

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

Date: 4/29/21

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 4/29/21 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.

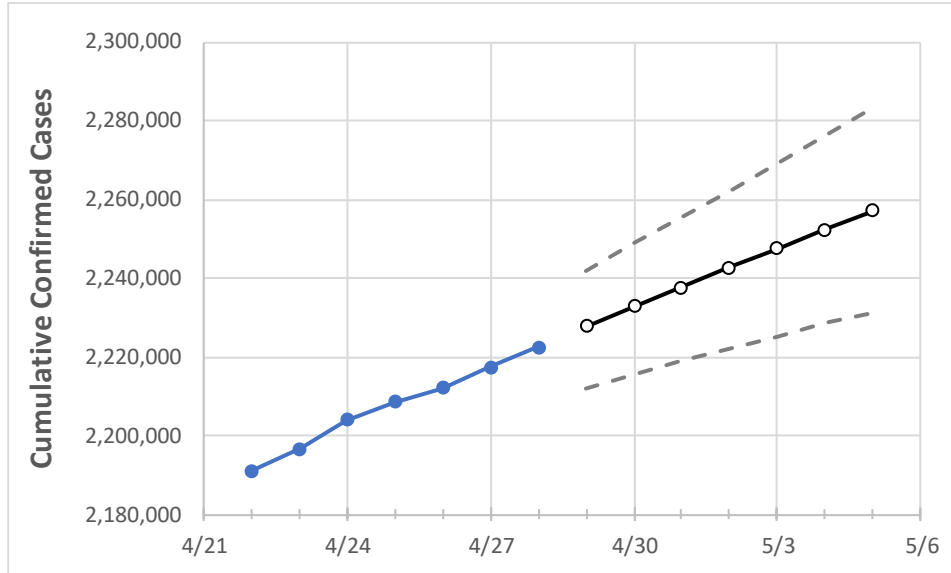
IEM's Modeling Lead

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:						
	4/25	4/26	4/27	4/28	4/29	4/30	5/1	5/2	5/3	5/4	5/5

Florida 2,208,584 2,212,097 2,217,368 2,222,546 2,227,695 2,232,725 2,237,735 2,242,650 2,247,572 2,252,370 2,257,072

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:						
	4/25	4/26	4/27	4/28	4/29	4/30	5/1	5/2	5/3	5/4	5/5
Alachua	24,466	24,482	24,518	24,564	24,605	24,646	24,687	24,729	24,768	24,810	24,849
Broward	233,165	233,624	234,243	234,699	235,276	235,845	236,400	236,935	237,473	238,001	238,499
Charlotte	12,564	12,587	12,624	12,658	12,688	12,717	12,746	12,775	12,803	12,831	12,858
Collier	34,898	34,948	35,037	35,128	35,204	35,281	35,356	35,428	35,501	35,571	35,643
Duval	96,470	96,587	96,749	96,927	97,092	97,256	97,427	97,596	97,760	97,923	98,095
Hillsborough	133,160	133,429	133,855	134,284	134,706	135,116	135,521	135,919	136,328	136,730	137,118
Lake	28,892	28,949	29,027	29,140	29,221	29,300	29,378	29,455	29,532	29,606	29,680
Lee	68,186	68,360	68,621	68,885	69,127	69,377	69,626	69,874	70,122	70,372	70,624
Manatee	37,641	37,699	37,798	37,900	37,993	38,085	38,173	38,261	38,349	38,440	38,524
Miami-Dade	478,660	479,426	480,483	481,397	482,369	483,338	484,249	485,138	486,038	486,889	487,758
Okaloosa	20,298	20,305	20,327	20,355	20,374	20,393	20,412	20,431	20,449	20,468	20,486
Orange	134,552	134,777	135,128	135,544	135,901	136,274	136,630	136,985	137,328	137,668	138,002
Osceola	43,380	43,483	43,628	43,772	43,914	44,054	44,193	44,329	44,466	44,605	44,741
Palm Beach	141,558	141,747	142,053	142,456	142,813	143,163	143,511	143,849	144,181	144,510	144,834
Pasco	40,085	40,168	40,308	40,434	40,569	40,707	40,843	40,978	41,108	41,242	41,373
Pinellas	77,954	78,084	78,241	78,420	78,583	78,739	78,892	79,047	79,195	79,342	79,488
Polk	66,558	66,692	66,922	67,107	67,331	67,553	67,777	68,003	68,225	68,451	68,677
Sarasota	32,048	32,115	32,191	32,273	32,360	32,447	32,530	32,616	32,698	32,781	32,863
Seminole	33,183	33,255	33,365	33,457	33,561	33,662	33,760	33,855	33,949	34,041	34,130
St. Johns	22,237	22,254	22,294	22,323	22,359	22,395	22,430	22,463	22,498	22,532	22,565
Sumter	9,205	9,208	9,220	9,234	9,246	9,258	9,269	9,281	9,292	9,304	9,315
Volusia	42,214	42,292	42,377	42,503	42,608	42,713	42,814	42,911	43,007	43,098	43,187

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:											
	4/25	4/26	4/27	4/28	4/30				5/2				5/4			
Alachua	24,466	24,482	24,518	24,564	24,646	(4,929)	[1,183]	{592}	24,729	(4,946)	[1,187]	{593}	24,810	(4,962)	[1,191]	{595}
Broward	233,165	233,624	234,243	234,699	235,845	(47,169)	[11,321]	{5,660}	236,935	(47,387)	[11,373]	{5,686}	238,001	(47,600)	[11,424]	{5,712}
Charlotte	12,564	12,587	12,624	12,658	12,717	(2,543)	[610]	{305}	12,775	(2,555)	[613]	{307}	12,831	(2,566)	[616]	{308}
Collier	34,898	34,948	35,037	35,128	35,281	(7,056)	[1,693]	{847}	35,428	(7,086)	[1,701]	{850}	35,571	(7,114)	[1,707]	{854}
Duval	96,470	96,587	96,749	96,927	97,256	(19,451)	[4,668]	{2,334}	97,596	(19,519)	[4,685]	{2,342}	97,923	(19,585)	[4,700]	{2,350}
Hillsborough	133,160	133,429	133,855	134,284	135,116	(27,023)	[6,486]	{3,243}	135,919	(27,184)	[6,524]	{3,262}	136,730	(27,346)	[6,563]	{3,282}
Lake	28,892	28,949	29,027	29,140	29,300	(5,860)	[1,406]	{703}	29,455	(5,891)	[1,414]	{707}	29,606	(5,921)	[1,421]	{711}
Lee	68,186	68,360	68,621	68,885	69,377	(13,875)	[3,330]	{1,665}	69,874	(13,975)	[3,354]	{1,677}	70,372	(14,074)	[3,378]	{1,689}
Manatee	37,641	37,699	37,798	37,900	38,085	(7,617)	[1,828]	{914}	38,261	(7,652)	[1,837]	{918}	38,440	(7,688)	[1,845]	{923}
Miami-Dade	478,660	479,426	480,483	481,397	483,338	(96,668)	[23,200]	{11,600}	485,138	(97,028)	[23,287]	{11,643}	486,889	(97,378)	[23,371]	{11,685}
Okaloosa	20,298	20,305	20,327	20,355	20,393	(4,079)	[979]	{489}	20,431	(4,086)	[981]	{490}	20,468	(4,094)	[982]	{491}
Orange	134,552	134,777	135,128	135,544	136,274	(27,255)	[6,541]	{3,271}	136,985	(27,397)	[6,575]	{3,288}	137,668	(27,534)	[6,608]	{3,304}
Osceola	43,380	43,483	43,628	43,772	44,054	(8,811)	[2,115]	{1,057}	44,329	(8,866)	[2,128]	{1,064}	44,605	(8,921)	[2,141]	{1,071}
Palm Beach	141,558	141,747	142,053	142,456	143,163	(28,633)	[6,872]	{3,436}	143,849	(28,770)	[6,905]	{3,452}	144,510	(28,902)	[6,936]	{3,468}
Pasco	40,085	40,168	40,308	40,434	40,707	(8,141)	[1,954]	{977}	40,978	(8,196)	[1,967]	{983}	41,242	(8,248)	[1,980]	{990}
Pinellas	77,954	78,084	78,241	78,420	78,739	(15,748)	[3,779]	{1,890}	79,047	(15,809)	[3,794]	{1,897}	79,342	(15,868)	[3,808]	{1,904}
Polk	66,558	66,692	66,922	67,107	67,553	(13,511)	[3,243]	{1,621}	68,003	(13,601)	[3,264]	{1,632}	68,451	(13,690)	[3,286]	{1,643}
Sarasota	32,048	32,115	32,191	32,273	32,447	(6,489)	[1,557]	{779}	32,616	(6,523)	[1,566]	{783}	32,781	(6,556)	[1,574]	{787}
Seminole	33,183	33,255	33,365	33,457	33,662	(6,732)	[1,616]	{808}	33,855	(6,771)	[1,625]	{813}	34,041	(6,808)	[1,634]	{817}
St. Johns	22,237	22,254	22,294	22,323	22,395	(4,479)	[1,075]	{537}	22,463	(4,493)	[1,078]	{539}	22,532	(4,506)	[1,082]	{541}
Sumter	9,205	9,208	9,220	9,234	9,258	(1,852)	[444]	{222}	9,281	(1,856)	[445]	{223}	9,304	(1,861)	[447]	{223}
Volusia	42,214	42,292	42,377	42,503	42,713	(8,543)	[2,050]	{1,025}	42,911	(8,582)	[2,060]	{1,030}	43,098	(8,620)	[2,069]	{1,034}

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.