

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

Date: 9/8/20

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

The projections shown in this document are based on data pulled in as of 9/8/20 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.

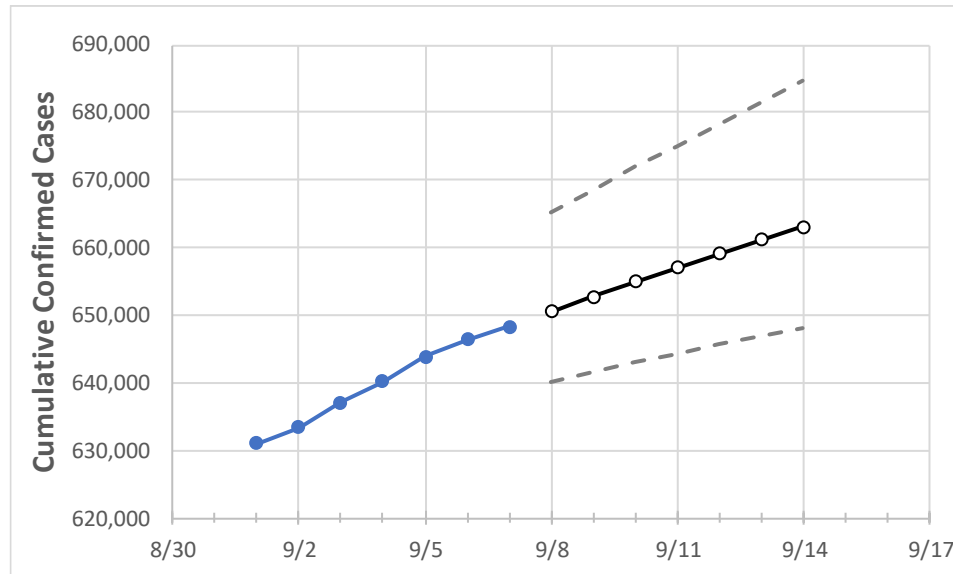
IEM's Modeling Lead

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:						
	9/4	9/5	9/6	9/7	9/8	9/9	9/10	9/11	9/12	9/13	9/14
Florida	640,211	643,867	646,431	648,269	650,564	652,799	654,974	657,093	659,155	661,163	663,117

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:						
	9/4	9/5	9/6	9/7	9/8	9/9	9/10	9/11	9/12	9/13	9/14
Alachua	5,409	5,498	5,582	5,633	5,669	5,705	5,741	5,776	5,812	5,848	5,883
Broward	72,880	73,112	73,293	73,426	73,593	73,753	73,906	74,053	74,193	74,328	74,457
Charlotte	2,762	2,778	2,793	2,811	2,828	2,845	2,862	2,879	2,896	2,913	2,930
Collier	11,893	11,951	11,994	12,024	12,054	12,083	12,111	12,138	12,165	12,191	12,217
Duval	27,405	27,544	27,635	27,734	27,852	27,970	28,086	28,202	28,317	28,431	28,545
Hillsborough	37,981	38,262	38,426	38,545	38,707	38,867	39,024	39,180	39,334	39,486	39,636
Lake	6,683	6,754	6,787	6,824	6,866	6,908	6,949	6,991	7,032	7,073	7,114
Lee	19,018	19,099	19,134	19,176	19,232	19,286	19,339	19,391	19,441	19,490	19,538
Manatee	10,601	10,633	10,656	10,673	10,694	10,714	10,733	10,752	10,770	10,787	10,803
Miami-Dade	160,469	161,018	161,363	161,637	161,993	162,331	162,651	162,955	163,243	163,516	163,775
Okaloosa	4,328	4,361	4,382	4,410	4,437	4,464	4,491	4,518	4,545	4,572	4,598
Orange	36,827	36,966	37,074	37,152	37,276	37,398	37,517	37,632	37,746	37,856	37,964
Osceola	11,406	11,472	11,517	11,542	11,582	11,621	11,658	11,695	11,731	11,767	11,801
Palm Beach	42,762	42,905	43,067	43,187	43,299	43,407	43,512	43,614	43,713	43,808	43,900
Pasco	8,230	8,267	8,316	8,338	8,368	8,397	8,425	8,453	8,480	8,507	8,533
Pinellas	20,259	20,355	20,425	20,474	20,536	20,597	20,657	20,717	20,775	20,833	20,891
Polk	17,566	17,693	17,799	17,863	17,965	18,066	18,167	18,267	18,367	18,467	18,567
Sarasota	7,338	7,378	7,410	7,434	7,457	7,479	7,501	7,522	7,543	7,563	7,583
Seminole	8,299	8,325	8,361	8,382	8,415	8,447	8,480	8,511	8,543	8,574	8,605
St. Johns	4,535	4,587	4,634	4,675	4,707	4,739	4,772	4,806	4,839	4,874	4,908
Sumter	1,985	2,021	2,042	2,048	2,065	2,082	2,100	2,118	2,135	2,153	2,171
Volusia	9,648	9,735	9,772	9,816	9,862	9,908	9,953	9,998	10,041	10,085	10,127

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:											
	9/4	9/5	9/6	9/7	9/9				9/11				9/13			
Alachua	5,409	5,498	5,582	5,633	5,705	(1,141)	[274]	{137}	5,776	(1,155)	[277]	{139}	5,848	(1,170)	[281]	{140}
Broward	72,880	73,112	73,293	73,426	73,753	(14,751)	[3,540]	{1,770}	74,053	(14,811)	[3,555]	{1,777}	74,328	(14,866)	[3,568]	{1,784}
Charlotte	2,762	2,778	2,793	2,811	2,845	(569)	[137]	{68}	2,879	(576)	[138]	{69}	2,913	(583)	[140]	{70}
Collier	11,893	11,951	11,994	12,024	12,083	(2,417)	[580]	{290}	12,138	(2,428)	[583]	{291}	12,191	(2,438)	[585]	{293}
Duval	27,405	27,544	27,635	27,734	27,970	(5,594)	[1,343]	{671}	28,202	(5,640)	[1,354]	{677}	28,431	(5,686)	[1,365]	{682}
Hillsborough	37,981	38,262	38,426	38,545	38,867	(7,773)	[1,866]	{933}	39,180	(7,836)	[1,881]	{940}	39,486	(7,897)	[1,895]	{948}
Lake	6,683	6,754	6,787	6,824	6,908	(1,382)	[332]	{166}	6,991	(1,398)	[336]	{168}	7,073	(1,415)	[340]	{170}
Lee	19,018	19,099	19,134	19,176	19,286	(3,857)	[926]	{463}	19,391	(3,878)	[931]	{465}	19,490	(3,898)	[936]	{468}
Manatee	10,601	10,633	10,656	10,673	10,714	(2,143)	[514]	{257}	10,752	(2,150)	[516]	{258}	10,787	(2,157)	[518]	{259}
Miami-Dade	160,469	161,018	161,363	161,637	162,331	(32,466)	[7,792]	{3,896}	162,955	(32,591)	[7,822]	{3,911}	163,516	(32,703)	[7,849]	{3,924}
Okaloosa	4,328	4,361	4,382	4,410	4,464	(893)	[214]	{107}	4,518	(904)	[217]	{108}	4,572	(914)	[219]	{110}
Orange	36,827	36,966	37,074	37,152	37,398	(7,480)	[1,795]	{898}	37,632	(7,526)	[1,806]	{903}	37,856	(7,571)	[1,817]	{909}
Osceola	11,406	11,472	11,517	11,542	11,621	(2,324)	[558]	{279}	11,695	(2,339)	[561]	{281}	11,767	(2,353)	[565]	{282}
Palm Beach	42,762	42,905	43,067	43,187	43,407	(8,681)	[2,084]	{1,042}	43,614	(8,723)	[2,093]	{1,047}	43,808	(8,762)	[2,103]	{1,051}
Pasco	8,230	8,267	8,316	8,338	8,397	(1,679)	[403]	{202}	8,453	(1,691)	[406]	{203}	8,507	(1,701)	[408]	{204}
Pinellas	20,259	20,355	20,425	20,474	20,597	(4,119)	[989]	{494}	20,717	(4,143)	[994]	{497}	20,833	(4,167)	[1,000]	{500}
Polk	17,566	17,693	17,799	17,863	18,066	(3,613)	[867]	{434}	18,267	(3,653)	[877]	{438}	18,467	(3,693)	[886]	{443}
Sarasota	7,338	7,378	7,410	7,434	7,479	(1,496)	[359]	{180}	7,522	(1,504)	[361]	{181}	7,563	(1,513)	[363]	{182}
Seminole	8,299	8,325	8,361	8,382	8,447	(1,689)	[405]	{203}	8,511	(1,702)	[409]	{204}	8,574	(1,715)	[412]	{206}
St. Johns	4,535	4,587	4,634	4,675	4,739	(948)	[227]	{114}	4,806	(961)	[231]	{115}	4,874	(975)	[234]	{117}
Sumter	1,985	2,021	2,042	2,048	2,082	(416)	[100]	{50}	2,118	(424)	[102]	{51}	2,153	(431)	[103]	{52}
Volusia	9,648	9,735	9,772	9,816	9,908	(1,982)	[476]	{238}	9,998	(2,000)	[480]	{240}	10,085	(2,017)	[484]	{242}

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.