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

Date: 9/27/21

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 9/27/21 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.

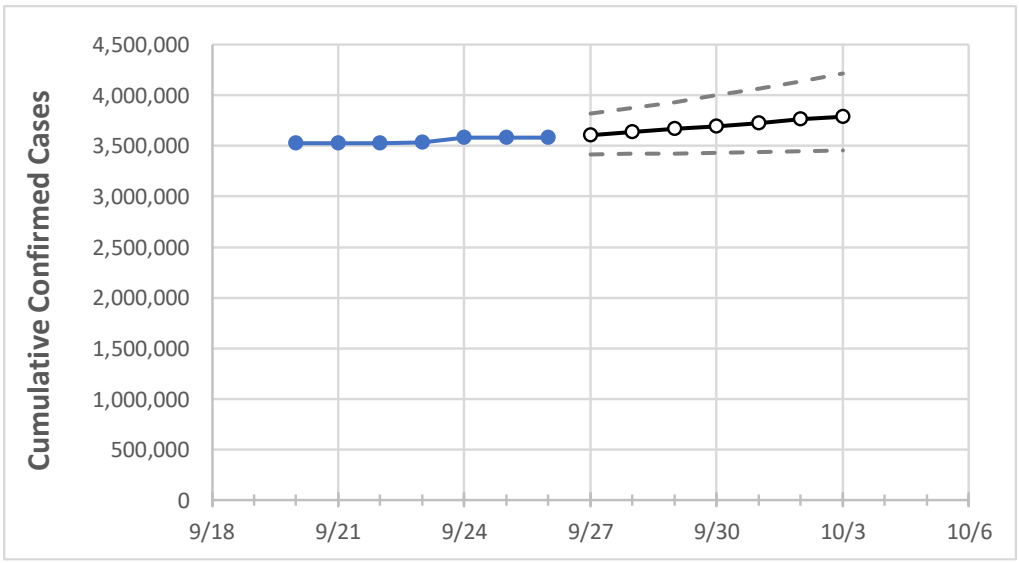
IEM's Modeling Lead

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:						
	9/23	9/24	9/25	9/26	9/27	9/28	9/29	9/30	10/1	10/2	10/3
Florida	3,531,465	3,582,807	3,582,807	3,582,807	3,608,853	3,638,610	3,667,425	3,693,206	3,725,725	3,760,790	3,789,947

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:						
	9/23	9/24	9/25	9/26	9/27	9/28	9/29	9/30	10/1	10/2	10/3
Alachua	38,395	38,477	38,477	38,477	38,554	38,626	38,698	38,765	38,831	38,897	38,959
Broward	348,796	349,394	349,394	349,394	349,928	350,443	350,956	351,447	351,928	352,401	352,860
Charlotte	22,291	22,350	22,350	22,350	22,409	22,465	22,519	22,571	22,623	22,671	22,719
Collier	56,321	56,489	56,489	56,489	56,653	56,816	56,978	57,139	57,298	57,456	57,610
Duval	161,951	162,195	162,195	162,195	162,418	162,630	162,841	163,040	163,239	163,435	163,623
Hillsborough	233,531	234,084	234,084	234,084	234,556	235,019	235,466	235,898	236,317	236,728	237,128
Lake	52,322	52,496	52,496	52,496	52,656	52,814	52,969	53,121	53,271	53,419	53,562
Lee	123,309	123,627	123,627	123,627	123,895	124,157	124,408	124,648	124,890	125,120	125,343
Manatee	63,506	63,668	63,668	63,668	63,809	63,946	64,079	64,207	64,336	64,458	64,575
Miami-Dade	662,702	663,737	663,737	663,737	664,834	665,938	667,050	668,166	669,283	670,397	671,501
Okaloosa	33,530	33,617	33,617	33,617	33,691	33,762	33,831	33,899	33,964	34,028	34,087
Orange	222,791	223,253	223,253	223,253	223,666	224,065	224,449	224,827	225,196	225,557	225,904
Osceola	70,059	70,213	70,213	70,213	70,350	70,483	70,611	70,737	70,861	70,984	71,102
Palm Beach	219,976	220,394	220,394	220,394	220,785	221,157	221,526	221,882	222,224	222,572	222,900
Pasco	76,685	76,920	76,920	76,920	77,140	77,353	77,557	77,761	77,952	78,139	78,326
Pinellas	131,734	132,039	132,039	132,039	132,328	132,596	132,863	133,116	133,371	133,613	133,847
Polk	124,606	124,944	124,944	124,944	125,236	125,520	125,791	126,061	126,318	126,568	126,811
Sarasota	55,130	55,274	55,274	55,274	55,398	55,517	55,634	55,748	55,857	55,962	56,064
Seminole	60,199	60,324	60,324	60,324	60,440	60,552	60,659	60,766	60,866	60,967	61,064
St. Johns	39,284	39,419	39,419	39,419	39,543	39,663	39,782	39,898	40,013	40,125	40,236
Sumter	14,067	14,101	14,101	14,101	14,136	14,170	14,204	14,236	14,268	14,299	14,330
Volusia	73,164	73,353	73,353	73,353	73,535	73,710	73,884	74,055	74,223	74,391	74,551

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:		
	9/23	9/24	9/25	9/26	9/28	9/30	10/2
Alachua	38,395	38,477	38,477	38,477	38,626 (7,725) [1,854] {927}	38,765 (7,753) [1,861] {930}	38,897 (7,779) [1,867] {934}
Broward	348,796	349,394	349,394	349,394	350,443 (70,089) [16,821] {8,411}	351,447 (70,289) [16,869] {8,435}	352,401 (70,480) [16,915] {8,458}
Charlotte	22,291	22,350	22,350	22,350	22,465 (4,493) [1,078] {539}	22,571 (4,514) [1,083] {542}	22,671 (4,534) [1,088] {544}
Collier	56,321	56,489	56,489	56,489	56,816 (11,363) [2,727] {1,364}	57,139 (11,428) [2,743] {1,371}	57,456 (11,491) [2,758] {1,379}
Duval	161,951	162,195	162,195	162,195	162,630 (32,526) [7,806] {3,903}	163,040 (32,608) [7,826] {3,913}	163,435 (32,687) [7,845] {3,922}
Hillsborough	233,531	234,084	234,084	234,084	235,019 (47,004) [11,281] {5,640}	235,898 (47,180) [11,323] {5,662}	236,728 (47,346) [11,363] {5,681}
Lake	52,322	52,496	52,496	52,496	52,814 (10,563) [2,535] {1,268}	53,121 (10,624) [2,550] {1,275}	53,419 (10,684) [2,564] {1,282}
Lee	123,309	123,627	123,627	123,627	124,157 (24,831) [5,960] {2,980}	124,648 (24,930) [5,983] {2,992}	125,120 (25,024) [6,006] {3,003}
Manatee	63,506	63,668	63,668	63,668	63,946 (12,789) [3,069] {1,535}	64,207 (12,841) [3,082] {1,541}	64,458 (12,892) [3,094] {1,547}
Miami-Dade	662,702	663,737	663,737	663,737	665,938 (133,188) [31,965] {15,983}	668,166 (133,633) [32,072] {16,036}	670,397 (134,079) [32,179] {16,090}
Okaloosa	33,530	33,617	33,617	33,617	33,762 (6,752) [1,621] {810}	33,899 (6,780) [1,627] {814}	34,028 (6,806) [1,633] {817}
Orange	222,791	223,253	223,253	223,253	224,065 (44,813) [10,755] {5,378}	224,827 (44,965) [10,792] {5,396}	225,557 (45,111) [10,827] {5,413}
Osceola	70,059	70,213	70,213	70,213	70,483 (14,097) [3,383] {1,692}	70,737 (14,147) [3,395] {1,698}	70,984 (14,197) [3,407] {1,704}
Palm Beach	219,976	220,394	220,394	220,394	221,157 (44,231) [10,616] {5,308}	221,882 (44,376) [10,650] {5,325}	222,572 (44,514) [10,683] {5,342}
Pasco	76,685	76,920	76,920	76,920	77,353 (15,471) [3,713] {1,856}	77,761 (15,552) [3,733] {1,866}	78,139 (15,628) [3,751] {1,875}
Pinellas	131,734	132,039	132,039	132,039	132,596 (26,519) [6,365] {3,182}	133,116 (26,623) [6,390] {3,195}	133,613 (26,723) [6,413] {3,207}
Polk	124,606	124,944	124,944	124,944	125,520 (25,104) [6,025] {3,012}	126,061 (25,212) [6,051] {3,025}	126,568 (25,314) [6,075] {3,038}
Sarasota	55,130	55,274	55,274	55,274	55,517 (11,103) [2,665] {1,332}	55,748 (11,150) [2,676] {1,338}	55,962 (11,192) [2,686] {1,343}
Seminole	60,199	60,324	60,324	60,324	60,552 (12,110) [2,907] {1,453}	60,766 (12,153) [2,917] {1,458}	60,967 (12,193) [2,926] {1,463}
St. Johns	39,284	39,419	39,419	39,419	39,663 (7,933) [1,904] {952}	39,898 (7,980) [1,915] {958}	40,125 (8,025) [1,926] {963}
Sumter	14,067	14,101	14,101	14,101	14,170 (2,834) [680] {340}	14,236 (2,847) [683] {342}	14,299 (2,860) [686] {343}
Volusia	73,164	73,353	73,353	73,353	73,710 (14,742) [3,538] {1,769}	74,055 (14,811) [3,555] {1,777}	74,391 (14,878) [3,571] {1,785}

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.