

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

Date: 4/14/21

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 4/14/21 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.

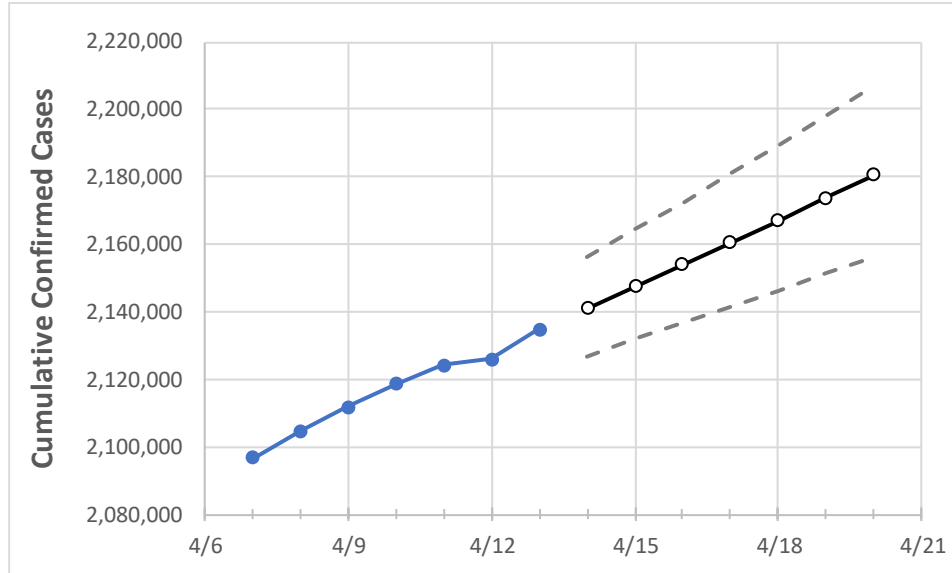
IEM's Modeling Lead

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:						
	4/10	4/11	4/12	4/13	4/14	4/15	4/16	4/17	4/18	4/19	4/20

Florida 2,118,713 2,124,233 2,125,846 2,134,914 2,141,153 2,147,633 2,154,043 2,160,515 2,167,100 2,173,906 2,180,760

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:							
	4/10	4/11	4/12	4/13	4/14	4/15	4/16	4/17	4/18	4/19	4/20	
Alachua	23,844	23,879	23,887	23,930	23,973	24,016	24,060	24,105	24,150	24,194	24,241	
Broward	222,445	223,152	223,356	224,546	225,353	226,188	227,014	227,855	228,685	229,519	230,365	
Charlotte	12,034	12,075	12,085	12,138	12,187	12,237	12,287	12,339	12,390	12,444	12,497	
Collier	33,548	33,644	33,654	33,782	33,891	34,001	34,113	34,226	34,345	34,463	34,582	
Duval	93,966	94,128	94,183	94,403	94,556	94,713	94,874	95,039	95,200	95,372	95,541	
Hillsborough	126,165	126,600	126,721	127,392	127,863	128,347	128,856	129,343	129,840	130,343	130,860	
Lake	27,557	27,632	27,654	27,771	27,862	27,953	28,046	28,141	28,239	28,337	28,436	
Lee	64,693	64,915	64,922	65,317	65,536	65,759	65,987	66,215	66,449	66,685	66,918	
Manatee	35,917	36,024	36,038	36,195	36,300	36,408	36,515	36,622	36,732	36,844	36,954	
Miami-Dade	459,493	460,653	461,041	463,365	464,859	466,358	467,867	469,420	470,936	472,495	474,116	
Okaloosa	19,942	19,954	19,961	19,999	20,018	20,036	20,055	20,074	20,092	20,111	20,131	
Orange	128,195	128,564	128,700	129,366	129,844	130,318	130,807	131,298	131,789	132,291	132,795	
Osceola	41,004	41,144	41,191	41,438	41,601	41,770	41,945	42,125	42,308	42,497	42,696	
Palm Beach	135,758	136,108	136,206	136,675	137,063	137,449	137,836	138,231	138,631	139,016	139,405	
Pasco	37,783	37,924	37,975	38,199	38,358	38,520	38,687	38,856	39,030	39,205	39,386	
Pinellas	74,799	75,056	75,108	75,419	75,687	75,955	76,228	76,506	76,789	77,073	77,363	
Polk	63,044	63,240	63,319	63,633	63,854	64,078	64,309	64,546	64,782	65,031	65,282	
Sarasota	30,505	30,608	30,637	30,720	30,835	30,949	31,061	31,180	31,300	31,425	31,549	
Seminole	31,220	31,317	31,342	31,555	31,676	31,800	31,926	32,053	32,181	32,310	32,441	
St. Johns	21,610	21,643	21,652	21,719	21,770	21,822	21,873	21,927	21,980	22,035	22,089	
Sumter	8,971	8,988	8,990	9,020	9,033	9,046	9,059	9,071	9,083	9,095	9,107	
Volusia	39,893	40,065	40,094	40,309	40,476	40,643	40,812	40,983	41,156	41,331	41,504	

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:											
	4/10	4/11	4/12	4/13	4/15				4/17				4/19			
Alachua	23,844	23,879	23,887	23,930	24,016	(4,803)	[1,153]	{576}	24,105	(4,821)	[1,157]	{579}	24,194	(4,839)	[1,161]	{581}
Broward	222,445	223,152	223,356	224,546	226,188	(45,238)	[10,857]	{5,429}	227,855	(45,571)	[10,937]	{5,469}	229,519	(45,904)	[11,017]	{5,508}
Charlotte	12,034	12,075	12,085	12,138	12,237	(2,447)	[587]	{294}	12,339	(2,468)	[592]	{296}	12,444	(2,489)	[597]	{299}
Collier	33,548	33,644	33,654	33,782	34,001	(6,800)	[1,632]	{816}	34,226	(6,845)	[1,643]	{821}	34,463	(6,893)	[1,654]	{827}
Duval	93,966	94,128	94,183	94,403	94,713	(18,943)	[4,546]	{2,273}	95,039	(19,008)	[4,562]	{2,281}	95,372	(19,074)	[4,578]	{2,289}
Hillsborough	126,165	126,600	126,721	127,392	128,347	(25,669)	[6,161]	{3,080}	129,343	(25,869)	[6,208]	{3,104}	130,343	(26,069)	[6,256]	{3,128}
Lake	27,557	27,632	27,654	27,771	27,953	(5,591)	[1,342]	{671}	28,141	(5,628)	[1,351]	{675}	28,337	(5,667)	[1,360]	{680}
Lee	64,693	64,915	64,922	65,317	65,759	(13,152)	[3,156]	{1,578}	66,215	(13,243)	[3,178]	{1,589}	66,685	(13,337)	[3,201]	{1,600}
Manatee	35,917	36,024	36,038	36,195	36,408	(7,282)	[1,748]	{874}	36,622	(7,324)	[1,758]	{879}	36,844	(7,369)	[1,768]	{884}
Miami-Dade	459,493	460,653	461,041	463,365	466,358	(93,272)	[22,385]	{11,193}	469,420	(93,884)	[22,532]	{11,266}	472,495	(94,499)	[22,680]	{11,340}
Okaloosa	19,942	19,954	19,961	19,999	20,036	(4,007)	[962]	{481}	20,074	(4,015)	[964]	{482}	20,111	(4,022)	[965]	{483}
Orange	128,195	128,564	128,700	129,366	130,318	(26,064)	[6,255]	{3,128}	131,298	(26,260)	[6,302]	{3,151}	132,291	(26,458)	[6,350]	{3,175}
Osceola	41,004	41,144	41,191	41,438	41,770	(8,354)	[2,005]	{1,002}	42,125	(8,425)	[2,022]	{1,011}	42,497	(8,499)	[2,040]	{1,020}
Palm Beach	135,758	136,108	136,206	136,675	137,449	(27,490)	[6,598]	{3,299}	138,231	(27,646)	[6,635]	{3,318}	139,016	(27,803)	[6,673]	{3,336}
Pasco	37,783	37,924	37,975	38,199	38,520	(7,704)	[1,849]	{924}	38,856	(7,771)	[1,865]	{933}	39,205	(7,841)	[1,882]	{941}
Pinellas	74,799	75,056	75,108	75,419	75,955	(15,191)	[3,646]	{1,823}	76,506	(15,301)	[3,672]	{1,836}	77,073	(15,415)	[3,700]	{1,850}
Polk	63,044	63,240	63,319	63,633	64,078	(12,816)	[3,076]	{1,538}	64,546	(12,909)	[3,098]	{1,549}	65,031	(13,006)	[3,121]	{1,561}
Sarasota	30,505	30,608	30,637	30,720	30,949	(6,190)	[1,486]	{743}	31,180	(6,236)	[1,497]	{748}	31,425	(6,285)	[1,508]	{754}
Seminole	31,220	31,317	31,342	31,555	31,800	(6,360)	[1,526]	{763}	32,053	(6,411)	[1,539]	{769}	32,310	(6,462)	[1,551]	{775}
St. Johns	21,610	21,643	21,652	21,719	21,822	(4,364)	[1,047]	{524}	21,927	(4,385)	[1,052]	{526}	22,035	(4,407)	[1,058]	{529}
Sumter	8,971	8,988	8,990	9,020	9,046	(1,809)	[434]	{217}	9,071	(1,814)	[435]	{218}	9,095	(1,819)	[437]	{218}
Volusia	39,893	40,065	40,094	40,309	40,643	(8,129)	[1,951]	{975}	40,983	(8,197)	[1,967]	{984}	41,331	(8,266)	[1,984]	{992}

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.