

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

Date: 9/9/20

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 9/9/20 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.

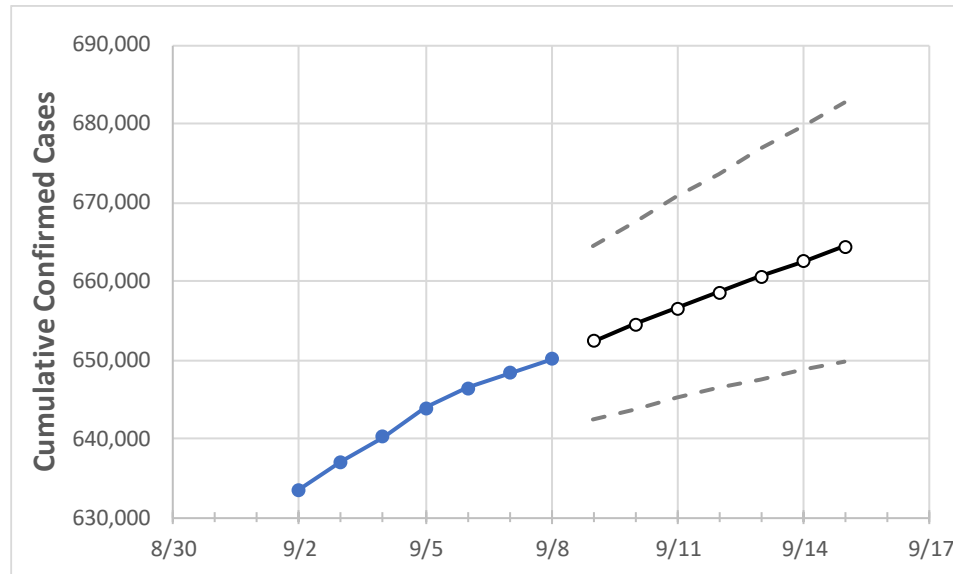
IEM's Modeling Lead

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:						
	9/5	9/6	9/7	9/8	9/9	9/10	9/11	9/12	9/13	9/14	9/15
Florida	643,867	646,431	648,269	650,092	652,315	654,476	656,578	658,621	660,608	662,538	664,415

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:						
	9/5	9/6	9/7	9/8	9/9	9/10	9/11	9/12	9/13	9/14	9/15
Alachua	5,498	5,582	5,633	5,722	5,763	5,805	5,848	5,890	5,933	5,977	6,021
Broward	73,112	73,293	73,426	73,556	73,710	73,857	73,997	74,131	74,259	74,380	74,496
Charlotte	2,778	2,793	2,811	2,822	2,838	2,854	2,869	2,885	2,900	2,916	2,931
Collier	11,951	11,994	12,024	12,049	12,074	12,098	12,121	12,143	12,165	12,186	12,207
Duval	27,544	27,635	27,734	27,802	27,916	28,029	28,141	28,252	28,362	28,470	28,577
Hillsborough	38,262	38,426	38,545	38,652	38,807	38,959	39,109	39,257	39,402	39,546	39,687
Lake	6,754	6,787	6,824	6,841	6,878	6,915	6,951	6,987	7,023	7,057	7,092
Lee	19,099	19,134	19,176	19,210	19,260	19,308	19,355	19,401	19,445	19,488	19,530
Manatee	10,633	10,656	10,673	10,699	10,720	10,740	10,759	10,777	10,795	10,812	10,828
Miami-Dade	161,018	161,363	161,637	162,026	162,360	162,676	162,976	163,260	163,529	163,784	164,025
Okaloosa	4,361	4,382	4,410	4,428	4,454	4,480	4,505	4,531	4,556	4,581	4,606
Orange	36,966	37,074	37,152	37,247	37,362	37,474	37,584	37,690	37,793	37,894	37,992
Osceola	11,472	11,517	11,542	11,560	11,594	11,627	11,659	11,690	11,720	11,749	11,777
Palm Beach	42,905	43,067	43,187	43,309	43,423	43,534	43,642	43,746	43,847	43,944	44,039
Pasco	8,267	8,316	8,338	8,357	8,384	8,411	8,437	8,463	8,488	8,512	8,536
Pinellas	20,355	20,425	20,474	20,526	20,585	20,644	20,701	20,757	20,813	20,867	20,920
Polk	17,693	17,799	17,863	17,932	18,027	18,120	18,213	18,305	18,395	18,484	18,573
Sarasota	7,378	7,410	7,434	7,457	7,482	7,506	7,530	7,553	7,576	7,599	7,621
Seminole	8,325	8,361	8,382	8,412	8,445	8,477	8,508	8,540	8,571	8,602	8,632
St. Johns	4,587	4,634	4,675	4,699	4,735	4,772	4,810	4,849	4,888	4,928	4,969
Sumter	2,021	2,042	2,048	2,049	2,061	2,073	2,084	2,095	2,107	2,118	2,128
Volusia	9,735	9,772	9,816	9,862	9,909	9,955	10,000	10,045	10,090	10,134	10,177

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:											
	9/5	9/6	9/7	9/8	9/10				9/12				9/14			
Alachua	5,498	5,582	5,633	5,722	5,805	(1,161)	[279]	{139}	5,890	(1,178)	[283]	{141}	5,977	(1,195)	[287]	{143}
Broward	73,112	73,293	73,426	73,556	73,857	(14,771)	[3,545]	{1,773}	74,131	(14,826)	[3,558]	{1,779}	74,380	(14,876)	[3,570]	{1,785}
Charlotte	2,778	2,793	2,811	2,822	2,854	(571)	[137]	{68}	2,885	(577)	[138]	{69}	2,916	(583)	[140]	{70}
Collier	11,951	11,994	12,024	12,049	12,098	(2,420)	[581]	{290}	12,143	(2,429)	[583]	{291}	12,186	(2,437)	[585]	{292}
Duval	27,544	27,635	27,734	27,802	28,029	(5,606)	[1,345]	{673}	28,252	(5,650)	[1,356]	{678}	28,470	(5,694)	[1,367]	{683}
Hillsborough	38,262	38,426	38,545	38,652	38,959	(7,792)	[1,870]	{935}	39,257	(7,851)	[1,884]	{942}	39,546	(7,909)	[1,898]	{949}
Lake	6,754	6,787	6,824	6,841	6,915	(1,383)	[332]	{166}	6,987	(1,397)	[335]	{168}	7,057	(1,411)	[339]	{169}
Lee	19,099	19,134	19,176	19,210	19,308	(3,862)	[927]	{463}	19,401	(3,880)	[931]	{466}	19,488	(3,898)	[935]	{468}
Manatee	10,633	10,656	10,673	10,699	10,740	(2,148)	[516]	{258}	10,777	(2,155)	[517]	{259}	10,812	(2,162)	[519]	{259}
Miami-Dade	161,018	161,363	161,637	162,026	162,676	(32,535)	[7,808]	{3,904}	163,260	(32,652)	[7,836]	{3,918}	163,784	(32,757)	[7,862]	{3,931}
Okaloosa	4,361	4,382	4,410	4,428	4,480	(896)	[215]	{108}	4,531	(906)	[217]	{109}	4,581	(916)	[220]	{110}
Orange	36,966	37,074	37,152	37,247	37,474	(7,495)	[1,799]	{899}	37,690	(7,538)	[1,809]	{905}	37,894	(7,579)	[1,819]	{909}
Osceola	11,472	11,517	11,542	11,560	11,627	(2,325)	[558]	{279}	11,690	(2,338)	[561]	{281}	11,749	(2,350)	[564]	{282}
Palm Beach	42,905	43,067	43,187	43,309	43,534	(8,707)	[2,090]	{1,045}	43,746	(8,749)	[2,100]	{1,050}	43,944	(8,789)	[2,109]	{1,055}
Pasco	8,267	8,316	8,338	8,357	8,411	(1,682)	[404]	{202}	8,463	(1,693)	[406]	{203}	8,512	(1,702)	[409]	{204}
Pinellas	20,355	20,425	20,474	20,526	20,644	(4,129)	[991]	{495}	20,757	(4,151)	[996]	{498}	20,867	(4,173)	[1,002]	{501}
Polk	17,693	17,799	17,863	17,932	18,120	(3,624)	[870]	{435}	18,305	(3,661)	[879]	{439}	18,484	(3,697)	[887]	{444}
Sarasota	7,378	7,410	7,434	7,457	7,506	(1,501)	[360]	{180}	7,553	(1,511)	[363]	{181}	7,599	(1,520)	[365]	{182}
Seminole	8,325	8,361	8,382	8,412	8,477	(1,695)	[407]	{203}	8,540	(1,708)	[410]	{205}	8,602	(1,720)	[413]	{206}
St. Johns	4,587	4,634	4,675	4,699	4,772	(954)	[229]	{115}	4,849	(970)	[233]	{116}	4,928	(986)	[237]	{118}
Sumter	2,021	2,042	2,048	2,049	2,073	(415)	[99]	{50}	2,095	(419)	[101]	{50}	2,118	(424)	[102]	{51}
Volusia	9,735	9,772	9,816	9,862	9,955	(1,991)	[478]	{239}	10,045	(2,009)	[482]	{241}	10,134	(2,027)	[486]	{243}

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.