

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

Date: 3/23/21

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 3/23/21 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.

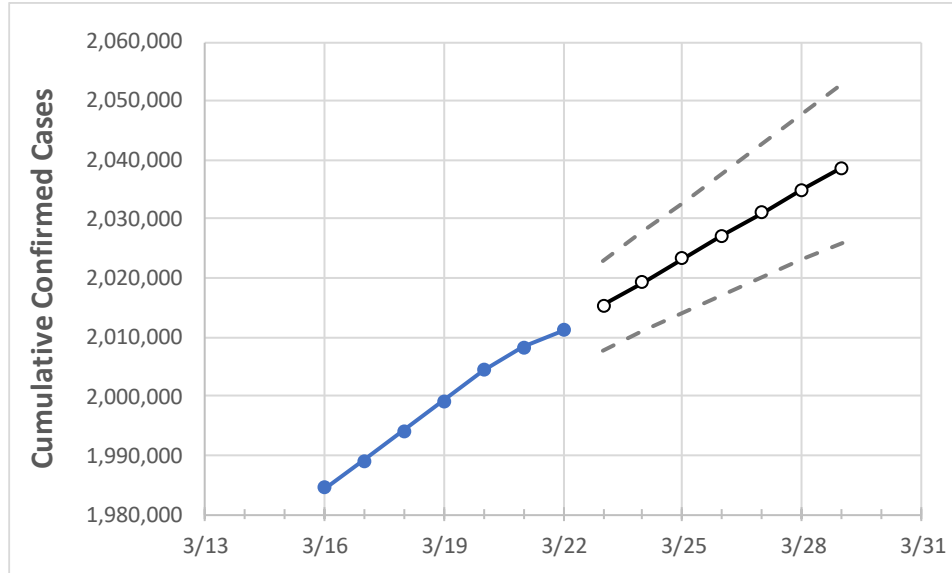
IEM's Modeling Lead

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

Florida 1,999,257 2,004,362 2,008,349 2,011,211 2,015,310 2,019,318 2,023,275 2,027,195 2,031,126 2,034,948 2,038,748

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:							
	3/19	3/20	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28	3/29	
Alachua	22,957	22,994	23,015	23,039	23,065	23,090	23,115	23,139	23,165	23,189	23,214	
Broward	206,889	207,580	208,096	208,462	209,005	209,546	210,083	210,598	211,096	211,617	212,136	
Charlotte	11,119	11,155	11,187	11,209	11,234	11,259	11,285	11,310	11,336	11,362	11,389	
Collier	31,620	31,697	31,736	31,763	31,822	31,882	31,941	31,999	32,058	32,115	32,172	
Duval	91,209	91,342	91,450	91,536	91,643	91,748	91,851	91,950	92,050	92,149	92,247	
Hillsborough	117,406	117,769	118,061	118,190	118,496	118,799	119,093	119,395	119,687	119,981	120,278	
Lake	25,895	25,943	25,978	26,009	26,056	26,103	26,149	26,193	26,236	26,280	26,322	
Lee	60,614	60,772	60,914	61,015	61,157	61,301	61,442	61,582	61,722	61,862	62,000	
Manatee	33,670	33,763	33,832	33,905	33,981	34,055	34,129	34,200	34,269	34,339	34,406	
Miami-Dade	432,177	433,452	434,352	435,135	436,088	437,037	437,973	438,885	439,793	440,716	441,633	
Okaloosa	19,575	19,588	19,599	19,601	19,617	19,631	19,647	19,660	19,672	19,685	19,696	
Orange	119,543	119,871	120,183	120,412	120,697	120,980	121,262	121,549	121,834	122,120	122,410	
Osceola	38,476	38,577	38,661	38,723	38,802	38,879	38,956	39,033	39,109	39,187	39,263	
Palm Beach	127,491	127,830	128,154	128,321	128,627	128,924	129,216	129,496	129,783	130,073	130,358	
Pasco	35,136	35,248	35,336	35,373	35,456	35,536	35,617	35,695	35,773	35,849	35,925	
Pinellas	69,829	70,089	70,251	70,382	70,543	70,702	70,857	71,005	71,161	71,310	71,463	
Polk	59,542	59,654	59,767	59,834	59,936	60,035	60,136	60,231	60,324	60,418	60,510	
Sarasota	28,325	28,399	28,455	28,515	28,580	28,644	28,710	28,773	28,836	28,901	28,965	
Seminole	28,807	28,892	28,997	29,062	29,151	29,240	29,329	29,419	29,510	29,602	29,694	
St. Johns	20,710	20,752	20,774	20,788	20,817	20,844	20,871	20,898	20,925	20,952	20,979	
Sumter	8,472	8,489	8,501	8,518	8,538	8,558	8,577	8,596	8,614	8,633	8,652	
Volusia	36,451	36,590	36,709	36,785	36,902	37,019	37,137	37,256	37,377	37,500	37,624	

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:											
	3/19	3/20	3/21	3/22	3/24			3/26			3/28					
Alachua	22,957	22,994	23,015	23,039	23,090	(4,618)	[1,108]	{554}	23,139	(4,628)	[1,111]	{555}	23,189	(4,638)	[1,113]	{557}
Broward	206,889	207,580	208,096	208,462	209,546	(41,909)	[10,058]	{5,029}	210,598	(42,120)	[10,109]	{5,054}	211,617	(42,323)	[10,158]	{5,079}
Charlotte	11,119	11,155	11,187	11,209	11,259	(2,252)	[540]	{270}	11,310	(2,262)	[543]	{271}	11,362	(2,272)	[545]	{273}
Collier	31,620	31,697	31,736	31,763	31,882	(6,376)	[1,530]	{765}	31,999	(6,400)	[1,536]	{768}	32,115	(6,423)	[1,542]	{771}
Duval	91,209	91,342	91,450	91,536	91,748	(18,350)	[4,404]	{2,202}	91,950	(18,390)	[4,414]	{2,207}	92,149	(18,430)	[4,423]	{2,212}
Hillsborough	117,406	117,769	118,061	118,190	118,799	(23,760)	[5,702]	{2,851}	119,395	(23,879)	[5,731]	{2,865}	119,981	(23,996)	[5,759]	{2,880}
Lake	25,895	25,943	25,978	26,009	26,103	(5,221)	[1,253]	{626}	26,193	(5,239)	[1,257]	{629}	26,280	(5,256)	[1,261]	{631}
Lee	60,614	60,772	60,914	61,015	61,301	(12,260)	[2,942]	{1,471}	61,582	(12,316)	[2,956]	{1,478}	61,862	(12,372)	[2,969]	{1,485}
Manatee	33,670	33,763	33,832	33,905	34,055	(6,811)	[1,635]	{817}	34,200	(6,840)	[1,642]	{821}	34,339	(6,868)	[1,648]	{824}
Miami-Dade	432,177	433,452	434,352	435,135	437,037	(87,407)	[20,978]	{10,489}	438,885	(87,777)	[21,066]	{10,533}	440,716	(88,143)	[21,154]	{10,577}
Okaloosa	19,575	19,588	19,599	19,601	19,631	(3,926)	[942]	{471}	19,660	(3,932)	[944]	{472}	19,685	(3,937)	[945]	{472}
Orange	119,543	119,871	120,183	120,412	120,980	(24,196)	[5,807]	{2,904}	121,549	(24,310)	[5,834]	{2,917}	122,120	(24,424)	[5,862]	{2,931}
Osceola	38,476	38,577	38,661	38,723	38,879	(7,776)	[1,866]	{933}	39,033	(7,807)	[1,874]	{937}	39,187	(7,837)	[1,881]	{940}
Palm Beach	127,491	127,830	128,154	128,321	128,924	(25,785)	[6,188]	{3,094}	129,496	(25,899)	[6,216]	{3,108}	130,073	(26,015)	[6,244]	{3,122}
Pasco	35,136	35,248	35,336	35,373	35,536	(7,107)	[1,706]	{853}	35,695	(7,139)	[1,713]	{857}	35,849	(7,170)	[1,721]	{860}
Pinellas	69,829	70,089	70,251	70,382	70,702	(14,140)	[3,394]	{1,697}	71,005	(14,201)	[3,408]	{1,704}	71,310	(14,262)	[3,423]	{1,711}
Polk	59,542	59,654	59,767	59,834	60,035	(12,007)	[2,882]	{1,441}	60,231	(12,046)	[2,891]	{1,446}	60,418	(12,084)	[2,900]	{1,450}
Sarasota	28,325	28,399	28,455	28,515	28,644	(5,729)	[1,375]	{687}	28,773	(5,755)	[1,381]	{691}	28,901	(5,780)	[1,387]	{694}
Seminole	28,807	28,892	28,997	29,062	29,240	(5,848)	[1,404]	{702}	29,419	(5,884)	[1,412]	{706}	29,602	(5,920)	[1,421]	{710}
St. Johns	20,710	20,752	20,774	20,788	20,844	(4,169)	[1,001]	{500}	20,898	(4,180)	[1,003]	{502}	20,952	(4,190)	[1,006]	{503}
Sumter	8,472	8,489	8,501	8,518	8,558	(1,712)	[411]	{205}	8,596	(1,719)	[413]	{206}	8,633	(1,727)	[414]	{207}
Volusia	36,451	36,590	36,709	36,785	37,019	(7,404)	[1,777]	{888}	37,256	(7,451)	[1,788]	{894}	37,500	(7,500)	[1,800]	{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.