

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

Date: 5/4/21

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 5/4/21 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.

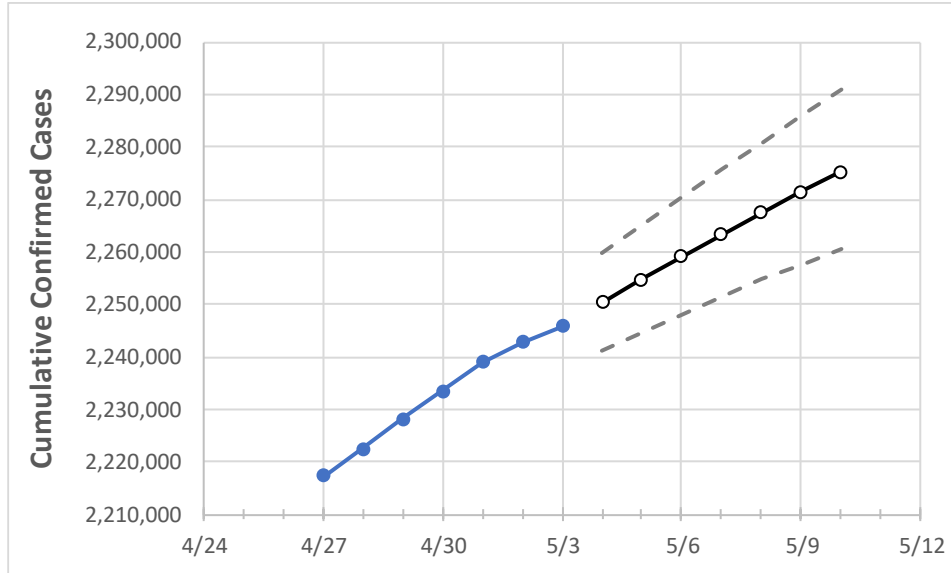
IEM's Modeling Lead

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:						
	4/30	5/1	5/2	5/3	5/4	5/5	5/6	5/7	5/8	5/9	5/10

Florida 2,233,518 2,238,937 2,242,778 2,245,853 2,250,374 2,254,789 2,259,030 2,263,270 2,267,410 2,271,381 2,275,241

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:							
	4/30	5/1	5/2	5/3	5/4	5/5	5/6	5/7	5/8	5/9	5/10	
Alachua	24,635	24,678	24,701	24,717	24,753	24,789	24,824	24,858	24,892	24,926	24,959	
Broward	235,971	236,592	237,067	237,510	238,018	238,534	239,033	239,520	239,995	240,455	240,929	
Charlotte	12,716	12,750	12,775	12,795	12,821	12,848	12,874	12,899	12,924	12,948	12,972	
Collier	35,358	35,451	35,525	35,575	35,656	35,734	35,814	35,893	35,969	36,047	36,125	
Duval	97,248	97,495	97,619	97,719	97,881	98,042	98,201	98,361	98,522	98,682	98,842	
Hillsborough	135,278	135,705	136,014	136,217	136,608	136,988	137,357	137,731	138,100	138,459	138,816	
Lake	29,290	29,369	29,429	29,468	29,534	29,597	29,659	29,720	29,780	29,839	29,897	
Lee	69,446	69,651	69,837	69,974	70,191	70,408	70,619	70,829	71,041	71,254	71,461	
Manatee	38,128	38,237	38,303	38,355	38,443	38,529	38,619	38,706	38,789	38,871	38,956	
Miami-Dade	483,371	484,514	485,300	486,025	486,894	487,725	488,559	489,351	490,153	490,926	491,662	
Okaloosa	20,418	20,448	20,462	20,479	20,500	20,521	20,543	20,565	20,585	20,606	20,627	
Orange	136,327	136,673	136,967	137,157	137,473	137,784	138,090	138,391	138,703	138,997	139,284	
Osceola	44,050	44,174	44,302	44,381	44,505	44,625	44,745	44,865	44,984	45,099	45,213	
Palm Beach	143,129	143,471	143,709	143,904	144,206	144,512	144,798	145,084	145,368	145,647	145,934	
Pasco	40,692	40,808	40,895	40,984	41,101	41,217	41,327	41,441	41,549	41,658	41,767	
Pinellas	78,803	78,971	79,072	79,146	79,287	79,418	79,551	79,677	79,801	79,924	80,047	
Polk	67,607	67,819	67,979	68,114	68,314	68,510	68,704	68,896	69,088	69,280	69,465	
Sarasota	32,385	32,479	32,545	32,576	32,640	32,702	32,761	32,818	32,874	32,928	32,982	
Seminole	33,689	33,775	33,833	33,885	33,974	34,058	34,140	34,220	34,300	34,377	34,453	
St. Johns	22,392	22,434	22,463	22,493	22,526	22,558	22,590	22,620	22,652	22,683	22,714	
Sumter	9,263	9,270	9,281	9,294	9,305	9,317	9,328	9,339	9,350	9,361	9,371	
Volusia	42,709	42,824	42,904	42,960	43,048	43,136	43,220	43,299	43,376	43,452	43,526	

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:											
	4/30	5/1	5/2	5/3	5/5			5/7			5/9					
Alachua	24,635	24,678	24,701	24,717	24,789	(4,958)	[1,190]	{595}	24,858	(4,972)	[1,193]	{597}	24,926	(4,985)	[1,196]	{598}
Broward	235,971	236,592	237,067	237,510	238,534	(47,707)	[11,450]	{5,725}	239,520	(47,904)	[11,497]	{5,748}	240,455	(48,091)	[11,542]	{5,771}
Charlotte	12,716	12,750	12,775	12,795	12,848	(2,570)	[617]	{308}	12,899	(2,580)	[619]	{310}	12,948	(2,590)	[622]	{311}
Collier	35,358	35,451	35,525	35,575	35,734	(7,147)	[1,715]	{858}	35,893	(7,179)	[1,723]	{861}	36,047	(7,209)	[1,730]	{865}
Duval	97,248	97,495	97,619	97,719	98,042	(19,608)	[4,706]	{2,353}	98,361	(19,672)	[4,721]	{2,361}	98,682	(19,736)	[4,737]	{2,368}
Hillsborough	135,278	135,705	136,014	136,217	136,988	(27,398)	[6,575]	{3,288}	137,731	(27,546)	[6,611]	{3,306}	138,459	(27,692)	[6,646]	{3,323}
Lake	29,290	29,369	29,429	29,468	29,597	(5,919)	[1,421]	{710}	29,720	(5,944)	[1,427]	{713}	29,839	(5,968)	[1,432]	{716}
Lee	69,446	69,651	69,837	69,974	70,408	(14,082)	[3,380]	{1,690}	70,829	(14,166)	[3,400]	{1,700}	71,254	(14,251)	[3,420]	{1,710}
Manatee	38,128	38,237	38,303	38,355	38,529	(7,706)	[1,849]	{925}	38,706	(7,741)	[1,858]	{929}	38,871	(7,774)	[1,866]	{933}
Miami-Dade	483,371	484,514	485,300	486,025	487,725	(97,545)	[23,411]	{11,705}	489,351	(97,870)	[23,489]	{11,744}	490,926	(98,185)	[23,564]	{11,782}
Okaloosa	20,418	20,448	20,462	20,479	20,521	(4,104)	[985]	{493}	20,565	(4,113)	[987]	{494}	20,606	(4,121)	[989]	{495}
Orange	136,327	136,673	136,967	137,157	137,784	(27,557)	[6,614]	{3,307}	138,391	(27,678)	[6,643]	{3,321}	138,997	(27,799)	[6,672]	{3,336}
Osceola	44,050	44,174	44,302	44,381	44,625	(8,925)	[2,142]	{1,071}	44,865	(8,973)	[2,154]	{1,077}	45,099	(9,020)	[2,165]	{1,082}
Palm Beach	143,129	143,471	143,709	143,904	144,512	(28,902)	[6,937]	{3,468}	145,084	(29,017)	[6,964]	{3,482}	145,647	(29,129)	[6,991]	{3,496}
Pasco	40,692	40,808	40,895	40,984	41,217	(8,243)	[1,978]	{989}	41,441	(8,288)	[1,989]	{995}	41,658	(8,332)	[2,000]	{1,000}
Pinellas	78,803	78,971	79,072	79,146	79,418	(15,884)	[3,812]	{1,906}	79,677	(15,935)	[3,824]	{1,912}	79,924	(15,985)	[3,836]	{1,918}
Polk	67,607	67,819	67,979	68,114	68,510	(13,702)	[3,288]	{1,644}	68,896	(13,779)	[3,307]	{1,654}	69,280	(13,856)	[3,325]	{1,663}
Sarasota	32,385	32,479	32,545	32,576	32,702	(6,540)	[1,570]	{785}	32,818	(6,564)	[1,575]	{788}	32,928	(6,586)	[1,581]	{790}
Seminole	33,689	33,775	33,833	33,885	34,058	(6,812)	[1,635]	{817}	34,220	(6,844)	[1,643]	{821}	34,377	(6,875)	[1,650]	{825}
St. Johns	22,392	22,434	22,463	22,493	22,558	(4,512)	[1,083]	{541}	22,620	(4,524)	[1,086]	{543}	22,683	(4,537)	[1,089]	{544}
Sumter	9,263	9,270	9,281	9,294	9,317	(1,863)	[447]	{224}	9,339	(1,868)	[448]	{224}	9,361	(1,872)	[449]	{225}
Volusia	42,709	42,824	42,904	42,960	43,136	(8,627)	[2,071]	{1,035}	43,299	(8,660)	[2,078]	{1,039}	43,452	(8,690)	[2,086]	{1,043}

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.