

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

Date: 7/21/20

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 20%, and are often within 10%, of actual confirmed cases.

The projections shown in this document are based on data pulled in as of 7/21/20 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.

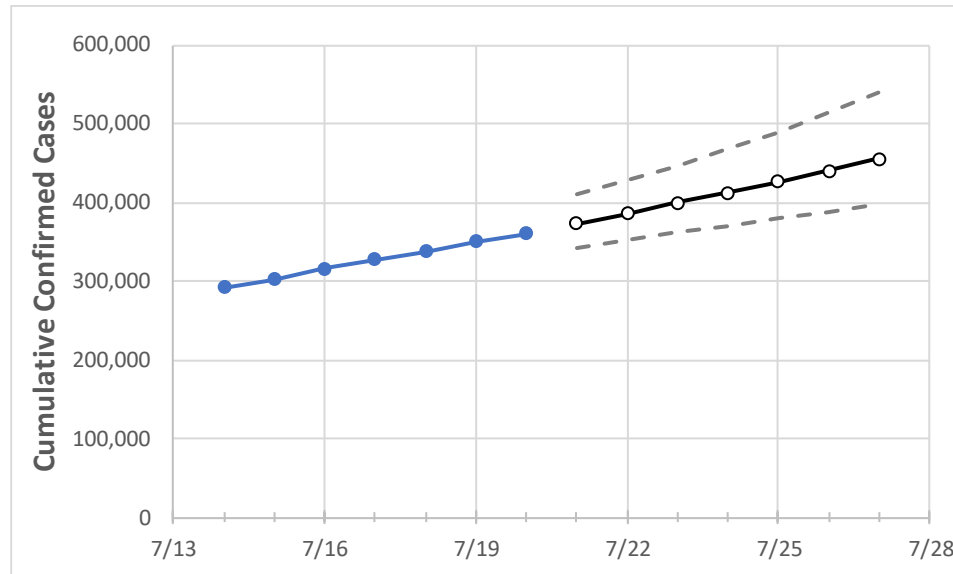
IEM's Modeling Lead

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:						
	7/17	7/18	7/19	7/20	7/21	7/22	7/23	7/24	7/25	7/26	7/27
Florida	327,239	337,569	350,047	360,394	373,051	385,971	399,162	412,635	426,400	440,467	454,844

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 20%, and are often within 10%, of actual confirmed cases.

Florida Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	7/17	7/18	7/19	7/20	7/21	7/22	7/23	7/24	7/25	7/26	7/27
Alachua	2,465	2,531	2,619	2,683	2,757	2,831	2,904	2,977	3,048	3,119	3,190
Broward	36,913	38,131	39,281	40,976	42,608	44,281	45,995	47,754	49,560	51,413	53,316
Charlotte	1,342	1,382	1,431	1,470	1,524	1,581	1,640	1,702	1,767	1,835	1,906
Collier	7,314	7,577	7,815	7,934	8,176	8,425	8,683	8,949	9,223	9,506	9,799
Duval	15,641	15,903	16,546	17,245	17,768	18,290	18,810	19,328	19,845	20,360	20,874
Hillsborough	22,502	23,103	23,706	24,135	24,716	25,287	25,846	26,395	26,934	27,463	27,983
Lake	3,139	3,206	3,343	3,391	3,495	3,600	3,705	3,810	3,916	4,022	4,128
Lee	12,043	12,397	12,711	12,906	13,265	13,629	13,997	14,369	14,745	15,126	15,512
Manatee	6,133	6,280	6,569	6,738	6,966	7,199	7,439	7,685	7,938	8,198	8,465
Miami-Dade	77,867	81,026	84,238	87,035	89,903	92,807	95,746	98,720	101,731	104,779	107,865
Okaloosa	1,698	1,753	1,813	1,973	2,079	2,193	2,314	2,444	2,582	2,729	2,886
Orange	22,049	22,518	23,259	23,584	24,193	24,800	25,406	26,009	26,611	27,212	27,810
Osceola	5,556	5,725	6,010	6,268	6,548	6,837	7,136	7,445	7,763	8,093	8,433
Palm Beach	24,361	25,045	25,785	26,426	27,204	28,001	28,817	29,651	30,505	31,379	32,276
Pasco	4,654	4,769	4,943	5,050	5,185	5,317	5,448	5,577	5,703	5,827	5,950
Pinellas	12,714	13,019	13,482	13,705	14,033	14,358	14,677	14,991	15,300	15,604	15,904
Polk	8,772	9,030	9,524	9,877	10,226	10,578	10,934	11,293	11,656	12,023	12,394
Sarasota	3,880	4,065	4,245	4,338	4,534	4,739	4,954	5,179	5,414	5,661	5,920
Seminole	5,030	5,150	5,329	5,411	5,539	5,667	5,793	5,918	6,042	6,165	6,287
St. Johns	2,270	2,326	2,431	2,541	2,637	2,734	2,832	2,932	3,033	3,136	3,240
Sumter	770	787	827	843	865	887	909	930	952	974	996
Volusia	4,768	4,959	5,188	5,297	5,494	5,695	5,899	6,107	6,319	6,534	6,754

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:											
	7/17	7/18	7/19	7/20	7/22				7/24				7/26			
Alachua	2,465	2,531	2,619	2,683	2,831	(566)	[136]	{68}	2,977	(595)	[143]	{71}	3,119	(624)	[150]	{75}
Broward	36,913	38,131	39,281	40,976	44,281	(8,856)	[2,125]	{1,063}	47,754	(9,551)	[2,292]	{1,146}	51,413	(10,283)	[2,468]	{1,234}
Charlotte	1,342	1,382	1,431	1,470	1,581	(316)	[76]	{38}	1,702	(340)	[82]	{41}	1,835	(367)	[88]	{44}
Collier	7,314	7,577	7,815	7,934	8,425	(1,685)	[404]	{202}	8,949	(1,790)	[430]	{215}	9,506	(1,901)	[456]	{228}
Duval	15,641	15,903	16,546	17,245	18,290	(3,658)	[878]	{439}	19,328	(3,866)	[928]	{464}	20,360	(4,072)	[977]	{489}
Hillsborough	22,502	23,103	23,706	24,135	25,287	(5,057)	[1,214]	{607}	26,395	(5,279)	[1,267]	{633}	27,463	(5,493)	[1,318]	{659}
Lake	3,139	3,206	3,343	3,391	3,600	(720)	[173]	{86}	3,810	(762)	[183]	{91}	4,022	(804)	[193]	{97}
Lee	12,043	12,397	12,711	12,906	13,629	(2,726)	[654]	{327}	14,369	(2,874)	[690]	{345}	15,126	(3,025)	[726]	{363}
Manatee	6,133	6,280	6,569	6,738	7,199	(1,440)	[346]	{173}	7,685	(1,537)	[369]	{184}	8,198	(1,640)	[393]	{197}
Miami-Dade	77,867	81,026	84,238	87,035	92,807	(18,561)	[4,455]	{2,227}	98,720	(19,744)	[4,739]	{2,369}	104,779	(20,956)	[5,029]	{2,515}
Okaloosa	1,698	1,753	1,813	1,973	2,193	(439)	[105]	{53}	2,444	(489)	[117]	{59}	2,729	(546)	[131]	{65}
Orange	22,049	22,518	23,259	23,584	24,800	(4,960)	[1,190]	{595}	26,009	(5,202)	[1,248]	{624}	27,212	(5,442)	[1,306]	{653}
Osceola	5,556	5,725	6,010	6,268	6,837	(1,367)	[328]	{164}	7,445	(1,489)	[357]	{179}	8,093	(1,619)	[388]	{194}
Palm Beach	24,361	25,045	25,785	26,426	28,001	(5,600)	[1,344]	{672}	29,651	(5,930)	[1,423]	{712}	31,379	(6,276)	[1,506]	{753}
Pasco	4,654	4,769	4,943	5,050	5,317	(1,063)	[255]	{128}	5,577	(1,115)	[268]	{134}	5,827	(1,165)	[280]	{140}
Pinellas	12,714	13,019	13,482	13,705	14,358	(2,872)	[689]	{345}	14,991	(2,998)	[720]	{360}	15,604	(3,121)	[749]	{374}
Polk	8,772	9,030	9,524	9,877	10,578	(2,116)	[508]	{254}	11,293	(2,259)	[542]	{271}	12,023	(2,405)	[577]	{289}
Sarasota	3,880	4,065	4,245	4,338	4,739	(948)	[227]	{114}	5,179	(1,036)	[249]	{124}	5,661	(1,132)	[272]	{136}
Seminole	5,030	5,150	5,329	5,411	5,667	(1,133)	[272]	{136}	5,918	(1,184)	[284]	{142}	6,165	(1,233)	[296]	{148}
St. Johns	2,270	2,326	2,431	2,541	2,734	(547)	[131]	{66}	2,932	(586)	[141]	{70}	3,136	(627)	[151]	{75}
Sumter	770	787	827	843	887	(177)	[43]	{21}	930	(186)	[45]	{22}	974	(195)	[47]	{23}
Volusia	4,768	4,959	5,188	5,297	5,695	(1,139)	[273]	{137}	6,107	(1,221)	[293]	{147}	6,534	(1,307)	[314]	{157}

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.