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

Date: 11/8/21

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 11/8/21 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.

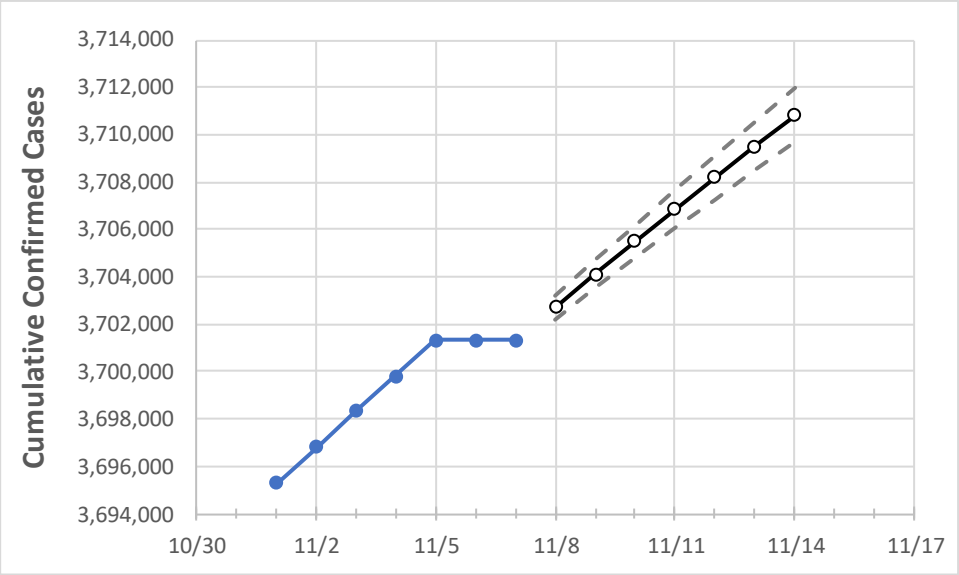
IEM's Modeling Lead

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:						
	11/4	11/5	11/6	11/7	11/8	11/9	11/10	11/11	11/12	11/13	11/14
Florida	3,699,810	3,701,310	3,701,310	3,701,310	3,702,722	3,704,118	3,705,486	3,706,844	3,708,186	3,709,513	3,710,807

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:						
	11/4	11/5	11/6	11/7	11/8	11/9	11/10	11/11	11/12	11/13	11/14
Alachua	39,945	39,960	39,960	39,960	39,975	39,989	40,003	40,016	40,029	40,042	40,055
Broward	360,650	360,798	360,798	360,798	360,939	361,078	361,217	361,354	361,489	361,622	361,754
Charlotte	23,523	23,533	23,533	23,533	23,542	23,551	23,559	23,567	23,575	23,583	23,590
Collier	58,298	58,317	58,317	58,317	58,335	58,353	58,370	58,387	58,404	58,421	58,437
Duval	166,348	166,387	166,387	166,387	166,421	166,453	166,484	166,515	166,545	166,574	166,602
Hillsborough	243,452	243,577	243,577	243,577	243,710	243,844	243,980	244,116	244,252	244,388	244,523
Lake	55,226	55,261	55,261	55,261	55,296	55,330	55,364	55,397	55,430	55,462	55,495
Lee	127,562	127,606	127,606	127,606	127,660	127,710	127,762	127,812	127,862	127,913	127,959
Manatee	65,842	65,864	65,864	65,864	65,884	65,903	65,921	65,939	65,957	65,974	65,991
Miami-Dade	680,536	680,807	680,807	680,807	681,080	681,352	681,625	681,897	682,168	682,437	682,705
Okaloosa	34,748	34,767	34,767	34,767	34,788	34,810	34,833	34,856	34,879	34,903	34,927
Orange	230,966	231,067	231,067	231,067	231,164	231,260	231,356	231,450	231,543	231,635	231,726
Osceola	72,586	72,617	72,617	72,617	72,646	72,674	72,701	72,728	72,754	72,781	72,805
Palm Beach	228,295	228,398	228,398	228,398	228,499	228,600	228,700	228,799	228,897	228,994	229,090
Pasco	79,693	79,725	79,725	79,725	79,757	79,789	79,822	79,854	79,886	79,917	79,949
Pinellas	136,704	136,755	136,755	136,755	136,806	136,857	136,908	136,959	137,010	137,059	137,108
Polk	129,196	129,243	129,243	129,243	129,285	129,326	129,367	129,407	129,446	129,484	129,521
Sarasota	56,962	56,984	56,984	56,984	57,006	57,028	57,050	57,072	57,094	57,116	57,138
Seminole	62,559	62,599	62,599	62,599	62,647	62,696	62,748	62,801	62,856	62,912	62,968
St. Johns	41,106	41,125	41,125	41,125	41,143	41,161	41,179	41,196	41,213	41,230	41,247
Sumter	14,703	14,713	14,713	14,713	14,723	14,732	14,742	14,752	14,761	14,771	14,780
Volusia	76,814	76,868	76,868	76,868	76,917	76,966	77,014	77,060	77,107	77,153	77,198

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:		
	11/4	11/5	11/6	11/7	11/9	11/11	11/13
Alachua	39,945	39,960	39,960	39,960	39,989 (7,998) [1,919] {960}	40,016 (8,003) [1,921] {960}	40,042 (8,008) [1,922] {961}
Broward	360,650	360,798	360,798	360,798	361,078 (72,216) [17,332] {8,666}	361,354 (72,271) [17,345] {8,672}	361,622 (72,324) [17,358] {8,679}
Charlotte	23,523	23,533	23,533	23,533	23,551 (4,710) [1,130] {565}	23,567 (4,713) [1,131] {566}	23,583 (4,717) [1,132] {566}
Collier	58,298	58,317	58,317	58,317	58,353 (11,671) [2,801] {1,400}	58,387 (11,677) [2,803] {1,401}	58,421 (11,684) [2,804] {1,402}
Duval	166,348	166,387	166,387	166,387	166,453 (33,291) [7,990] {3,995}	166,515 (33,303) [7,993] {3,996}	166,574 (33,315) [7,996] {3,998}
Hillsborough	243,452	243,577	243,577	243,577	243,844 (48,769) [11,705] {5,852}	244,116 (48,823) [11,718] {5,859}	244,388 (48,878) [11,731] {5,865}
Lake	55,226	55,261	55,261	55,261	55,330 (11,066) [2,656] {1,328}	55,397 (11,079) [2,659] {1,330}	55,462 (11,092) [2,662] {1,331}
Lee	127,562	127,606	127,606	127,606	127,710 (25,542) [6,130] {3,065}	127,812 (25,562) [6,135] {3,067}	127,913 (25,583) [6,140] {3,070}
Manatee	65,842	65,864	65,864	65,864	65,903 (13,181) [3,163] {1,582}	65,939 (13,188) [3,165] {1,583}	65,974 (13,195) [3,167] {1,583}
Miami-Dade	680,536	680,807	680,807	680,807	681,352 (136,270) [32,705] {16,352}	681,897 (136,379) [32,731] {16,366}	682,437 (136,487) [32,757] {16,378}
Okaloosa	34,748	34,767	34,767	34,767	34,810 (6,962) [1,671] {835}	34,856 (6,971) [1,673] {837}	34,903 (6,981) [1,675] {838}
Orange	230,966	231,067	231,067	231,067	231,260 (46,252) [11,100] {5,550}	231,450 (46,290) [11,110] {5,555}	231,635 (46,327) [11,118] {5,559}
Osceola	72,586	72,617	72,617	72,617	72,674 (14,535) [3,488] {1,744}	72,728 (14,546) [3,491] {1,745}	72,781 (14,556) [3,493] {1,747}
Palm Beach	228,295	228,398	228,398	228,398	228,600 (45,720) [10,973] {5,486}	228,799 (45,760) [10,982] {5,491}	228,994 (45,799) [10,992] {5,496}
Pasco	79,693	79,725	79,725	79,725	79,789 (15,958) [3,830] {1,915}	79,854 (15,971) [3,833] {1,916}	79,917 (15,983) [3,836] {1,918}
Pinellas	136,704	136,755	136,755	136,755	136,857 (27,371) [6,569] {3,285}	136,959 (27,392) [6,574] {3,287}	137,059 (27,412) [6,579] {3,289}
Polk	129,196	129,243	129,243	129,243	129,326 (25,865) [6,208] {3,104}	129,407 (25,881) [6,212] {3,106}	129,484 (25,897) [6,215] {3,108}
Sarasota	56,962	56,984	56,984	56,984	57,028 (11,406) [2,737] {1,369}	57,072 (11,414) [2,739] {1,370}	57,116 (11,423) [2,742] {1,371}
Seminole	62,559	62,599	62,599	62,599	62,696 (12,539) [3,009] {1,505}	62,801 (12,560) [3,014] {1,507}	62,912 (12,582) [3,020] {1,510}
St. Johns	41,106	41,125	41,125	41,125	41,161 (8,232) [1,976] {988}	41,196 (8,239) [1,977] {989}	41,230 (8,246) [1,979] {990}
Sumter	14,703	14,713	14,713	14,713	14,732 (2,946) [707] {354}	14,752 (2,950) [708] {354}	14,771 (2,954) [709] {354}
Volusia	76,814	76,868	76,868	76,868	76,966 (15,393) [3,694] {1,847}	77,060 (15,412) [3,699] {1,849}	77,153 (15,431) [3,703] {1,852}

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.