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

Date: 12/8/21

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 12/8/21 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.

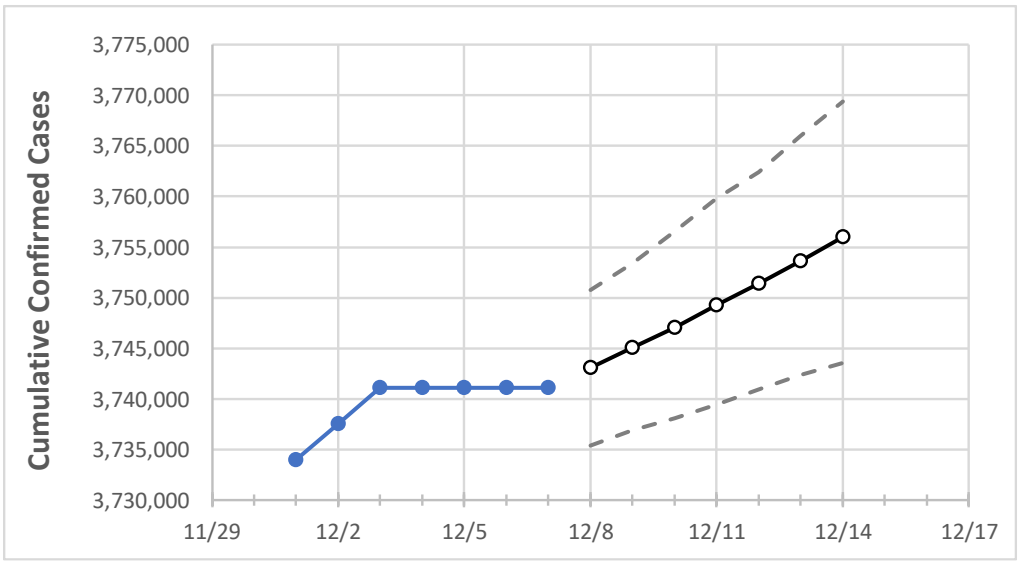
IEM's Modeling Lead

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:						
	12/4	12/5	12/6	12/7	12/8	12/9	12/10	12/11	12/12	12/13	12/14
Florida	3,741,058	3,741,058	3,741,058	3,741,058	3,743,080	3,745,092	3,747,045	3,749,283	3,751,422	3,753,622	3,755,953

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:						
	12/4	12/5	12/6	12/7	12/8	12/9	12/10	12/11	12/12	12/13	12/14
Alachua	40,476	40,476	40,476	40,476	40,493	40,510	40,526	40,544	40,562	40,579	40,596
Broward	364,555	364,555	364,555	364,555	364,753	364,938	365,140	365,338	365,559	365,784	365,993
Charlotte	23,859	23,859	23,859	23,859	23,874	23,891	23,908	23,923	23,941	23,958	23,976
Collier	59,022	59,022	59,022	59,022	59,068	59,114	59,160	59,207	59,257	59,309	59,362
Duval	167,422	167,422	167,422	167,422	167,477	167,528	167,581	167,638	167,695	167,754	167,814
Hillsborough	247,153	247,153	247,153	247,153	247,272	247,378	247,490	247,596	247,713	247,834	247,940
Lake	56,072	56,072	56,072	56,072	56,100	56,126	56,153	56,179	56,206	56,235	56,261
Lee	128,922	128,922	128,922	128,922	129,006	129,096	129,185	129,279	129,371	129,479	129,582
Manatee	66,503	66,503	66,503	66,503	66,536	66,569	66,602	66,636	66,672	66,707	66,746
Miami-Dade	688,109	688,109	688,109	688,109	688,482	688,874	689,260	689,670	690,087	690,512	690,921
Okaloosa	35,078	35,078	35,078	35,078	35,089	35,100	35,112	35,123	35,135	35,147	35,159
Orange	233,378	233,378	233,378	233,378	233,599	233,820	234,061	234,313	234,579	234,852	235,150
Osceola	73,623	73,623	73,623	73,623	73,666	73,708	73,753	73,796	73,842	73,889	73,933
Palm Beach	231,033	231,033	231,033	231,033	231,154	231,288	231,411	231,530	231,682	231,807	231,947
Pasco	80,537	80,537	80,537	80,537	80,581	80,626	80,675	80,720	80,772	80,822	80,873
Pinellas	138,159	138,159	138,159	138,159	138,245	138,327	138,418	138,507	138,599	138,703	138,798
Polk	130,665	130,665	130,665	130,665	130,726	130,790	130,849	130,910	130,972	131,040	131,101
Sarasota	57,800	57,800	57,800	57,800	57,862	57,923	57,990	58,056	58,126	58,201	58,277
Seminole	63,677	63,677	63,677	63,677	63,720	63,763	63,805	63,851	63,898	63,941	63,988
St. Johns	41,711	41,711	41,711	41,711	41,739	41,765	41,792	41,820	41,849	41,881	41,911
Sumter	14,918	14,918	14,918	14,918	14,927	14,938	14,947	14,957	14,967	14,978	14,988
Volusia	78,132	78,132	78,132	78,132	78,182	78,227	78,274	78,326	78,376	78,429	78,477

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:		
	12/4	12/5	12/6	12/7	12/9	12/11	12/13
Alachua	40,476	40,476	40,476	40,476	40,510 (8,102) [1,944] {972}	40,544 (8,109) [1,946] {973}	40,579 (8,116) [1,948] {974}
Broward	364,555	364,555	364,555	364,555	364,938 (72,988) [17,517] {8,759}	365,338 (73,068) [17,536] {8,768}	365,784 (73,157) [17,558] {8,779}
Charlotte	23,859	23,859	23,859	23,859	23,891 (4,778) [1,147] {573}	23,923 (4,785) [1,148] {574}	23,958 (4,792) [1,150] {575}
Collier	59,022	59,022	59,022	59,022	59,114 (11,823) [2,837] {1,419}	59,207 (11,841) [2,842] {1,421}	59,309 (11,862) [2,847] {1,423}
Duval	167,422	167,422	167,422	167,422	167,528 (33,506) [8,041] {4,021}	167,638 (33,528) [8,047] {4,023}	167,754 (33,551) [8,052] {4,026}
Hillsborough	247,153	247,153	247,153	247,153	247,378 (49,476) [11,874] {5,937}	247,596 (49,519) [11,885] {5,942}	247,834 (49,567) [11,896] {5,948}
Lake	56,072	56,072	56,072	56,072	56,126 (11,225) [2,694] {1,347}	56,179 (11,236) [2,697] {1,348}	56,235 (11,247) [2,699] {1,350}
Lee	128,922	128,922	128,922	128,922	129,096 (25,819) [6,197] {3,098}	129,279 (25,856) [6,205] {3,103}	129,479 (25,896) [6,215] {3,107}
Manatee	66,503	66,503	66,503	66,503	66,569 (13,314) [3,195] {1,598}	66,636 (13,327) [3,199] {1,599}	66,707 (13,341) [3,202] {1,601}
Miami-Dade	688,109	688,109	688,109	688,109	688,874 (137,775) [33,066] {16,533}	689,670 (137,934) [33,104] {16,552}	690,512 (138,102) [33,145] {16,572}
Okaloosa	35,078	35,078	35,078	35,078	35,100 (7,020) [1,685] {842}	35,123 (7,025) [1,686] {843}	35,147 (7,029) [1,687] {844}
Orange	233,378	233,378	233,378	233,378	233,820 (46,764) [11,223] {5,612}	234,313 (46,863) [11,247] {5,624}	234,852 (46,970) [11,273] {5,636}
Osceola	73,623	73,623	73,623	73,623	73,708 (14,742) [3,538] {1,769}	73,796 (14,759) [3,542] {1,771}	73,889 (14,778) [3,547] {1,773}
Palm Beach	231,033	231,033	231,033	231,033	231,288 (46,258) [11,102] {5,551}	231,530 (46,306) [11,113] {5,557}	231,807 (46,361) [11,127] {5,563}
Pasco	80,537	80,537	80,537	80,537	80,626 (16,125) [3,870] {1,935}	80,720 (16,144) [3,875] {1,937}	80,822 (16,164) [3,879] {1,940}
Pinellas	138,159	138,159	138,159	138,159	138,327 (27,665) [6,640] {3,320}	138,507 (27,701) [6,648] {3,324}	138,703 (27,741) [6,658] {3,329}
Polk	130,665	130,665	130,665	130,665	130,790 (26,158) [6,278] {3,139}	130,910 (26,182) [6,284] {3,142}	131,040 (26,208) [6,290] {3,145}
Sarasota	57,800	57,800	57,800	57,800	57,923 (11,585) [2,780] {1,390}	58,056 (11,611) [2,787] {1,393}	58,201 (11,640) [2,794] {1,397}
Seminole	63,677	63,677	63,677	63,677	63,763 (12,753) [3,061] {1,530}	63,851 (12,770) [3,065] {1,532}	63,941 (12,788) [3,069] {1,535}
St. Johns	41,711	41,711	41,711	41,711	41,765 (8,353) [2,005] {1,002}	41,820 (8,364) [2,007] {1,004}	41,881 (8,376) [2,010] {1,005}
Sumter	14,918	14,918	14,918	14,918	14,938 (2,988) [717] {359}	14,957 (2,991) [718] {359}	14,978 (2,996) [719] {359}
Volusia	78,132	78,132	78,132	78,132	78,227 (15,645) [3,755] {1,877}	78,326 (15,665) [3,760] {1,880}	78,429 (15,686) [3,765] {1,882}

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.