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

Date: 9/29/21

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 9/29/21 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.

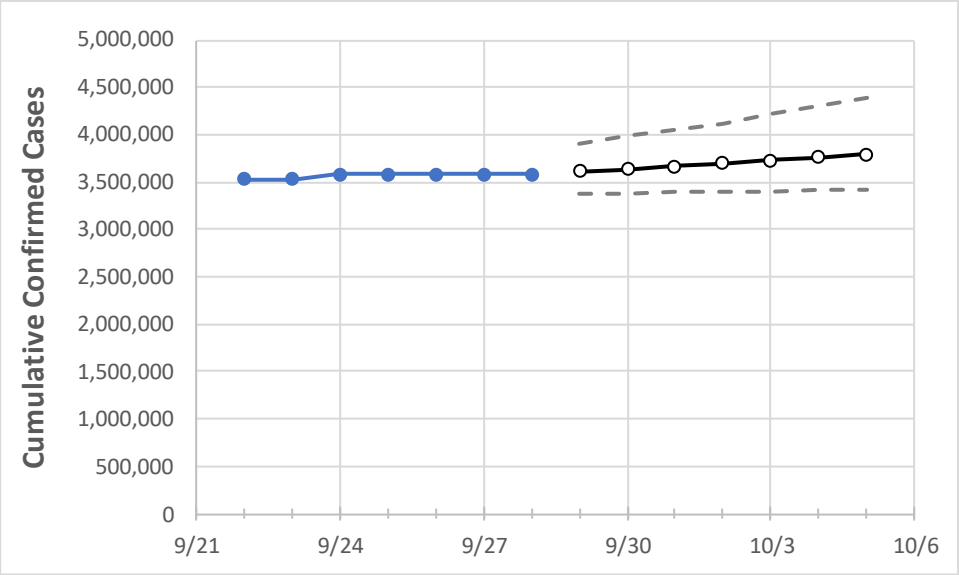
IEM's Modeling Lead

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:						
	9/25	9/26	9/27	9/28	9/29	9/30	10/1	10/2	10/3	10/4	10/5
Florida	3,582,807	3,582,807	3,582,807	3,582,807	3,611,905	3,638,568	3,667,856	3,700,751	3,729,468	3,762,340	3,794,186

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:						
	9/25	9/26	9/27	9/28	9/29	9/30	10/1	10/2	10/3	10/4	10/5
Alachua	38,477	38,477	38,477	38,477	38,549	38,616	38,681	38,746	38,809	38,870	38,929
Broward	349,394	349,394	349,394	349,394	349,903	350,400	350,883	351,360	351,824	352,289	352,738
Charlotte	22,350	22,350	22,350	22,350	22,405	22,454	22,505	22,555	22,600	22,647	22,689
Collier	56,489	56,489	56,489	56,489	56,651	56,811	56,970	57,129	57,285	57,440	57,595
Duval	162,195	162,195	162,195	162,195	162,407	162,613	162,812	163,006	163,194	163,383	163,560
Hillsborough	234,084	234,084	234,084	234,084	234,527	234,959	235,380	235,794	236,193	236,578	236,950
Lake	52,496	52,496	52,496	52,496	52,651	52,804	52,954	53,101	53,247	53,392	53,532
Lee	123,627	123,627	123,627	123,627	123,875	124,117	124,353	124,577	124,798	125,013	125,216
Manatee	63,668	63,668	63,668	63,668	63,800	63,928	64,056	64,178	64,296	64,414	64,526
Miami-Dade	663,737	663,737	663,737	663,737	664,846	665,969	667,100	668,241	669,381	670,522	671,662
Okaloosa	33,617	33,617	33,617	33,617	33,685	33,752	33,817	33,881	33,941	34,002	34,059
Orange	223,253	223,253	223,253	223,253	223,639	224,019	224,395	224,744	225,104	225,440	225,784
Osceola	70,213	70,213	70,213	70,213	70,343	70,472	70,596	70,718	70,838	70,955	71,069
Palm Beach	220,394	220,394	220,394	220,394	220,764	221,119	221,470	221,802	222,137	222,454	222,775
Pasco	76,920	76,920	76,920	76,920	77,130	77,325	77,524	77,717	77,900	78,082	78,257
Pinellas	132,039	132,039	132,039	132,039	132,307	132,564	132,809	133,052	133,289	133,517	133,745
Polk	124,944	124,944	124,944	124,944	125,220	125,486	125,743	125,994	126,239	126,481	126,710
Sarasota	55,274	55,274	55,274	55,274	55,392	55,503	55,612	55,718	55,824	55,924	56,022
Seminole	60,324	60,324	60,324	60,324	60,431	60,538	60,639	60,739	60,837	60,932	61,020
St. Johns	39,419	39,419	39,419	39,419	39,540	39,658	39,773	39,888	39,999	40,108	40,215
Sumter	14,101	14,101	14,101	14,101	14,134	14,166	14,196	14,226	14,256	14,284	14,313
Volusia	73,353	73,353	73,353	73,353	73,525	73,698	73,865	74,031	74,192	74,354	74,510

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:		
	9/25	9/26	9/27	9/28	9/30	10/2	10/4
Alachua	38,477	38,477	38,477	38,477	38,616 (7,723) [1,854] {927}	38,746 (7,749) [1,860] {930}	38,870 (7,774) [1,866] {933}
Broward	349,394	349,394	349,394	349,394	350,400 (70,080) [16,819] {8,410}	351,360 (70,272) [16,865] {8,433}	352,289 (70,458) [16,910] {8,455}
Charlotte	22,350	22,350	22,350	22,350	22,454 (4,491) [1,078] {539}	22,555 (4,511) [1,083] {541}	22,647 (4,529) [1,087] {544}
Collier	56,489	56,489	56,489	56,489	56,811 (11,362) [2,727] {1,363}	57,129 (11,426) [2,742] {1,371}	57,440 (11,488) [2,757] {1,379}
Duval	162,195	162,195	162,195	162,195	162,613 (32,523) [7,805] {3,903}	163,006 (32,601) [7,824] {3,912}	163,383 (32,677) [7,842] {3,921}
Hillsborough	234,084	234,084	234,084	234,084	234,959 (46,992) [11,278] {5,639}	235,794 (47,159) [11,318] {5,659}	236,578 (47,316) [11,356] {5,678}
Lake	52,496	52,496	52,496	52,496	52,804 (10,561) [2,535] {1,267}	53,101 (10,620) [2,549] {1,274}	53,392 (10,678) [2,563] {1,281}
Lee	123,627	123,627	123,627	123,627	124,117 (24,823) [5,958] {2,979}	124,577 (24,915) [5,980] {2,990}	125,013 (25,003) [6,001] {3,000}
Manatee	63,668	63,668	63,668	63,668	63,928 (12,786) [3,069] {1,534}	64,178 (12,836) [3,081] {1,540}	64,414 (12,883) [3,092] {1,546}
Miami-Dade	663,737	663,737	663,737	663,737	665,969 (133,194) [31,967] {15,983}	668,241 (133,648) [32,076] {16,038}	670,522 (134,104) [32,185] {16,093}
Okaloosa	33,617	33,617	33,617	33,617	33,752 (6,750) [1,620] {810}	33,881 (6,776) [1,626] {813}	34,002 (6,800) [1,632] {816}
Orange	223,253	223,253	223,253	223,253	224,019 (44,804) [10,753] {5,376}	224,744 (44,949) [10,788] {5,394}	225,440 (45,088) [10,821] {5,411}
Osceola	70,213	70,213	70,213	70,213	70,472 (14,094) [3,383] {1,691}	70,718 (14,144) [3,394] {1,697}	70,955 (14,191) [3,406] {1,703}
Palm Beach	220,394	220,394	220,394	220,394	221,119 (44,224) [10,614] {5,307}	221,802 (44,360) [10,647] {5,323}	222,454 (44,491) [10,678] {5,339}
Pasco	76,920	76,920	76,920	76,920	77,325 (15,465) [3,712] {1,856}	77,717 (15,543) [3,730] {1,865}	78,082 (15,616) [3,748] {1,874}
Pinellas	132,039	132,039	132,039	132,039	132,564 (26,513) [6,363] {3,182}	133,052 (26,610) [6,387] {3,193}	133,517 (26,703) [6,409] {3,204}
Polk	124,944	124,944	124,944	124,944	125,486 (25,097) [6,023] {3,012}	125,994 (25,199) [6,048] {3,024}	126,481 (25,296) [6,071] {3,036}
Sarasota	55,274	55,274	55,274	55,274	55,503 (11,101) [2,664] {1,332}	55,718 (11,144) [2,674] {1,337}	55,924 (11,185) [2,684] {1,342}
Seminole	60,324	60,324	60,324	60,324	60,538 (12,108) [2,906] {1,453}	60,739 (12,148) [2,915] {1,458}	60,932 (12,186) [2,925] {1,462}
St. Johns	39,419	39,419	39,419	39,419	39,658 (7,932) [1,904] {952}	39,888 (7,978) [1,915] {957}	40,108 (8,022) [1,925] {963}
Sumter	14,101	14,101	14,101	14,101	14,166 (2,833) [680] {340}	14,226 (2,845) [683] {341}	14,284 (2,857) [686] {343}
Volusia	73,353	73,353	73,353	73,353	73,698 (14,740) [3,538] {1,769}	74,031 (14,806) [3,553] {1,777}	74,354 (14,871) [3,569] {1,784}

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.