

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

Date: 1/28/22

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 1/28/22 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.

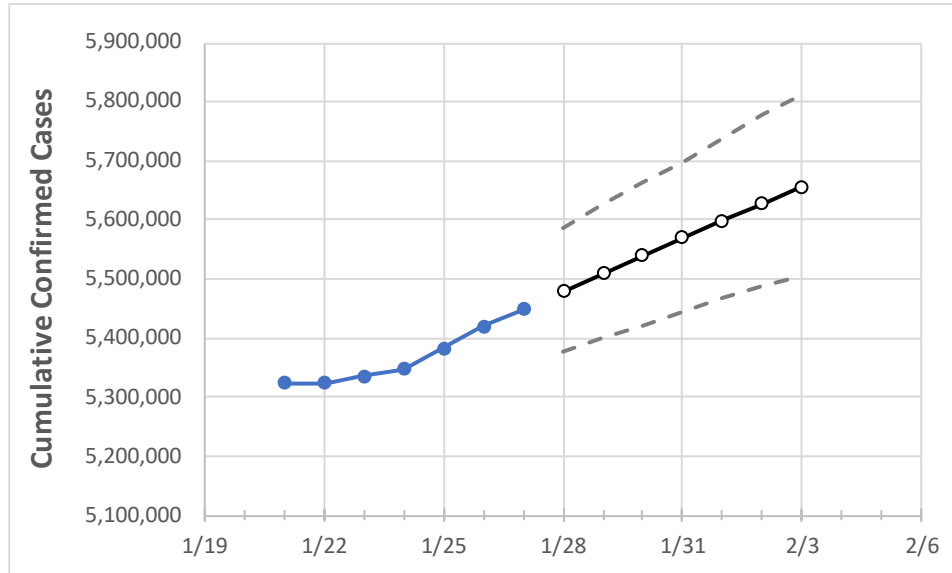
IEM's Modeling Lead

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:						
	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31	2/1	2/2	2/3
Florida	5,347,828	5,383,094	5,420,755	5,448,288	5,479,707	5,510,091	5,540,766	5,569,599	5,598,238	5,627,535	5,656,209

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:						
	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31	2/1	2/2	2/3
Alachua	58,853	58,853	58,853	58,853	59,631	60,404	61,177	61,960	62,747	63,557	64,391
Broward	564,397	564,397	564,397	564,397	567,587	570,652	573,729	576,534	579,416	582,197	584,796
Charlotte	30,627	30,627	30,627	30,627	31,014	31,405	31,803	32,211	32,629	33,052	33,477
Collier	77,641	77,641	77,641	77,641	78,248	78,849	79,445	80,041	80,632	81,223	81,815
Duval	226,792	226,792	226,792	226,792	229,124	231,439	233,745	236,050	238,349	240,642	242,941
Hillsborough	334,482	334,482	334,482	334,482	337,453	340,410	343,357	346,292	349,216	352,124	355,026
Lake	75,015	75,015	75,015	75,015	75,725	76,426	77,125	77,817	78,506	79,198	79,896
Lee	171,307	171,307	171,307	171,307	173,048	174,788	176,536	178,285	180,037	181,794	183,561
Manatee	85,070	85,070	85,070	85,070	85,875	86,685	87,500	88,324	89,150	89,981	90,810
Miami-Dade	1,105,391	1,105,391	1,105,391	1,105,391	1,111,197	1,116,874	1,122,402	1,127,750	1,132,766	1,137,819	1,142,555
Okaloosa	45,031	45,031	45,031	45,031	45,745	46,472	47,216	47,978	48,768	49,569	50,380
Orange	340,846	340,846	340,846	340,846	343,612	346,354	349,033	351,645	354,228	356,811	359,279
Osceola	104,506	104,506	104,506	104,506	105,330	106,135	106,918	107,703	108,470	109,222	109,969
Palm Beach	342,003	342,003	342,003	342,003	344,089	346,155	348,155	350,131	352,057	353,950	355,787
Pasco	107,177	107,177	107,177	107,177	108,476	109,773	111,100	112,423	113,764	115,118	116,479
Pinellas	185,177	185,177	185,177	185,177	187,264	189,358	191,474	193,596	195,718	197,867	200,021
Polk	179,085	179,085	179,085	179,085	180,759	182,410	184,050	185,673	187,292	188,912	190,509
Sarasota	78,606	78,606	78,606	78,606	79,631	80,668	81,717	82,784	83,852	84,949	86,056
Seminole	92,415	92,415	92,415	92,415	93,311	94,200	95,077	95,951	96,814	97,675	98,537
St. Johns	54,465	54,465	54,465	54,465	55,131	55,800	56,483	57,177	57,874	58,590	59,308
Sumter	18,611	18,611	18,611	18,611	18,794	18,978	19,163	19,350	19,541	19,732	19,926
Volusia	103,387	103,387	103,387	103,387	104,340	105,291	106,239	107,187	108,136	109,085	110,030

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:											
	1/24	1/25	1/26	1/27	1/29				1/31				2/2			
Alachua	58,853	58,853	58,853	58,853	60,404	(12,081)	[2,899]	{1,450}	61,960	(12,392)	[2,974]	{1,487}	63,557	(12,711)	[3,051]	{1,525}
Broward	564,397	564,397	564,397	564,397	570,652	(114,130)	[27,391]	{13,696}	576,534	(115,307)	[27,674]	{13,837}	582,197	(116,439)	[27,945]	{13,973}
Charlotte	30,627	30,627	30,627	30,627	31,405	(6,281)	[1,507]	{754}	32,211	(6,442)	[1,546]	{773}	33,052	(6,610)	[1,586]	{793}
Collier	77,641	77,641	77,641	77,641	78,849	(15,770)	[3,785]	{1,892}	80,041	(16,008)	[3,842]	{1,921}	81,223	(16,245)	[3,899]	{1,949}
Duval	226,792	226,792	226,792	226,792	231,439	(46,288)	[11,109]	{5,555}	236,050	(47,210)	[11,330]	{5,665}	240,642	(48,128)	[11,551]	{5,775}
Hillsborough	334,482	334,482	334,482	334,482	340,410	(68,082)	[16,340]	{8,170}	346,292	(69,258)	[16,622]	{8,311}	352,124	(70,425)	[16,902]	{8,451}
Lake	75,015	75,015	75,015	75,015	76,426	(15,285)	[3,668]	{1,834}	77,817	(15,563)	[3,735]	{1,868}	79,198	(15,840)	[3,802]	{1,901}
Lee	171,307	171,307	171,307	171,307	174,788	(34,958)	[8,390]	{4,195}	178,285	(35,657)	[8,558]	{4,279}	181,794	(36,359)	[8,726]	{4,363}
Manatee	85,070	85,070	85,070	85,070	86,685	(17,337)	[4,161]	{2,080}	88,324	(17,665)	[4,240]	{2,120}	89,981	(17,996)	[4,319]	{2,160}
Miami-Dade	1,105,391	1,105,391	1,105,391	1,105,391	1,116,874	(223,375)	[53,610]	{26,805}	1,127,750	(225,550)	[54,132]	{27,066}	1,137,819	(227,564)	[54,615]	{27,308}
Okaloosa	45,031	45,031	45,031	45,031	46,472	(9,294)	[2,231]	{1,115}	47,978	(9,596)	[2,303]	{1,151}	49,569	(9,914)	[2,379]	{1,190}
Orange	340,846	340,846	340,846	340,846	346,354	(69,271)	[16,625]	{8,312}	351,645	(70,329)	[16,879]	{8,439}	356,811	(71,362)	[17,127]	{8,563}
Osceola	104,506	104,506	104,506	104,506	106,135	(21,227)	[5,094]	{2,547}	107,703	(21,541)	[5,170]	{2,585}	109,222	(21,844)	[5,243]	{2,621}
Palm Beach	342,003	342,003	342,003	342,003	346,155	(69,231)	[16,615]	{8,308}	350,131	(70,026)	[16,806]	{8,403}	353,950	(70,790)	[16,990]	{8,495}
Pasco	107,177	107,177	107,177	107,177	109,773	(21,955)	[5,269]	{2,635}	112,423	(22,485)	[5,396]	{2,698}	115,118	(23,024)	[5,526]	{2,763}
Pinellas	185,177	185,177	185,177	185,177	189,358	(37,872)	[9,089]	{4,545}	193,596	(38,719)	[9,293]	{4,646}	197,867	(39,573)	[9,498]	{4,749}
Polk	179,085	179,085	179,085	179,085	182,410	(36,482)	[8,756]	{4,378}	185,673	(37,135)	[8,912]	{4,456}	188,912	(37,782)	[9,068]	{4,534}
Sarasota	78,606	78,606	78,606	78,606	80,668	(16,134)	[3,872]	{1,936}	82,784	(16,557)	[3,974]	{1,987}	84,949	(16,990)	[4,078]	{2,039}
Seminole	92,415	92,415	92,415	92,415	94,200	(18,840)	[4,522]	{2,261}	95,951	(19,190)	[4,606]	{2,303}	97,675	(19,535)	[4,688]	{2,344}
St. Johns	54,465	54,465	54,465	54,465	55,800	(11,160)	[2,678]	{1,339}	57,177	(11,435)	[2,744]	{1,372}	58,590	(11,718)	[2,812]	{1,406}
Sumter	18,611	18,611	18,611	18,611	18,978	(3,796)	[911]	{455}	19,350	(3,870)	[929]	{464}	19,732	(3,946)	[947]	{474}
Volusia	103,387	103,387	103,387	103,387	105,291	(21,058)	[5,054]	{2,527}	107,187	(21,437)	[5,145]	{2,572}	109,085	(21,817)	[5,236]	{2,618}

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.