

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

Date: 4/21/21

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 4/21/21 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.

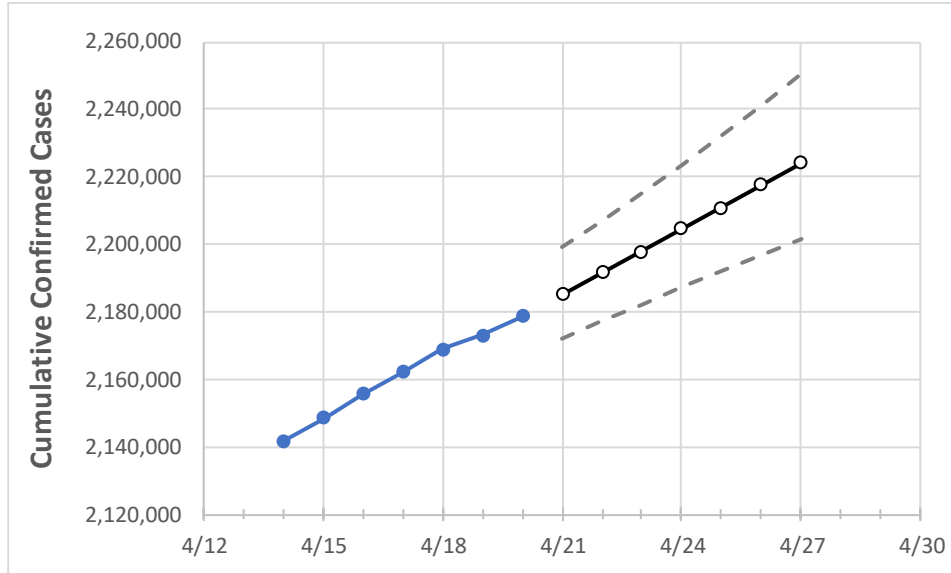
IEM's Modeling Lead

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:							
	4/17	4/18	4/19	4/20	4/21	4/22	4/23	4/24	4/25	4/26	4/27	

Florida 2,162,067 2,168,901 2,173,138 2,178,783 2,185,214 2,191,572 2,198,009 2,204,541 2,211,000 2,217,533 2,224,134

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:						
	4/17	4/18	4/19	4/20	4/21	4/22	4/23	4/24	4/25	4/26	4/27
Alachua	24,110	24,151	24,184	24,234	24,275	24,317	24,360	24,401	24,442	24,484	24,525
Broward	227,738	228,502	229,073	229,641	230,369	231,089	231,816	232,533	233,263	233,977	234,698
Charlotte	12,297	12,331	12,358	12,391	12,425	12,458	12,491	12,524	12,555	12,587	12,617
Collier	34,223	34,321	34,370	34,447	34,539	34,629	34,722	34,812	34,902	34,992	35,080
Duval	95,143	95,314	95,425	95,569	95,740	95,914	96,088	96,266	96,446	96,623	96,804
Hillsborough	129,549	130,034	130,329	130,797	131,288	131,781	132,279	132,790	133,305	133,812	134,339
Lake	28,213	28,317	28,379	28,465	28,569	28,676	28,783	28,892	29,002	29,111	29,224
Lee	66,301	66,554	66,760	66,959	67,207	67,459	67,717	67,968	68,231	68,502	68,762
Manatee	36,768	36,883	36,938	37,088	37,214	37,342	37,469	37,599	37,730	37,861	37,996
Miami-Dade	468,908	470,668	471,595	472,941	474,382	475,820	477,311	478,807	480,306	481,805	483,291
Okaloosa	20,114	20,151	20,168	20,193	20,222	20,253	20,284	20,316	20,350	20,385	20,421
Orange	131,312	131,738	132,053	132,355	132,818	133,268	133,738	134,192	134,671	135,135	135,600
Osceola	42,145	42,317	42,430	42,584	42,760	42,939	43,122	43,308	43,498	43,690	43,883
Palm Beach	138,476	138,967	139,199	139,479	139,866	140,254	140,642	141,025	141,413	141,798	142,172
Pasco	38,883	39,036	39,145	39,315	39,484	39,656	39,829	40,005	40,187	40,371	40,554
Pinellas	76,425	76,637	76,792	76,960	77,188	77,409	77,642	77,866	78,093	78,312	78,533
Polk	64,706	64,922	65,084	65,317	65,574	65,838	66,101	66,367	66,642	66,922	67,209
Sarasota	31,236	31,387	31,472	31,567	31,688	31,808	31,930	32,051	32,172	32,294	32,416
Seminole	32,131	32,284	32,403	32,597	32,751	32,912	33,076	33,244	33,413	33,587	33,765
St. Johns	21,893	21,947	21,976	22,015	22,055	22,094	22,133	22,172	22,210	22,247	22,284
Sumter	9,084	9,093	9,101	9,116	9,129	9,142	9,155	9,168	9,179	9,191	9,203
Volusia	41,080	41,255	41,346	41,500	41,668	41,835	42,002	42,167	42,328	42,489	42,654

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:											
	4/17	4/18	4/19	4/20	4/22				4/24				4/26			
Alachua	24,110	24,151	24,184	24,234	24,317	(4,863)	[1,167]	{584}	24,401	(4,880)	[1,171]	{586}	24,484	(4,897)	[1,175]	{588}
Broward	227,738	228,502	229,073	229,641	231,089	(46,218)	[11,092]	{5,546}	232,533	(46,507)	[11,162]	{5,581}	233,977	(46,795)	[11,231]	{5,615}
Charlotte	12,297	12,331	12,358	12,391	12,458	(2,492)	[598]	{299}	12,524	(2,505)	[601]	{301}	12,587	(2,517)	[604]	{302}
Collier	34,223	34,321	34,370	34,447	34,629	(6,926)	[1,662]	{831}	34,812	(6,962)	[1,671]	{835}	34,992	(6,998)	[1,680]	{840}
Duval	95,143	95,314	95,425	95,569	95,914	(19,183)	[4,604]	{2,302}	96,266	(19,253)	[4,621]	{2,310}	96,623	(19,325)	[4,638]	{2,319}
Hillsborough	129,549	130,034	130,329	130,797	131,781	(26,356)	[6,325]	{3,163}	132,790	(26,558)	[6,374]	{3,187}	133,812	(26,762)	[6,423]	{3,211}
Lake	28,213	28,317	28,379	28,465	28,676	(5,735)	[1,376]	{688}	28,892	(5,778)	[1,387]	{693}	29,111	(5,822)	[1,397]	{699}
Lee	66,301	66,554	66,760	66,959	67,459	(13,492)	[3,238]	{1,619}	67,968	(13,594)	[3,262]	{1,631}	68,502	(13,700)	[3,288]	{1,644}
Manatee	36,768	36,883	36,938	37,088	37,342	(7,468)	[1,792]	{896}	37,599	(7,520)	[1,805]	{902}	37,861	(7,572)	[1,817]	{909}
Miami-Dade	468,908	470,668	471,595	472,941	475,820	(95,164)	[22,839]	{11,420}	478,807	(95,761)	[22,983]	{11,491}	481,805	(96,361)	[23,127]	{11,563}
Okaloosa	20,114	20,151	20,168	20,193	20,253	(4,051)	[972]	{486}	20,316	(4,063)	[975]	{488}	20,385	(4,077)	[978]	{489}
Orange	131,312	131,738	132,053	132,355	133,268	(26,654)	[6,397]	{3,198}	134,192	(26,838)	[6,441]	{3,221}	135,135	(27,027)	[6,486]	{3,243}
Osceola	42,145	42,317	42,430	42,584	42,939	(8,588)	[2,061]	{1,031}	43,308	(8,662)	[2,079]	{1,039}	43,690	(8,738)	[2,097]	{1,049}
Palm Beach	138,476	138,967	139,199	139,479	140,254	(28,051)	[6,732]	{3,366}	141,025	(28,205)	[6,769]	{3,385}	141,798	(28,360)	[6,806]	{3,403}
Pasco	38,883	39,036	39,145	39,315	39,656	(7,931)	[1,903]	{952}	40,005	(8,001)	[1,920]	{960}	40,371	(8,074)	[1,938]	{969}
Pinellas	76,425	76,637	76,792	76,960	77,409	(15,482)	[3,716]	{1,858}	77,866	(15,573)	[3,738]	{1,869}	78,312	(15,662)	[3,759]	{1,879}
Polk	64,706	64,922	65,084	65,317	65,838	(13,168)	[3,160]	{1,580}	66,367	(13,273)	[3,186]	{1,593}	66,922	(13,384)	[3,212]	{1,606}
Sarasota	31,236	31,387	31,472	31,567	31,808	(6,362)	[1,527]	{763}	32,051	(6,410)	[1,538]	{769}	32,294	(6,459)	[1,550]	{775}
Seminole	32,131	32,284	32,403	32,597	32,912	(6,582)	[1,580]	{790}	33,244	(6,649)	[1,596]	{798}	33,587	(6,717)	[1,612]	{806}
St. Johns	21,893	21,947	21,976	22,015	22,094	(4,419)	[1,061]	{530}	22,172	(4,434)	[1,064]	{532}	22,247	(4,449)	[1,068]	{534}
Sumter	9,084	9,093	9,101	9,116	9,142	(1,828)	[439]	{219}	9,168	(1,834)	[440]	{220}	9,191	(1,838)	[441]	{221}
Volusia	41,080	41,255	41,346	41,500	41,835	(8,367)	[2,008]	{1,004}	42,167	(8,433)	[2,024]	{1,012}	42,489	(8,498)	[2,039]	{1,020}

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.