

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

Date: 1/31/22

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 1/31/22 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.

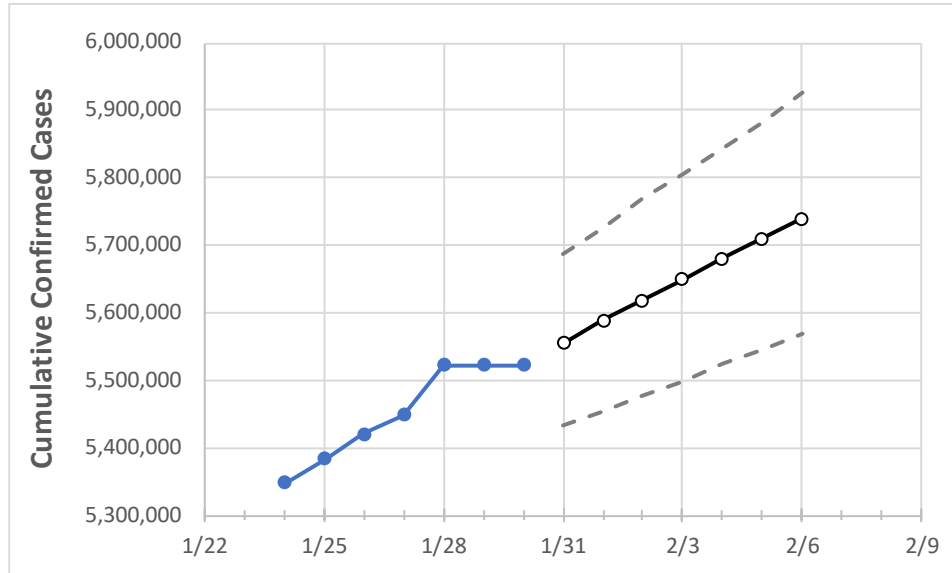
IEM's Modeling Lead

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:						
	1/27	1/28	1/29	1/30	1/31	2/1	2/2	2/3	2/4	2/5	2/6

Florida	5,448,288	5,522,206	5,522,206	5,522,206	5,555,707	5,589,146	5,618,408	5,649,844	5,681,004	5,710,067	5,739,229
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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:							
	1/27	1/28	1/29	1/30	1/31	2/1	2/2	2/3	2/4	2/5	2/6	
Alachua	61,925	62,437	62,437	62,437	63,092	63,733	64,369	65,004	65,616	66,236	66,851	
Broward	574,612	576,314	576,314	576,314	578,174	579,924	581,625	583,256	584,778	586,249	587,675	
Charlotte	32,050	32,287	32,287	32,287	32,574	32,856	33,139	33,422	33,705	33,999	34,289	
Collier	79,647	79,981	79,981	79,981	80,400	80,798	81,202	81,584	81,960	82,330	82,701	
Duval	236,044	237,586	237,586	237,586	239,401	241,169	242,896	244,616	246,360	248,032	249,713	
Hillsborough	346,074	348,006	348,006	348,006	350,143	352,169	354,189	356,164	358,141	360,062	361,964	
Lake	78,100	78,614	78,614	78,614	79,164	79,718	80,253	80,791	81,312	81,837	82,351	
Lee	177,137	178,109	178,109	178,109	179,305	180,489	181,646	182,819	183,924	185,080	186,187	
Manatee	88,294	88,831	88,831	88,831	89,414	89,997	90,566	91,138	91,703	92,269	92,826	
Miami-Dade	1,125,122	1,128,410	1,128,410	1,128,410	1,131,919	1,135,325	1,138,298	1,141,392	1,144,283	1,147,031	1,149,659	
Okaloosa	47,495	47,906	47,906	47,906	48,447	48,991	49,521	50,071	50,618	51,175	51,736	
Orange	351,522	353,301	353,301	353,301	355,162	357,003	358,758	360,515	362,136	363,778	365,378	
Osceola	107,369	107,846	107,846	107,846	108,393	108,921	109,436	109,941	110,418	110,890	111,355	
Palm Beach	349,470	350,714	350,714	350,714	352,067	353,338	354,558	355,744	356,896	357,982	359,084	
Pasco	111,955	112,751	112,751	112,751	113,709	114,652	115,581	116,510	117,438	118,360	119,300	
Pinellas	192,872	194,154	194,154	194,154	195,678	197,167	198,663	200,113	201,567	203,036	204,487	
Polk	185,798	186,917	186,917	186,917	188,145	189,371	190,559	191,723	192,887	194,012	195,131	
Sarasota	81,853	82,394	82,394	82,394	83,078	83,758	84,434	85,094	85,755	86,421	87,083	
Seminole	96,059	96,666	96,666	96,666	97,330	97,971	98,608	99,219	99,827	100,434	101,025	
St. Johns	57,234	57,696	57,696	57,696	58,203	58,701	59,196	59,697	60,199	60,705	61,206	
Sumter	19,461	19,603	19,603	19,603	19,756	19,908	20,060	20,213	20,364	20,518	20,674	
Volusia	107,639	108,348	108,348	108,348	109,081	109,817	110,532	111,237	111,940	112,637	113,345	

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:											
	1/27	1/28	1/29	1/30	2/1			2/3			2/5					
Alachua	61,925	62,437	62,437	62,437	63,733	(12,747)	[3,059]	{1,530}	65,004	(13,001)	[3,120]	{1,560}	66,236	(13,247)	[3,179]	{1,590}
Broward	574,612	576,314	576,314	576,314	579,924	(115,985)	[27,836]	{13,918}	583,256	(116,651)	[27,996]	{13,998}	586,249	(117,250)	[28,140]	{14,070}
Charlotte	32,050	32,287	32,287	32,287	32,856	(6,571)	[1,577]	{789}	33,422	(6,684)	[1,604]	{802}	33,999	(6,800)	[1,632]	{816}
Collier	79,647	79,981	79,981	79,981	80,798	(16,160)	[3,878]	{1,939}	81,584	(16,317)	[3,916]	{1,958}	82,330	(16,466)	[3,952]	{1,976}
Duval	236,044	237,586	237,586	237,586	241,169	(48,234)	[11,576]	{5,788}	244,616	(48,923)	[11,742]	{5,871}	248,032	(49,606)	[11,906]	{5,953}
Hillsborough	346,074	348,006	348,006	348,006	352,169	(70,434)	[16,904]	{8,452}	356,164	(71,233)	[17,096]	{8,548}	360,062	(72,012)	[17,283]	{8,641}
Lake	78,100	78,614	78,614	78,614	79,718	(15,944)	[3,826]	{1,913}	80,791	(16,158)	[3,878]	{1,939}	81,837	(16,367)	[3,928]	{1,964}
Lee	177,137	178,109	178,109	178,109	180,489	(36,098)	[8,663]	{4,332}	182,819	(36,564)	[8,775]	{4,388}	185,080	(37,016)	[8,884]	{4,442}
Manatee	88,294	88,831	88,831	88,831	89,997	(17,999)	[4,320]	{2,160}	91,138	(18,228)	[4,375]	{2,187}	92,269	(18,454)	[4,429]	{2,214}
Miami-Dade	1,125,122	1,128,410	1,128,410	1,128,410	1,135,325	(227,065)	[54,496]	{27,248}	1,141,392	(228,278)	[54,787]	{27,393}	1,147,031	(229,406)	[55,058]	{27,529}
Okaloosa	47,495	47,906	47,906	47,906	48,991	(9,798)	[2,352]	{1,176}	50,071	(10,014)	[2,403]	{1,202}	51,175	(10,235)	[2,456]	{1,228}
Orange	351,522	353,301	353,301	353,301	357,003	(71,401)	[17,136]	{8,568}	360,515	(72,103)	[17,305]	{8,652}	363,778	(72,756)	[17,461]	{8,731}
Osceola	107,369	107,846	107,846	107,846	108,921	(21,784)	[5,228]	{2,614}	109,941	(21,988)	[5,277]	{2,639}	110,890	(22,178)	[5,323]	{2,661}
Palm Beach	349,470	350,714	350,714	350,714	353,338	(70,668)	[16,960]	{8,480}	355,744	(71,149)	[17,076]	{8,538}	357,982	(71,596)	[17,183]	{8,592}
Pasco	111,955	112,751	112,751	112,751	114,652	(22,930)	[5,503]	{2,752}	116,510	(23,302)	[5,592]	{2,796}	118,360	(23,672)	[5,681]	{2,841}
Pinellas	192,872	194,154	194,154	194,154	197,167	(39,433)	[9,464]	{4,732}	200,113	(40,023)	[9,605]	{4,803}	203,036	(40,607)	[9,746]	{4,873}
Polk	185,798	186,917	186,917	186,917	189,371	(37,874)	[9,090]	{4,545}	191,723	(38,345)	[9,203]	{4,601}	194,012	(38,802)	[9,313]	{4,656}
Sarasota	81,853	82,394	82,394	82,394	83,758	(16,752)	[4,020]	{2,010}	85,094	(17,019)	[4,085]	{2,042}	86,421	(17,284)	[4,148]	{2,074}
Seminole	96,059	96,666	96,666	96,666	97,971	(19,594)	[4,703]	{2,351}	99,219	(19,844)	[4,762]	{2,381}	100,434	(20,087)	[4,821]	{2,410}
St. Johns	57,234	57,696	57,696	57,696	58,701	(11,740)	[2,818]	{1,409}	59,697	(11,939)	[2,865]	{1,433}	60,705	(12,141)	[2,914]	{1,457}
Sumter	19,461	19,603	19,603	19,603	19,908	(3,982)	[956]	{478}	20,213	(4,043)	[970]	{485}	20,518	(4,104)	[985]	{492}
Volusia	107,639	108,348	108,348	108,348	109,817	(21,963)	[5,271]	{2,636}	111,237	(22,247)	[5,339]	{2,670}	112,637	(22,527)	[5,407]	{2,703}

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.