

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

Date: 1/13/21

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 1/13/21 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.

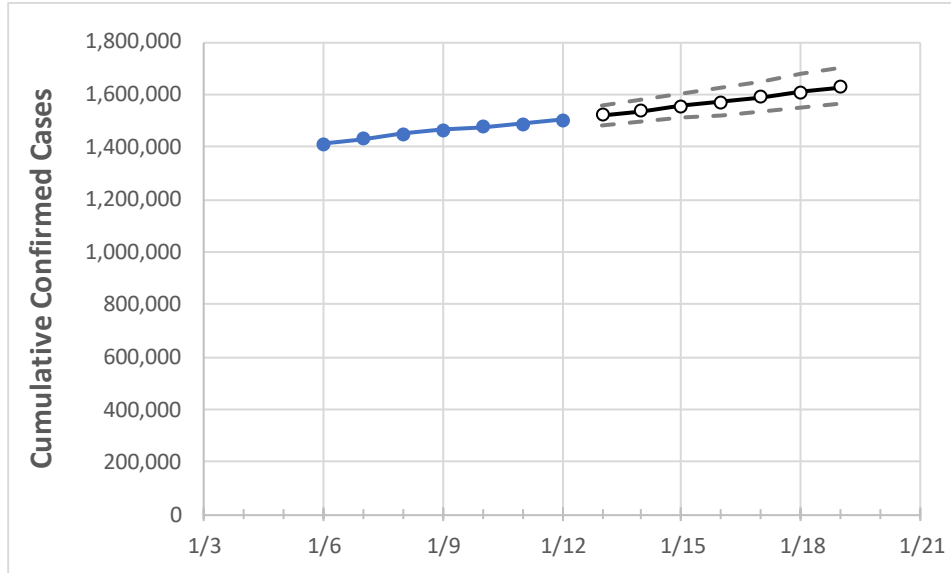
IEM's Modeling Lead

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:						
	1/9	1/10	1/11	1/12	1/13	1/14	1/15	1/16	1/17	1/18	1/19

Florida	1,464,697	1,477,010	1,488,586	1,503,482	1,520,427	1,537,592	1,555,003	1,572,759	1,591,388	1,609,645	1,628,368
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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:							
	1/9	1/10	1/11	1/12	1/13	1/14	1/15	1/16	1/17	1/18	1/19	
Alachua	17,430	17,614	17,727	17,878	18,078	18,280	18,490	18,707	18,927	19,163	19,400	
Broward	149,168	150,371	151,524	152,645	154,059	155,499	156,967	158,455	159,947	161,506	163,093	
Charlotte	8,382	8,456	8,522	8,599	8,706	8,812	8,920	9,030	9,140	9,252	9,363	
Collier	24,304	24,443	24,575	24,814	25,032	25,251	25,477	25,704	25,946	26,183	26,428	
Duval	69,773	70,524	70,905	71,854	72,820	73,796	74,830	75,893	76,949	78,029	79,118	
Hillsborough	85,855	86,509	87,511	88,217	89,264	90,332	91,431	92,589	93,716	94,877	96,070	
Lake	17,742	17,973	18,142	18,333	18,588	18,845	19,107	19,371	19,636	19,914	20,199	
Lee	44,819	45,282	45,650	46,104	46,604	47,118	47,637	48,175	48,713	49,250	49,804	
Manatee	24,530	24,755	24,871	25,134	25,399	25,668	25,943	26,226	26,505	26,795	27,095	
Miami-Dade	324,260	326,607	328,701	331,649	334,596	337,570	340,570	343,590	346,659	349,774	352,859	
Okaloosa	14,131	14,233	14,313	14,507	14,664	14,821	14,983	15,144	15,312	15,481	15,654	
Orange	85,875	86,634	87,688	88,697	89,894	91,114	92,385	93,675	95,003	96,352	97,782	
Osceola	28,251	28,480	28,827	29,106	29,462	29,822	30,191	30,561	30,943	31,342	31,726	
Palm Beach	91,049	91,711	92,542	93,295	94,288	95,309	96,336	97,401	98,469	99,578	100,716	
Pasco	24,663	24,942	25,224	25,483	25,801	26,127	26,458	26,792	27,120	27,453	27,801	
Pinellas	50,491	50,978	51,384	51,874	52,498	53,130	53,779	54,434	55,101	55,778	56,477	
Polk	42,056	42,422	42,880	43,363	43,931	44,517	45,100	45,702	46,312	46,942	47,582	
Sarasota	21,017	21,223	21,328	21,626	21,917	22,211	22,520	22,835	23,173	23,502	23,833	
Seminole	20,328	20,464	20,616	20,852	21,111	21,378	21,651	21,928	22,216	22,502	22,805	
St. Johns	15,165	15,329	15,492	15,700	15,938	16,180	16,429	16,679	16,937	17,192	17,446	
Sumter	5,904	5,975	6,029	6,108	6,206	6,308	6,409	6,515	6,626	6,737	6,848	
Volusia	25,200	25,461	25,624	25,970	26,319	26,677	27,051	27,437	27,821	28,224	28,626	

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:											
	1/9	1/10	1/11	1/12	1/14				1/16				1/18			
Alachua	17,430	17,614	17,727	17,878	18,280	(3,656)	[877]	{439}	18,707	(3,741)	[898]	{449}	19,163	(3,833)	[920]	{460}
Broward	149,168	150,371	151,524	152,645	155,499	(31,100)	[7,464]	{3,732}	158,455	(31,691)	[7,606]	{3,803}	161,506	(32,301)	[7,752]	{3,876}
Charlotte	8,382	8,456	8,522	8,599	8,812	(1,762)	[423]	{211}	9,030	(1,806)	[433]	{217}	9,252	(1,850)	[444]	{222}
Collier	24,304	24,443	24,575	24,814	25,251	(5,050)	[1,212]	{606}	25,704	(5,141)	[1,234]	{617}	26,183	(5,237)	[1,257]	{628}
Duval	69,773	70,524	70,905	71,854	73,796	(14,759)	[3,542]	{1,771}	75,893	(15,179)	[3,643]	{1,821}	78,029	(15,606)	[3,745]	{1,873}
Hillsborough	85,855	86,509	87,511	88,217	90,332	(18,066)	[4,336]	{2,168}	92,589	(18,518)	[4,444]	{2,222}	94,877	(18,975)	[4,554]	{2,277}
Lake	17,742	17,973	18,142	18,333	18,845	(3,769)	[905]	{452}	19,371	(3,874)	[930]	{465}	19,914	(3,983)	[956]	{478}
Lee	44,819	45,282	45,650	46,104	47,118	(9,424)	[2,262]	{1,131}	48,175	(9,635)	[2,312]	{1,156}	49,250	(9,850)	[2,364]	{1,182}
Manatee	24,530	24,755	24,871	25,134	25,668	(5,134)	[1,232]	{616}	26,226	(5,245)	[1,259]	{629}	26,795	(5,359)	[1,286]	{643}
Miami-Dade	324,260	326,607	328,701	331,649	337,570	(67,514)	[16,203]	{8,102}	343,590	(68,718)	[16,492]	{8,246}	349,774	(69,955)	[16,789]	{8,395}
Okaloosa	14,131	14,233	14,313	14,507	14,821	(2,964)	[711]	{356}	15,144	(3,029)	[727]	{363}	15,481	(3,096)	[743]	{372}
Orange	85,875	86,634	87,688	88,697	91,114	(18,223)	[4,373]	{2,187}	93,675	(18,735)	[4,496]	{2,248}	96,352	(19,270)	[4,625]	{2,312}
Osceola	28,251	28,480	28,827	29,106	29,822	(5,964)	[1,431]	{716}	30,561	(6,112)	[1,467]	{733}	31,342	(6,268)	[1,504]	{752}
Palm Beach	91,049	91,711	92,542	93,295	95,309	(19,062)	[4,575]	{2,287}	97,401	(19,480)	[4,675]	{2,338}	99,578	(19,916)	[4,780]	{2,390}
Pasco	24,663	24,942	25,224	25,483	26,127	(5,225)	[1,254]	{627}	26,792	(5,358)	[1,286]	{643}	27,453	(5,491)	[1,318]	{659}
Pinellas	50,491	50,978	51,384	51,874	53,130	(10,626)	[2,550]	{1,275}	54,434	(10,887)	[2,613]	{1,306}	55,778	(11,156)	[2,677]	{1,339}
Polk	42,056	42,422	42,880	43,363	44,517	(8,903)	[2,137]	{1,068}	45,702	(9,140)	[2,194]	{1,097}	46,942	(9,388)	[2,253]	{1,127}
Sarasota	21,017	21,223	21,328	21,626	22,211	(4,442)	[1,066]	{533}	22,835	(4,567)	[1,096]	{548}	23,502	(4,700)	[1,128]	{564}
Seminole	20,328	20,464	20,616	20,852	21,378	(4,276)	[1,026]	{513}	21,928	(4,386)	[1,053]	{526}	22,502	(4,500)	[1,080]	{540}
St. Johns	15,165	15,329	15,492	15,700	16,180	(3,236)	[777]	{388}	16,679	(3,336)	[801]	{400}	17,192	(3,438)	[825]	{413}
Sumter	5,904	5,975	6,029	6,108	6,308	(1,262)	[303]	{151}	6,515	(1,303)	[313]	{156}	6,737	(1,347)	[323]	{162}
Volusia	25,200	25,461	25,624	25,970	26,677	(5,335)	[1,280]	{640}	27,437	(5,487)	[1,317]	{658}	28,224	(5,645)	[1,355]	{677}

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.