,579] {3,289}
Polk	129,243	129,243	129,243	129,243	129,322 (25,864) [6,207] {3,104}	129,398 (25,880) [6,211] {3,106}	129,472 (25,894) [6,215] {3,107}
Sarasota	56,984	56,984	56,984	56,984	57,029 (11,406) [2,737] {1,369}	57,075 (11,415) [2,740] {1,370}	57,121 (11,424) [2,742] {1,371}
Seminole	62,599	62,599	62,599	62,599	62,688 (12,538) [3,009] {1,505}	62,778 (12,556) [3,013] {1,507}	62,871 (12,574) [3,018] {1,509}
St. Johns	41,125	41,125	41,125	41,125	41,158 (8,232) [1,976] {988}	41,189 (8,238) [1,977] {989}	41,220 (8,244) [1,979] {989}
Sumter	14,713	14,713	14,713	14,713	14,732 (2,946) [707] {354}	14,751 (2,950) [708] {354}	14,770 (2,954) [709] {354}
Volusia	76,868	76,868	76,868	76,868	76,962 (15,392) [3,694] {1,847}	77,055 (15,411) [3,699] {1,849}	77,144 (15,429) [3,703] {1,851}

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.