

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

Date: 3/3/21

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 3/3/21 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.

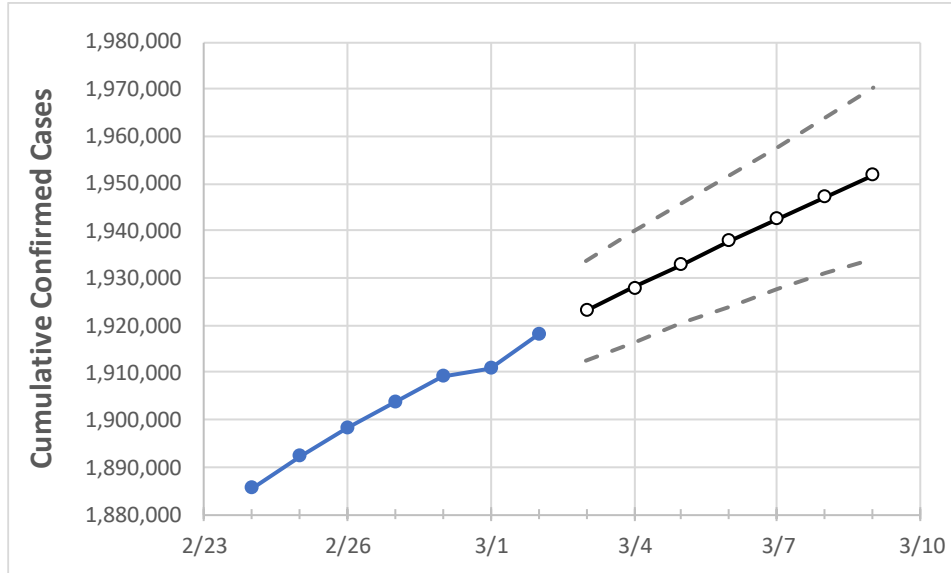
IEM's Modeling Lead

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:					
	2/27	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	

Florida 1,903,682 1,909,221 1,910,921 1,918,100 1,923,103 1,928,097 1,932,970 1,937,924 1,942,605 1,947,313 1,951,834

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:							
	2/27	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	
Alachua	22,319	22,354	22,371	22,412	22,436	22,460	22,482	22,504	22,524	22,544	22,562	
Broward	194,236	194,992	195,217	196,114	196,775	197,436	198,091	198,737	199,382	200,016	200,666	
Charlotte	10,662	10,684	10,698	10,725	10,747	10,767	10,787	10,806	10,825	10,844	10,861	
Collier	30,224	30,283	30,300	30,429	30,505	30,581	30,657	30,732	30,806	30,878	30,953	
Duval	88,578	88,774	88,825	88,998	89,127	89,252	89,372	89,491	89,600	89,713	89,815	
Hillsborough	111,141	111,441	111,550	111,990	112,303	112,620	112,932	113,235	113,539	113,841	114,131	
Lake	24,538	24,611	24,635	24,744	24,821	24,894	24,969	25,043	25,117	25,189	25,260	
Lee	57,618	57,737	57,763	58,004	58,143	58,275	58,406	58,533	58,661	58,788	58,912	
Manatee	31,804	31,909	31,962	32,089	32,188	32,289	32,391	32,490	32,593	32,694	32,794	
Miami-Dade	409,216	410,717	410,952	412,908	414,020	415,105	416,183	417,258	418,316	419,380	420,415	
Okaloosa	18,811	18,871	18,900	19,008	19,069	19,132	19,196	19,261	19,323	19,386	19,448	
Orange	114,010	114,322	114,434	114,841	115,136	115,430	115,726	116,010	116,287	116,561	116,836	
Osceola	36,713	36,802	36,839	36,981	37,071	37,158	37,245	37,330	37,414	37,500	37,583	
Palm Beach	120,322	120,735	120,868	121,226	121,596	121,956	122,315	122,679	123,044	123,385	123,715	
Pasco	33,265	33,377	33,426	33,551	33,657	33,758	33,859	33,957	34,052	34,146	34,241	
Pinellas	66,412	66,571	66,646	66,894	67,106	67,310	67,511	67,711	67,906	68,101	68,299	
Polk	56,954	57,096	57,150	57,339	57,476	57,608	57,736	57,862	57,984	58,103	58,220	
Sarasota	26,939	27,038	27,065	27,122	27,186	27,249	27,315	27,378	27,442	27,506	27,569	
Seminole	27,169	27,237	27,262	27,384	27,463	27,544	27,620	27,698	27,775	27,846	27,918	
St. Johns	20,048	20,095	20,105	20,154	20,181	20,207	20,231	20,256	20,279	20,302	20,324	
Sumter	7,990	8,017	8,021	8,071	8,099	8,126	8,153	8,181	8,208	8,235	8,264	
Volusia	34,454	34,546	34,565	34,680	34,765	34,850	34,931	35,006	35,087	35,161	35,234	

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:											
	2/27	2/28	3/1	3/2	3/4			3/6			3/8					
Alachua	22,319	22,354	22,371	22,412	22,460	(4,492)	[1,078]	{539}	22,504	(4,501)	[1,080]	{540}	22,544	(4,509)	[1,082]	{541}
Broward	194,236	194,992	195,217	196,114	197,436	(39,487)	[9,477]	{4,738}	198,737	(39,747)	[9,539]	{4,770}	200,016	(40,003)	[9,601]	{4,800}
Charlotte	10,662	10,684	10,698	10,725	10,767	(2,153)	[517]	{258}	10,806	(2,161)	[519]	{259}	10,844	(2,169)	[520]	{260}
Collier	30,224	30,283	30,300	30,429	30,581	(6,116)	[1,468]	{734}	30,732	(6,146)	[1,475]	{738}	30,878	(6,176)	[1,482]	{741}
Duval	88,578	88,774	88,825	88,998	89,252	(17,850)	[4,284]	{2,142}	89,491	(17,898)	[4,296]	{2,148}	89,713	(17,943)	[4,306]	{2,153}
Hillsborough	111,141	111,441	111,550	111,990	112,620	(22,524)	[5,406]	{2,703}	113,235	(22,647)	[5,435]	{2,718}	113,841	(22,768)	[5,464]	{2,732}
Lake	24,538	24,611	24,635	24,744	24,894	(4,979)	[1,195]	{597}	25,043	(5,009)	[1,202]	{601}	25,189	(5,038)	[1,209]	{605}
Lee	57,618	57,737	57,763	58,004	58,275	(11,655)	[2,797]	{1,399}	58,533	(11,707)	[2,810]	{1,405}	58,788	(11,758)	[2,822]	{1,411}
Manatee	31,804	31,909	31,962	32,089	32,289	(6,458)	[1,550]	{775}	32,490	(6,498)	[1,560]	{780}	32,694	(6,539)	[1,569]	{785}
Miami-Dade	409,216	410,717	410,952	412,908	415,105	(83,021)	[19,925]	{9,963}	417,258	(83,452)	[20,028]	{10,014}	419,380	(83,876)	[20,130]	{10,065}
Okaloosa	18,811	18,871	18,900	19,008	19,132	(3,826)	[918]	{459}	19,261	(3,852)	[925]	{462}	19,386	(3,877)	[931]	{465}
Orange	114,010	114,322	114,434	114,841	115,430	(23,086)	[5,541]	{2,770}	116,010	(23,202)	[5,568]	{2,784}	116,561	(23,312)	[5,595]	{2,797}
Osceola	36,713	36,802	36,839	36,981	37,158	(7,432)	[1,784]	{892}	37,330	(7,466)	[1,792]	{896}	37,500	(7,500)	[1,800]	{900}
Palm Beach	120,322	120,735	120,868	121,226	121,956	(24,391)	[5,854]	{2,927}	122,679	(24,536)	[5,889]	{2,944}	123,385	(24,677)	[5,922]	{2,961}
Pasco	33,265	33,377	33,426	33,551	33,758	(6,752)	[1,620]	{810}	33,957	(6,791)	[1,630]	{815}	34,146	(6,829)	[1,639]	{820}
Pinellas	66,412	66,571	66,646	66,894	67,310	(13,462)	[3,231]	{1,615}	67,711	(13,542)	[3,250]	{1,625}	68,101	(13,620)	[3,269]	{1,634}
Polk	56,954	57,096	57,150	57,339	57,608	(11,522)	[2,765]	{1,383}	57,862	(11,572)	[2,777]	{1,389}	58,103	(11,621)	[2,789]	{1,394}
Sarasota	26,939	27,038	27,065	27,122	27,249	(5,450)	[1,308]	{654}	27,378	(5,476)	[1,314]	{657}	27,506	(5,501)	[1,320]	{660}
Seminole	27,169	27,237	27,262	27,384	27,544	(5,509)	[1,322]	{661}	27,698	(5,540)	[1,329]	{665}	27,846	(5,569)	[1,337]	{668}
St. Johns	20,048	20,095	20,105	20,154	20,207	(4,041)	[970]	{485}	20,256	(4,051)	[972]	{486}	20,302	(4,060)	[974]	{487}
Sumter	7,990	8,017	8,021	8,071	8,126	(1,625)	[390]	{195}	8,181	(1,636)	[393]	{196}	8,235	(1,647)	[395]	{198}
Volusia	34,454	34,546	34,565	34,680	34,850	(6,970)	[1,673]	{836}	35,006	(7,001)	[1,680]	{840}	35,161	(7,032)	[1,688]	{844}

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.