

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

Date: 4/16/21

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 4/16/21 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.

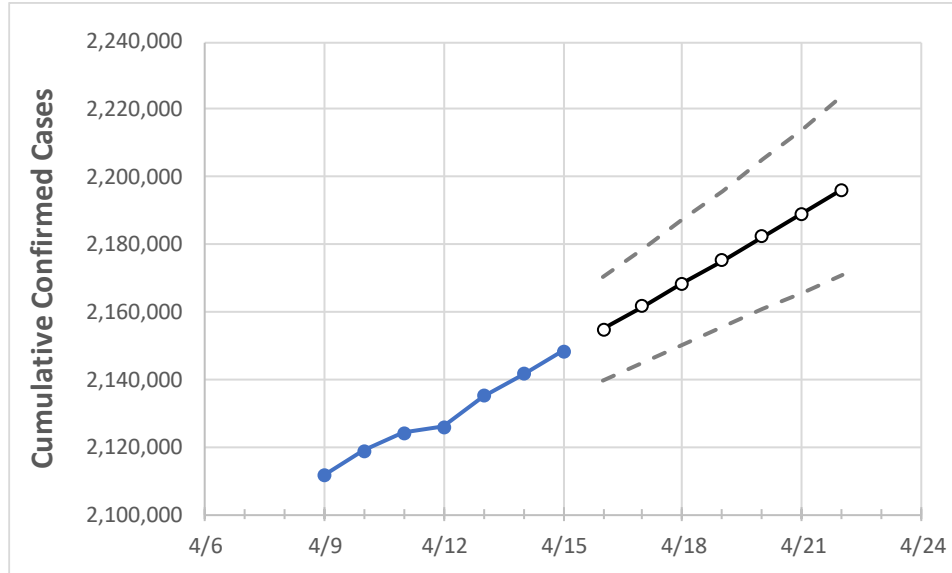
IEM's Modeling Lead

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:							
	4/12	4/13	4/14	4/15	4/16	4/17	4/18	4/19	4/20	4/21	4/22	

Florida 2,125,846 2,134,914 2,141,686 2,148,448 2,154,976 2,161,546 2,168,360 2,175,210 2,182,199 2,189,037 2,196,054

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:						
	4/12	4/13	4/14	4/15	4/16	4/17	4/18	4/19	4/20	4/21	4/22
Alachua	23,887	23,930	23,975	24,021	24,066	24,110	24,157	24,204	24,250	24,298	24,347
Broward	223,356	224,546	225,352	226,054	226,836	227,609	228,392	229,181	229,966	230,786	231,596
Charlotte	12,085	12,138	12,178	12,227	12,275	12,322	12,370	12,418	12,467	12,516	12,566
Collier	33,654	33,782	33,911	34,006	34,114	34,222	34,335	34,449	34,565	34,682	34,799
Duval	94,183	94,403	94,630	94,802	94,973	95,146	95,324	95,504	95,692	95,881	96,074
Hillsborough	126,721	127,392	127,969	128,503	129,000	129,512	130,036	130,574	131,106	131,657	132,214
Lake	27,654	27,771	27,913	28,022	28,124	28,229	28,333	28,442	28,559	28,673	28,787
Lee	64,922	65,317	65,544	65,791	66,010	66,227	66,445	66,662	66,878	67,103	67,333
Manatee	36,038	36,195	36,362	36,505	36,627	36,753	36,875	36,999	37,126	37,253	37,390
Miami-Dade	461,041	463,365	464,557	466,000	467,404	468,862	470,294	471,740	473,227	474,739	476,234
Okaloosa	19,961	19,999	20,038	20,069	20,093	20,118	20,144	20,169	20,195	20,221	20,248
Orange	128,700	129,366	129,839	130,366	130,851	131,335	131,830	132,359	132,879	133,388	133,904
Osceola	41,191	41,438	41,633	41,829	42,009	42,196	42,396	42,602	42,814	43,032	43,254
Palm Beach	136,206	136,675	137,132	137,552	137,953	138,353	138,764	139,169	139,577	139,987	140,396
Pasco	37,975	38,199	38,387	38,522	38,688	38,858	39,032	39,209	39,391	39,575	39,765
Pinellas	75,108	75,419	75,615	75,873	76,130	76,386	76,652	76,919	77,188	77,454	77,729
Polk	63,319	63,633	63,919	64,189	64,434	64,689	64,954	65,224	65,507	65,796	66,090
Sarasota	30,637	30,720	30,849	30,986	31,111	31,237	31,368	31,494	31,625	31,757	31,893
Seminole	31,342	31,555	31,680	31,853	31,986	32,123	32,259	32,398	32,542	32,685	32,831
St. Johns	21,652	21,719	21,767	21,808	21,852	21,898	21,943	21,987	22,033	22,079	22,124
Sumter	8,990	9,020	9,035	9,048	9,061	9,074	9,087	9,099	9,112	9,124	9,136
Volusia	40,094	40,309	40,528	40,741	40,922	41,107	41,293	41,481	41,673	41,865	42,057

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:											
	4/12	4/13	4/14	4/15	4/17			4/19			4/21					
Alachua	23,887	23,930	23,975	24,021	24,110	(4,822)	[1,157]	{579}	24,204	(4,841)	[1,162]	{581}	24,298	(4,860)	[1,166]	{583}
Broward	223,356	224,546	225,352	226,054	227,609	(45,522)	[10,925]	{5,463}	229,181	(45,836)	[11,001]	{5,500}	230,786	(46,157)	[11,078]	{5,539}
Charlotte	12,085	12,138	12,178	12,227	12,322	(2,464)	[591]	{296}	12,418	(2,484)	[596]	{298}	12,516	(2,503)	[601]	{300}
Collier	33,654	33,782	33,911	34,006	34,222	(6,844)	[1,643]	{821}	34,449	(6,890)	[1,654]	{827}	34,682	(6,936)	[1,665]	{832}
Duval	94,183	94,403	94,630	94,802	95,146	(19,029)	[4,567]	{2,284}	95,504	(19,101)	[4,584]	{2,292}	95,881	(19,176)	[4,602]	{2,301}
Hillsborough	126,721	127,392	127,969	128,503	129,512	(25,902)	[6,217]	{3,108}	130,574	(26,115)	[6,268]	{3,134}	131,657	(26,331)	[6,320]	{3,160}
Lake	27,654	27,771	27,913	28,022	28,229	(5,646)	[1,355]	{677}	28,442	(5,688)	[1,365]	{683}	28,673	(5,735)	[1,376]	{688}
Lee	64,922	65,317	65,544	65,791	66,227	(13,245)	[3,179]	{1,589}	66,662	(13,332)	[3,200]	{1,600}	67,103	(13,421)	[3,221]	{1,610}
Manatee	36,038	36,195	36,362	36,505	36,753	(7,351)	[1,764]	{882}	36,999	(7,400)	[1,776]	{888}	37,253	(7,451)	[1,788]	{894}
Miami-Dade	461,041	463,365	464,557	466,000	468,862	(93,772)	[22,505]	{11,253}	471,740	(94,348)	[22,644]	{11,322}	474,739	(94,948)	[22,787]	{11,394}
Okaloosa	19,961	19,999	20,038	20,069	20,118	(4,024)	[966]	{483}	20,169	(4,034)	[968]	{484}	20,221	(4,044)	[971]	{485}
Orange	128,700	129,366	129,839	130,366	131,335	(26,267)	[6,304]	{3,152}	132,359	(26,472)	[6,353]	{3,177}	133,388	(26,678)	[6,403]	{3,201}
Osceola	41,191	41,438	41,633	41,829	42,196	(8,439)	[2,025]	{1,013}	42,602	(8,520)	[2,045]	{1,022}	43,032	(8,606)	[2,066]	{1,033}
Palm Beach	136,206	136,675	137,132	137,552	138,353	(27,671)	[6,641]	{3,320}	139,169	(27,834)	[6,680]	{3,340}	139,987	(27,997)	[6,719]	{3,360}
Pasco	37,975	38,199	38,387	38,522	38,858	(7,772)	[1,865]	{933}	39,209	(7,842)	[1,882]	{941}	39,575	(7,915)	[1,900]	{950}
Pinellas	75,108	75,419	75,615	75,873	76,386	(15,277)	[3,667]	{1,833}	76,919	(15,384)	[3,692]	{1,846}	77,454	(15,491)	[3,718]	{1,859}
Polk	63,319	63,633	63,919	64,189	64,689	(12,938)	[3,105]	{1,553}	65,224	(13,045)	[3,131]	{1,565}	65,796	(13,159)	[3,158]	{1,579}
Sarasota	30,637	30,720	30,849	30,986	31,237	(6,247)	[1,499]	{750}	31,494	(6,299)	[1,512]	{756}	31,757	(6,351)	[1,524]	{762}
Seminole	31,342	31,555	31,680	31,853	32,123	(6,425)	[1,542]	{771}	32,398	(6,480)	[1,555]	{778}	32,685	(6,537)	[1,569]	{784}
St. Johns	21,652	21,719	21,767	21,808	21,898	(4,380)	[1,051]	{526}	21,987	(4,397)	[1,055]	{528}	22,079	(4,416)	[1,060]	{530}
Sumter	8,990	9,020	9,035	9,048	9,074	(1,815)	[436]	{218}	9,099	(1,820)	[437]	{218}	9,124	(1,825)	[438]	{219}
Volusia	40,094	40,309	40,528	40,741	41,107	(8,221)	[1,973]	{987}	41,481	(8,296)	[1,991]	{996}	41,865	(8,373)	[2,010]	{1,005}

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.