

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

Date: 3/22/21

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 3/22/21 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.

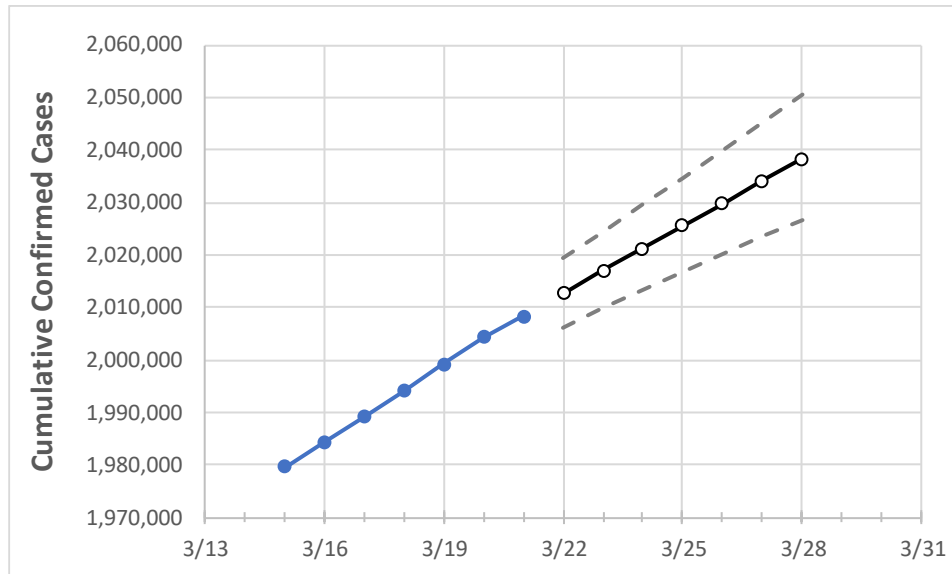
IEM's Modeling Lead

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:							
	3/18	3/19	3/20	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28	

Florida 1,994,117 1,999,257 2,004,362 2,008,349 2,012,680 2,016,993 2,021,276 2,025,583 2,029,779 2,034,067 2,038,274

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:							
	3/18	3/19	3/20	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28	
Alachua	22,911	22,957	22,994	23,015	23,042	23,069	23,095	23,122	23,147	23,173	23,199	
Broward	206,185	206,889	207,580	208,096	208,692	209,277	209,859	210,446	211,032	211,615	212,191	
Charlotte	11,096	11,119	11,155	11,187	11,213	11,240	11,266	11,293	11,321	11,349	11,376	
Collier	31,564	31,620	31,697	31,736	31,803	31,870	31,936	32,003	32,069	32,135	32,201	
Duval	91,085	91,209	91,342	91,450	91,560	91,670	91,776	91,884	91,991	92,093	92,195	
Hillsborough	117,040	117,406	117,769	118,061	118,391	118,728	119,066	119,401	119,738	120,081	120,427	
Lake	25,831	25,895	25,943	25,978	26,029	26,079	26,128	26,176	26,222	26,267	26,311	
Lee	60,451	60,614	60,772	60,914	61,071	61,228	61,387	61,545	61,705	61,864	62,024	
Manatee	33,581	33,670	33,763	33,832	33,907	33,977	34,049	34,117	34,188	34,255	34,323	
Miami-Dade	430,942	432,177	433,452	434,352	435,373	436,385	437,401	438,412	439,426	440,424	441,408	
Okaloosa	19,545	19,575	19,588	19,599	19,616	19,633	19,648	19,663	19,677	19,690	19,702	
Orange	119,224	119,543	119,871	120,183	120,476	120,771	121,067	121,370	121,669	121,983	122,284	
Osceola	38,381	38,476	38,577	38,661	38,744	38,827	38,910	38,993	39,076	39,158	39,241	
Palm Beach	127,111	127,491	127,830	128,154	128,481	128,803	129,120	129,440	129,757	130,068	130,380	
Pasco	35,039	35,136	35,248	35,336	35,423	35,510	35,596	35,681	35,763	35,849	35,933	
Pinellas	69,667	69,829	70,089	70,251	70,412	70,573	70,735	70,893	71,054	71,207	71,367	
Polk	59,400	59,542	59,654	59,767	59,879	59,991	60,102	60,214	60,323	60,433	60,542	
Sarasota	28,254	28,325	28,399	28,455	28,521	28,587	28,653	28,718	28,783	28,847	28,911	
Seminole	28,693	28,807	28,892	28,997	29,088	29,179	29,270	29,364	29,458	29,553	29,648	
St. Johns	20,673	20,710	20,752	20,774	20,805	20,835	20,866	20,897	20,928	20,958	20,988	
Sumter	8,442	8,472	8,489	8,501	8,522	8,542	8,562	8,582	8,602	8,621	8,640	
Volusia	36,328	36,451	36,590	36,709	36,831	36,955	37,083	37,213	37,346	37,480	37,616	

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:											
	3/18	3/19	3/20	3/21	3/23			3/25			3/27					
Alachua	22,911	22,957	22,994	23,015	23,069	(4,614)	[1,107]	{554}	23,122	(4,624)	[1,110]	{555}	23,173	(4,635)	[1,112]	{556}
Broward	206,185	206,889	207,580	208,096	209,277	(41,855)	[10,045]	{5,023}	210,446	(42,089)	[10,101]	{5,051}	211,615	(42,323)	[10,157]	{5,079}
Charlotte	11,096	11,119	11,155	11,187	11,240	(2,248)	[539]	{270}	11,293	(2,259)	[542]	{271}	11,349	(2,270)	[545]	{272}
Collier	31,564	31,620	31,697	31,736	31,870	(6,374)	[1,530]	{765}	32,003	(6,401)	[1,536]	{768}	32,135	(6,427)	[1,542]	{771}
Duval	91,085	91,209	91,342	91,450	91,670	(18,334)	[4,400]	{2,200}	91,884	(18,377)	[4,410]	{2,205}	92,093	(18,419)	[4,420]	{2,210}
Hillsborough	117,040	117,406	117,769	118,061	118,728	(23,746)	[5,699]	{2,849}	119,401	(23,880)	[5,731]	{2,866}	120,081	(24,016)	[5,764]	{2,882}
Lake	25,831	25,895	25,943	25,978	26,079	(5,216)	[1,252]	{626}	26,176	(5,235)	[1,256]	{628}	26,267	(5,253)	[1,261]	{630}
Lee	60,451	60,614	60,772	60,914	61,228	(12,246)	[2,939]	{1,469}	61,545	(12,309)	[2,954]	{1,477}	61,864	(12,373)	[2,969]	{1,485}
Manatee	33,581	33,670	33,763	33,832	33,977	(6,795)	[1,631]	{815}	34,117	(6,823)	[1,638]	{819}	34,255	(6,851)	[1,644]	{822}
Miami-Dade	430,942	432,177	433,452	434,352	436,385	(87,277)	[20,946]	{10,473}	438,412	(87,682)	[21,044]	{10,522}	440,424	(88,085)	[21,140]	{10,570}
Okaloosa	19,545	19,575	19,588	19,599	19,633	(3,927)	[942]	{471}	19,663	(3,933)	[944]	{472}	19,690	(3,938)	[945]	{473}
Orange	119,224	119,543	119,871	120,183	120,771	(24,154)	[5,797]	{2,899}	121,370	(24,274)	[5,826]	{2,913}	121,983	(24,397)	[5,855]	{2,928}
Osceola	38,381	38,476	38,577	38,661	38,827	(7,765)	[1,864]	{932}	38,993	(7,799)	[1,872]	{936}	39,158	(7,832)	[1,880]	{940}
Palm Beach	127,111	127,491	127,830	128,154	128,803	(25,761)	[6,183]	{3,091}	129,440	(25,888)	[6,213]	{3,107}	130,068	(26,014)	[6,243]	{3,122}
Pasco	35,039	35,136	35,248	35,336	35,510	(7,102)	[1,704]	{852}	35,681	(7,136)	[1,713]	{856}	35,849	(7,170)	[1,721]	{860}
Pinellas	69,667	69,829	70,089	70,251	70,573	(14,115)	[3,388]	{1,694}	70,893	(14,179)	[3,403]	{1,701}	71,207	(14,241)	[3,418]	{1,709}
Polk	59,400	59,542	59,654	59,767	59,991	(11,998)	[2,880]	{1,440}	60,214	(12,043)	[2,890]	{1,445}	60,433	(12,087)	[2,901]	{1,450}
Sarasota	28,254	28,325	28,399	28,455	28,587	(5,717)	[1,372]	{686}	28,718	(5,744)	[1,378]	{689}	28,847	(5,769)	[1,385]	{692}
Seminole	28,693	28,807	28,892	28,997	29,179	(5,836)	[1,401]	{700}	29,364	(5,873)	[1,409]	{705}	29,553	(5,911)	[1,419]	{709}
St. Johns	20,673	20,710	20,752	20,774	20,835	(4,167)	[1,000]	{500}	20,897	(4,179)	[1,003]	{502}	20,958	(4,192)	[1,006]	{503}
Sumter	8,442	8,472	8,489	8,501	8,542	(1,708)	[410]	{205}	8,582	(1,716)	[412]	{206}	8,621	(1,724)	[414]	{207}
Volusia	36,328	36,451	36,590	36,709	36,955	(7,391)	[1,774]	{887}	37,213	(7,443)	[1,786]	{893}	37,480	(7,496)	[1,799]	{900}

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.