

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

Date: 12/8/20

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 10%, and are often within 5%, of actual confirmed cases.

The projections shown in this document are based on data pulled in as of 12/8/20 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.

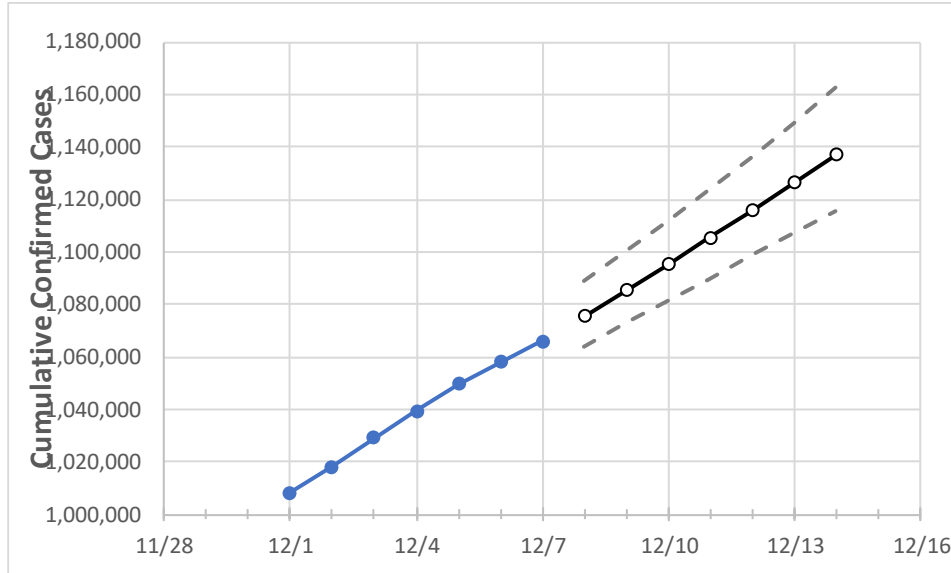
IEM's Modeling Lead

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:							
	12/4	12/5	12/6	12/7	12/8	12/9	12/10	12/11	12/12	12/13	12/14	

Florida 1,039,207 1,049,638 1,058,074 1,065,785 1,075,476 1,085,330 1,095,349 1,105,534 1,115,888 1,126,414 1,137,112

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:							
	12/4	12/5	12/6	12/7	12/8	12/9	12/10	12/11	12/12	12/13	12/14	
Alachua	13,190	13,314	13,382	13,479	13,559	13,641	13,723	13,806	13,891	13,976	14,062	
Broward	111,629	112,729	113,634	114,426	115,463	116,519	117,594	118,690	119,805	120,941	122,098	
Charlotte	5,354	5,437	5,527	5,593	5,665	5,738	5,813	5,891	5,970	6,050	6,133	
Collier	18,548	18,751	18,926	19,026	19,184	19,345	19,510	19,679	19,852	20,029	20,211	
Duval	46,112	46,606	47,036	47,418	47,974	48,546	49,135	49,741	50,365	51,008	51,668	
Hillsborough	60,241	60,761	61,276	61,599	62,055	62,520	62,993	63,476	63,968	64,470	64,981	
Lake	10,982	11,091	11,183	11,301	11,394	11,490	11,587	11,687	11,789	11,894	12,001	
Lee	31,571	31,897	32,209	32,476	32,815	33,161	33,513	33,871	34,237	34,609	34,988	
Manatee	17,450	17,606	17,713	17,800	17,938	18,078	18,218	18,359	18,501	18,643	18,787	
Miami-Dade	238,813	241,051	243,050	245,064	247,429	249,840	252,298	254,803	257,356	259,957	262,609	
Okaloosa	9,605	9,714	9,776	9,870	9,971	10,075	10,180	10,286	10,395	10,506	10,619	
Orange	60,392	61,030	61,474	62,041	62,584	63,137	63,698	64,270	64,850	65,441	66,041	
Osceola	19,255	19,487	19,625	19,809	20,006	20,208	20,413	20,622	20,836	21,054	21,276	
Palm Beach	67,736	68,381	68,912	69,331	69,870	70,415	70,965	71,522	72,084	72,653	73,228	
Pasco	15,700	15,948	16,153	16,338	16,554	16,775	17,002	17,235	17,475	17,721	17,974	
Pinellas	34,152	34,603	34,899	35,202	35,517	35,836	36,162	36,492	36,829	37,171	37,519	
Polk	28,640	28,918	29,135	29,362	29,603	29,850	30,105	30,368	30,638	30,917	31,203	
Sarasota	14,384	14,575	14,753	14,862	15,031	15,202	15,374	15,548	15,724	15,902	16,082	
Seminole	13,427	13,556	13,642	13,770	13,884	13,999	14,117	14,236	14,357	14,479	14,604	
St. Johns	9,339	9,433	9,542	9,620	9,747	9,876	10,009	10,144	10,283	10,425	10,571	
Sumter	3,644	3,701	3,716	3,745	3,783	3,823	3,864	3,908	3,954	4,002	4,053	
Volusia	17,080	17,286	17,388	17,498	17,662	17,829	17,999	18,172	18,348	18,528	18,710	

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:											
	12/4	12/5	12/6	12/7	12/9			12/11			12/13					
Alachua	13,190	13,314	13,382	13,479	13,641	(2,728)	[655]	{327}	13,806	(2,761)	[663]	{331}	13,976	(2,795)	[671]	{335}
Broward	111,629	112,729	113,634	114,426	116,519	(23,304)	[5,593]	{2,796}	118,690	(23,738)	[5,697]	{2,849}	120,941	(24,188)	[5,805]	{2,903}
Charlotte	5,354	5,437	5,527	5,593	5,738	(1,148)	[275]	{138}	5,891	(1,178)	[283]	{141}	6,050	(1,210)	[290]	{145}
Collier	18,548	18,751	18,926	19,026	19,345	(3,869)	[929]	{464}	19,679	(3,936)	[945]	{472}	20,029	(4,006)	[961]	{481}
Duval	46,112	46,606	47,036	47,418	48,546	(9,709)	[2,330]	{1,165}	49,741	(9,948)	[2,388]	{1,194}	51,008	(10,202)	[2,448]	{1,224}
Hillsborough	60,241	60,761	61,276	61,599	62,520	(12,504)	[3,001]	{1,500}	63,476	(12,695)	[3,047]	{1,523}	64,470	(12,894)	[3,095]	{1,547}
Lake	10,982	11,091	11,183	11,301	11,490	(2,298)	[551]	{276}	11,687	(2,337)	[561]	{280}	11,894	(2,379)	[571]	{285}
Lee	31,571	31,897	32,209	32,476	33,161	(6,632)	[1,592]	{796}	33,871	(6,774)	[1,626]	{813}	34,609	(6,922)	[1,661]	{831}
Manatee	17,450	17,606	17,713	17,800	18,078	(3,616)	[868]	{434}	18,359	(3,672)	[881]	{441}	18,643	(3,729)	[895]	{447}
Miami-Dade	238,813	241,051	243,050	245,064	249,840	(49,968)	[11,992]	{5,996}	254,803	(50,961)	[12,231]	{6,115}	259,957	(51,991)	[12,478]	{6,239}
Okaloosa	9,605	9,714	9,776	9,870	10,075	(2,015)	[484]	{242}	10,286	(2,057)	[494]	{247}	10,506	(2,101)	[504]	{252}
Orange	60,392	61,030	61,474	62,041	63,137	(12,627)	[3,031]	{1,515}	64,270	(12,854)	[3,085]	{1,542}	65,441	(13,088)	[3,141]	{1,571}
Osceola	19,255	19,487	19,625	19,809	20,208	(4,042)	[970]	{485}	20,622	(4,124)	[990]	{495}	21,054	(4,211)	[1,011]	{505}
Palm Beach	67,736	68,381	68,912	69,331	70,415	(14,083)	[3,380]	{1,690}	71,522	(14,304)	[3,433]	{1,717}	72,653	(14,531)	[3,487]	{1,744}
Pasco	15,700	15,948	16,153	16,338	16,775	(3,355)	[805]	{403}	17,235	(3,447)	[827]	{414}	17,721	(3,544)	[851]	{425}
Pinellas	34,152	34,603	34,899	35,202	35,836	(7,167)	[1,720]	{860}	36,492	(7,298)	[1,752]	{876}	37,171	(7,434)	[1,784]	{892}
Polk	28,640	28,918	29,135	29,362	29,850	(5,970)	[1,433]	{716}	30,368	(6,074)	[1,458]	{729}	30,917	(6,183)	[1,484]	{742}
Sarasota	14,384	14,575	14,753	14,862	15,202	(3,040)	[730]	{365}	15,548	(3,110)	[746]	{373}	15,902	(3,180)	[763]	{382}
Seminole	13,427	13,556	13,642	13,770	13,999	(2,800)	[672]	{336}	14,236	(2,847)	[683]	{342}	14,479	(2,896)	[695]	{348}
St. Johns	9,339	9,433	9,542	9,620	9,876	(1,975)	[474]	{237}	10,144	(2,029)	[487]	{243}	10,425	(2,085)	[500]	{250}
Sumter	3,644	3,701	3,716	3,745	3,823	(765)	[183]	{92}	3,908	(782)	[188]	{94}	4,002	(800)	[192]	{96}
Volusia	17,080	17,286	17,388	17,498	17,829	(3,566)	[856]	{428}	18,172	(3,634)	[872]	{436}	18,528	(3,706)	[889]	{445}

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.