

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

Date: 1/8/21

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 1/8/21 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.

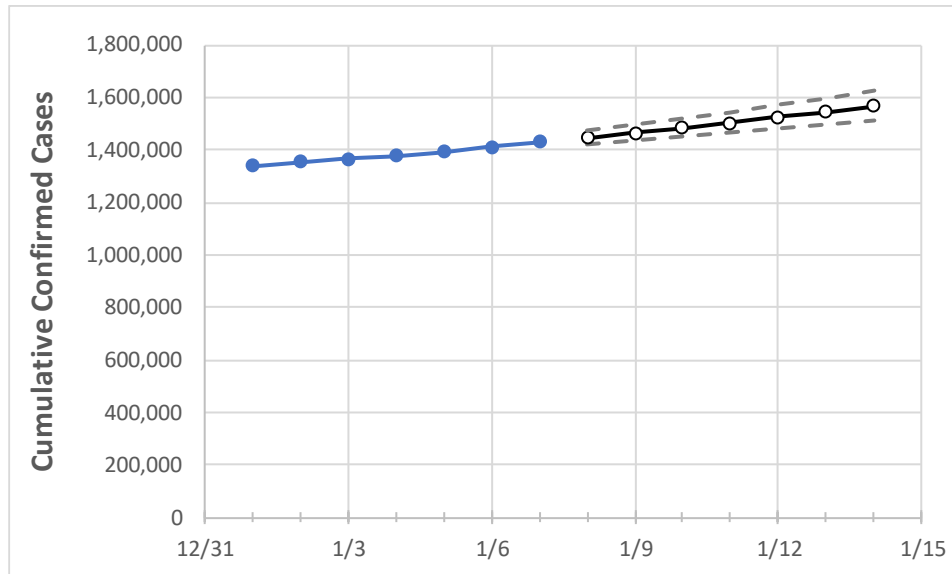
IEM's Modeling Lead

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:						
	1/4	1/5	1/6	1/7	1/8	1/9	1/10	1/11	1/12	1/13	1/14
Florida	1,376,692	1,392,123	1,409,906	1,429,722	1,447,280	1,465,402	1,484,199	1,503,948	1,524,429	1,545,861	1,567,803

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

Florida Counties

	Actual Confirmed Cases On:				Projected Cases For:							
	1/4	1/5	1/6	1/7	1/8	1/9	1/10	1/11	1/12	1/13	1/14	
Alachua	16,437	16,585	16,804	17,000	17,181	17,365	17,560	17,760	17,972	18,188	18,422	
Broward	141,993	143,186	144,590	146,201	147,641	149,128	150,665	152,255	153,899	155,589	157,335	
Charlotte	7,807	7,880	8,029	8,147	8,262	8,379	8,500	8,626	8,752	8,886	9,022	
Collier	23,197	23,323	23,502	23,707	23,898	24,100	24,302	24,503	24,712	24,924	25,141	
Duval	64,225	65,556	66,647	67,938	69,040	70,184	71,355	72,555	73,838	75,189	76,614	
Hillsborough	80,586	81,105	82,257	83,574	84,589	85,604	86,671	87,728	88,859	90,021	91,173	
Lake	16,483	16,697	16,897	17,228	17,494	17,762	18,041	18,327	18,630	18,939	19,258	
Lee	42,368	42,845	43,327	43,871	44,386	44,907	45,451	46,004	46,576	47,166	47,771	
Manatee	23,044	23,338	23,690	24,000	24,280	24,563	24,859	25,166	25,479	25,808	26,140	
Miami-Dade	308,259	311,606	314,742	318,115	321,129	324,261	327,465	330,722	334,059	337,448	340,910	
Okaloosa	13,268	13,371	13,571	13,756	13,895	14,029	14,169	14,307	14,454	14,602	14,756	
Orange	80,053	81,162	82,155	83,462	84,627	85,819	87,041	88,325	89,637	90,999	92,425	
Osceola	26,550	26,727	27,113	27,569	27,898	28,238	28,586	28,934	29,296	29,672	30,059	
Palm Beach	86,275	86,839	87,683	88,852	89,769	90,713	91,670	92,679	93,725	94,801	95,924	
Pasco	23,082	23,258	23,606	23,948	24,230	24,518	24,811	25,111	25,410	25,727	26,052	
Pinellas	47,207	47,739	48,273	48,998	49,621	50,259	50,911	51,596	52,299	53,010	53,754	
Polk	39,268	39,739	40,361	40,983	41,586	42,233	42,903	43,590	44,310	45,054	45,830	
Sarasota	19,409	19,787	20,190	20,512	20,840	21,182	21,537	21,919	22,324	22,740	23,184	
Seminole	18,886	19,213	19,539	19,803	20,080	20,363	20,664	20,968	21,288	21,622	21,968	
St. Johns	13,858	14,165	14,407	14,697	14,954	15,221	15,493	15,779	16,069	16,377	16,697	
Sumter	5,403	5,508	5,634	5,720	5,833	5,948	6,070	6,197	6,331	6,471	6,615	
Volusia	23,229	23,791	24,205	24,553	24,905	25,266	25,642	26,028	26,418	26,834	27,268	

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:											
	1/4	1/5	1/6	1/7	1/9				1/11				1/13			
Alachua	16,437	16,585	16,804	17,000	17,365	(3,473)	[834]	{417}	17,760	(3,552)	[852]	{426}	18,188	(3,638)	[873]	{437}
Broward	141,993	143,186	144,590	146,201	149,128	(29,826)	[7,158]	{3,579}	152,255	(30,451)	[7,308]	{3,654}	155,589	(31,118)	[7,468]	{3,734}
Charlotte	7,807	7,880	8,029	8,147	8,379	(1,676)	[402]	{201}	8,626	(1,725)	[414]	{207}	8,886	(1,777)	[427]	{213}
Collier	23,197	23,323	23,502	23,707	24,100	(4,820)	[1,157]	{578}	24,503	(4,901)	[1,176]	{588}	24,924	(4,985)	[1,196]	{598}
Duval	64,225	65,556	66,647	67,938	70,184	(14,037)	[3,369]	{1,684}	72,555	(14,511)	[3,483]	{1,741}	75,189	(15,038)	[3,609]	{1,805}
Hillsborough	80,586	81,105	82,257	83,574	85,604	(17,121)	[4,109]	{2,054}	87,728	(17,546)	[4,211]	{2,105}	90,021	(18,004)	[4,321]	{2,161}
Lake	16,483	16,697	16,897	17,228	17,762	(3,552)	[853]	{426}	18,327	(3,665)	[880]	{440}	18,939	(3,788)	[909]	{455}
Lee	42,368	42,845	43,327	43,871	44,907	(8,981)	[2,156]	{1,078}	46,004	(9,201)	[2,208]	{1,104}	47,166	(9,433)	[2,264]	{1,132}
Manatee	23,044	23,338	23,690	24,000	24,563	(4,913)	[1,179]	{590}	25,166	(5,033)	[1,208]	{604}	25,808	(5,162)	[1,239]	{619}
Miami-Dade	308,259	311,606	314,742	318,115	324,261	(64,852)	[15,565]	{7,782}	330,722	(66,144)	[15,875]	{7,937}	337,448	(67,490)	[16,197]	{8,099}
Okaloosa	13,268	13,371	13,571	13,756	14,029	(2,806)	[673]	{337}	14,307	(2,861)	[687]	{343}	14,602	(2,920)	[701]	{350}
Orange	80,053	81,162	82,155	83,462	85,819	(17,164)	[4,119]	{2,060}	88,325	(17,665)	[4,240]	{2,120}	90,999	(18,200)	[4,368]	{2,184}
Osceola	26,550	26,727	27,113	27,569	28,238	(5,648)	[1,355]	{678}	28,934	(5,787)	[1,389]	{694}	29,672	(5,934)	[1,424]	{712}
Palm Beach	86,275	86,839	87,683	88,852	90,713	(18,143)	[4,354]	{2,177}	92,679	(18,536)	[4,449]	{2,224}	94,801	(18,960)	[4,550]	{2,275}
Pasco	23,082	23,258	23,606	23,948	24,518	(4,904)	[1,177]	{588}	25,111	(5,022)	[1,205]	{603}	25,727	(5,145)	[1,235]	{617}
Pinellas	47,207	47,739	48,273	48,998	50,259	(10,052)	[2,412]	{1,206}	51,596	(10,319)	[2,477]	{1,238}	53,010	(10,602)	[2,544]	{1,272}
Polk	39,268	39,739	40,361	40,983	42,233	(8,447)	[2,027]	{1,014}	43,590	(8,718)	[2,092]	{1,046}	45,054	(9,011)	[2,163]	{1,081}
Sarasota	19,409	19,787	20,190	20,512	21,182	(4,236)	[1,017]	{508}	21,919	(4,384)	[1,052]	{526}	22,740	(4,548)	[1,091]	{546}
Seminole	18,886	19,213	19,539	19,803	20,363	(4,073)	[977]	{489}	20,968	(4,194)	[1,006]	{503}	21,622	(4,324)	[1,038]	{519}
St. Johns	13,858	14,165	14,407	14,697	15,221	(3,044)	[731]	{365}	15,779	(3,156)	[757]	{379}	16,377	(3,275)	[786]	{393}
Sumter	5,403	5,508	5,634	5,720	5,948	(1,190)	[285]	{143}	6,197	(1,239)	[297]	{149}	6,471	(1,294)	[311]	{155}
Volusia	23,229	23,791	24,205	24,553	25,266	(5,053)	[1,213]	{606}	26,028	(5,206)	[1,249]	{625}	26,834	(5,367)	[1,288]	{644}

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.