

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

Date: 7/30/20

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 7/30/20 11 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.

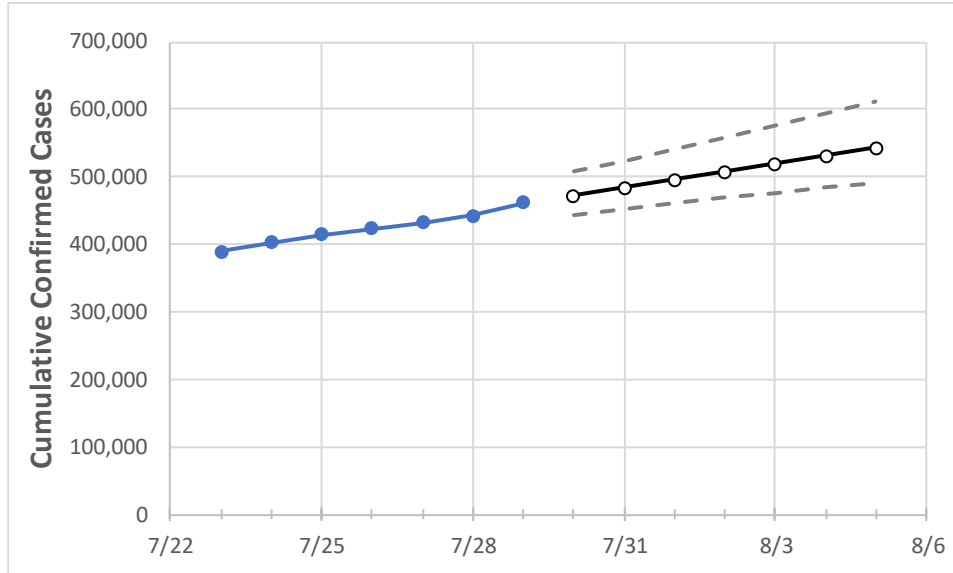
IEM's Modeling Lead

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:						
	7/26	7/27	7/28	7/29	7/30	7/31	8/1	8/2	8/3	8/4	8/5
Florida	423,843	432,709	441,917	461,379	472,845	484,406	496,062	507,813	519,657	531,594	543,623

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:						
	7/26	7/27	7/28	7/29	7/30	7/31	8/1	8/2	8/3	8/4	8/5
Alachua	3,144	3,186	3,297	3,448	3,531	3,616	3,702	3,791	3,881	3,973	4,066
Broward	49,350	50,784	51,657	54,312	55,832	57,385	58,972	60,593	62,248	63,938	65,663
Charlotte	1,683	1,717	1,784	1,889	1,938	1,988	2,041	2,095	2,151	2,209	2,269
Collier	8,795	8,870	9,069	9,355	9,488	9,619	9,749	9,877	10,003	10,128	10,251
Duval	19,753	20,001	20,138	20,816	21,152	21,484	21,811	22,133	22,450	22,763	23,071
Hillsborough	27,077	27,483	27,823	28,742	29,175	29,602	30,021	30,433	30,839	31,238	31,630
Lake	4,090	4,169	4,259	4,408	4,519	4,631	4,745	4,862	4,980	5,100	5,222
Lee	14,415	14,540	14,716	15,137	15,336	15,531	15,721	15,908	16,090	16,268	16,443
Manatee	7,859	7,982	8,090	8,337	8,497	8,656	8,815	8,973	9,131	9,288	9,445
Miami-Dade	104,755	107,315	110,352	115,916	119,452	123,093	126,840	130,697	134,665	138,748	142,949
Okaloosa	2,368	2,411	2,482	2,704	2,788	2,875	2,964	3,057	3,152	3,251	3,352
Orange	26,980	27,393	27,820	28,591	29,081	29,569	30,054	30,536	31,016	31,494	31,969
Osceola	7,614	7,728	7,973	8,281	8,522	8,769	9,021	9,279	9,542	9,811	10,086
Palm Beach	30,325	30,958	31,598	32,696	33,412	34,142	34,885	35,643	36,415	37,202	38,003
Pasco	5,803	5,911	5,992	6,201	6,320	6,440	6,559	6,678	6,798	6,917	7,037
Pinellas	15,147	15,339	15,541	16,114	16,341	16,566	16,788	17,006	17,222	17,436	17,646
Polk	11,423	11,717	11,893	12,281	12,545	12,810	13,075	13,341	13,607	13,874	14,141
Sarasota	5,103	5,168	5,274	5,443	5,555	5,668	5,781	5,894	6,007	6,120	6,234
Seminole	6,034	6,116	6,231	6,419	6,524	6,629	6,733	6,836	6,939	7,041	7,143
St. Johns	2,929	2,993	3,057	3,168	3,238	3,309	3,380	3,453	3,525	3,599	3,674
Sumter	992	1,003	1,028	1,058	1,083	1,108	1,135	1,162	1,190	1,218	1,248
Volusia	6,240	6,341	6,473	6,707	6,849	6,991	7,133	7,275	7,417	7,559	7,702

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:											
	7/26	7/27	7/28	7/29	7/31			8/2			8/4					
Alachua	3,144	3,186	3,297	3,448	3,616	(723)	[174]	{87}	3,791	(758)	[182]	{91}	3,973	(795)	[191]	{95}
Broward	49,350	50,784	51,657	54,312	57,385	(11,477)	[2,755]	{1,377}	60,593	(12,119)	[2,908]	{1,454}	63,938	(12,788)	[3,069]	{1,535}
Charlotte	1,683	1,717	1,784	1,889	1,988	(398)	[95]	{48}	2,095	(419)	[101]	{50}	2,209	(442)	[106]	{53}
Collier	8,795	8,870	9,069	9,355	9,619	(1,924)	[462]	{231}	9,877	(1,975)	[474]	{237}	10,128	(2,026)	[486]	{243}
Duval	19,753	20,001	20,138	20,816	21,484	(4,297)	[1,031]	{516}	22,133	(4,427)	[1,062]	{531}	22,763	(4,553)	[1,093]	{546}
Hillsborough	27,077	27,483	27,823	28,742	29,602	(5,920)	[1,421]	{710}	30,433	(6,087)	[1,461]	{730}	31,238	(6,248)	[1,499]	{750}
Lake	4,090	4,169	4,259	4,408	4,631	(926)	[222]	{111}	4,862	(972)	[233]	{117}	5,100	(1,020)	[245]	{122}
Lee	14,415	14,540	14,716	15,137	15,531	(3,106)	[745]	{373}	15,908	(3,182)	[764]	{382}	16,268	(3,254)	[781]	{390}
Manatee	7,859	7,982	8,090	8,337	8,656	(1,731)	[415]	{208}	8,973	(1,795)	[431]	{215}	9,288	(1,858)	[446]	{223}
Miami-Dade	104,755	107,315	110,352	115,916	123,093	(24,619)	[5,908]	{2,954}	130,697	(26,139)	[6,273]	{3,137}	138,748	(27,750)	[6,660]	{3,330}
Okaloosa	2,368	2,411	2,482	2,704	2,875	(575)	[138]	{69}	3,057	(611)	[147]	{73}	3,251	(650)	[156]	{78}
Orange	26,980	27,393	27,820	28,591	29,569	(5,914)	[1,419]	{710}	30,536	(6,107)	[1,466]	{733}	31,494	(6,299)	[1,512]	{756}
Osceola	7,614	7,728	7,973	8,281	8,769	(1,754)	[421]	{210}	9,279	(1,856)	[445]	{223}	9,811	(1,962)	[471]	{235}
Palm Beach	30,325	30,958	31,598	32,696	34,142	(6,828)	[1,639]	{819}	35,643	(7,129)	[1,711]	{855}	37,202	(7,440)	[1,786]	{893}
Pasco	5,803	5,911	5,992	6,201	6,440	(1,288)	[309]	{155}	6,678	(1,336)	[321]	{160}	6,917	(1,383)	[332]	{166}
Pinellas	15,147	15,339	15,541	16,114	16,566	(3,313)	[795]	{398}	17,006	(3,401)	[816]	{408}	17,436	(3,487)	[837]	{418}
Polk	11,423	11,717	11,893	12,281	12,810	(2,562)	[615]	{307}	13,341	(2,668)	[640]	{320}	13,874	(2,775)	[666]	{333}
Sarasota	5,103	5,168	5,274	5,443	5,668	(1,134)	[272]	{136}	5,894	(1,179)	[283]	{141}	6,120	(1,224)	[294]	{147}
Seminole	6,034	6,116	6,231	6,419	6,629	(1,326)	[318]	{159}	6,836	(1,367)	[328]	{164}	7,041	(1,408)	[338]	{169}
St. Johns	2,929	2,993	3,057	3,168	3,309	(662)	[159]	{79}	3,453	(691)	[166]	{83}	3,599	(720)	[173]	{86}
Sumter	992	1,003	1,028	1,058	1,108	(222)	[53]	{27}	1,162	(232)	[56]	{28}	1,218	(244)	[58]	{29}
Volusia	6,240	6,341	6,473	6,707	6,991	(1,398)	[336]	{168}	7,275	(1,455)	[349]	{175}	7,559	(1,512)	[363]	{181}

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.