

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

Date: 1/11/21

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 1/11/21 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.

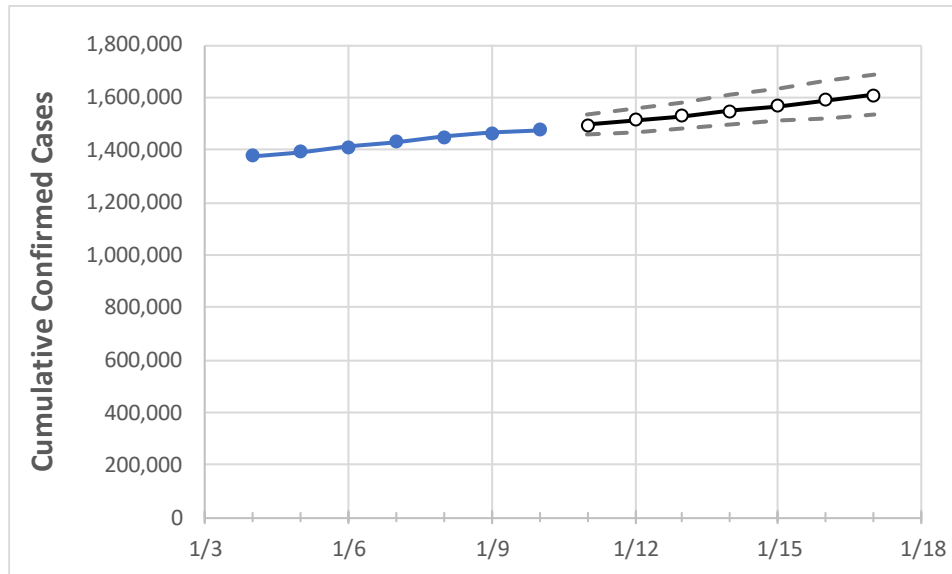
IEM's Modeling Lead

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:						
	1/7	1/8	1/9	1/10	1/11	1/12	1/13	1/14	1/15	1/16	1/17
Florida	1,429,722	1,449,252	1,464,697	1,477,010	1,494,659	1,512,332	1,530,770	1,549,761	1,569,075	1,589,266	1,609,852

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:						
	1/7	1/8	1/9	1/10	1/11	1/12	1/13	1/14	1/15	1/16	1/17
Alachua	17,000	17,254	17,430	17,614	17,827	18,050	18,276	18,516	18,772	19,036	19,306
Broward	146,201	147,944	149,168	150,371	151,883	153,424	154,994	156,651	158,295	159,990	161,748
Charlotte	8,147	8,293	8,382	8,456	8,570	8,685	8,801	8,920	9,040	9,163	9,288
Collier	23,707	24,012	24,304	24,443	24,666	24,888	25,120	25,362	25,602	25,851	26,112
Duval	67,938	68,971	69,773	70,524	71,597	72,707	73,845	74,981	76,177	77,418	78,712
Hillsborough	83,574	84,714	85,855	86,509	87,541	88,574	89,672	90,769	91,916	93,097	94,282
Lake	17,228	17,489	17,742	17,973	18,244	18,521	18,799	19,089	19,399	19,706	20,015
Lee	43,871	44,395	44,819	45,282	45,803	46,336	46,873	47,427	48,005	48,593	49,176
Manatee	24,000	24,278	24,530	24,755	25,035	25,321	25,611	25,921	26,234	26,557	26,891
Miami-Dade	318,115	321,555	324,260	326,607	329,710	332,817	336,005	339,172	342,439	345,756	349,132
Okaloosa	13,756	13,952	14,131	14,233	14,383	14,532	14,687	14,845	15,001	15,172	15,345
Orange	83,462	84,854	85,875	86,634	87,809	89,012	90,258	91,558	92,867	94,221	95,628
Osceola	27,569	27,934	28,251	28,480	28,827	29,184	29,551	29,925	30,316	30,710	31,111
Palm Beach	88,852	90,058	91,049	91,711	92,730	93,775	94,854	95,969	97,106	98,306	99,501
Pasco	23,948	24,363	24,663	24,942	25,258	25,581	25,916	26,250	26,593	26,933	27,298
Pinellas	48,998	49,771	50,491	50,978	51,660	52,375	53,114	53,864	54,645	55,444	56,257
Polk	40,983	41,620	42,056	42,422	43,007	43,619	44,236	44,872	45,521	46,191	46,896
Sarasota	20,512	20,774	21,017	21,223	21,532	21,853	22,185	22,531	22,891	23,263	23,649
Seminole	19,803	20,103	20,328	20,464	20,733	21,013	21,302	21,594	21,895	22,209	22,526
St. Johns	14,697	15,000	15,165	15,329	15,580	15,841	16,109	16,380	16,659	16,944	17,233
Sumter	5,720	5,829	5,904	5,975	6,080	6,189	6,302	6,419	6,539	6,661	6,784
Volusia	24,553	24,890	25,200	25,461	25,833	26,209	26,590	26,990	27,403	27,818	28,260

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:											
	1/7	1/8	1/9	1/10	1/12				1/14				1/16			
Alachua	17,000	17,254	17,430	17,614	18,050	(3,610)	[866]	{433}	18,516	(3,703)	[889]	{444}	19,036	(3,807)	[914]	{457}
Broward	146,201	147,944	149,168	150,371	153,424	(30,685)	[7,364]	{3,682}	156,651	(31,330)	[7,519]	{3,760}	159,990	(31,998)	[7,680]	{3,840}
Charlotte	8,147	8,293	8,382	8,456	8,685	(1,737)	[417]	{208}	8,920	(1,784)	[428]	{214}	9,163	(1,833)	[440]	{220}
Collier	23,707	24,012	24,304	24,443	24,888	(4,978)	[1,195]	{597}	25,362	(5,072)	[1,217]	{609}	25,851	(5,170)	[1,241]	{620}
Duval	67,938	68,971	69,773	70,524	72,707	(14,541)	[3,490]	{1,745}	74,981	(14,996)	[3,599]	{1,800}	77,418	(15,484)	[3,716]	{1,858}
Hillsborough	83,574	84,714	85,855	86,509	88,574	(17,715)	[4,252]	{2,126}	90,769	(18,154)	[4,357]	{2,178}	93,097	(18,619)	[4,469]	{2,234}
Lake	17,228	17,489	17,742	17,973	18,521	(3,704)	[889]	{445}	19,089	(3,818)	[916]	{458}	19,706	(3,941)	[946]	{473}
Lee	43,871	44,395	44,819	45,282	46,336	(9,267)	[2,224]	{1,112}	47,427	(9,485)	[2,277]	{1,138}	48,593	(9,719)	[2,332]	{1,166}
Manatee	24,000	24,278	24,530	24,755	25,321	(5,064)	[1,215]	{608}	25,921	(5,184)	[1,244]	{622}	26,557	(5,311)	[1,275]	{637}
Miami-Dade	318,115	321,555	324,260	326,607	332,817	(66,563)	[15,975]	{7,988}	339,172	(67,834)	[16,280]	{8,140}	345,756	(69,151)	[16,596]	{8,298}
Okaloosa	13,756	13,952	14,131	14,233	14,532	(2,906)	[698]	{349}	14,845	(2,969)	[713]	{356}	15,172	(3,034)	[728]	{364}
Orange	83,462	84,854	85,875	86,634	89,012	(17,802)	[4,273]	{2,136}	91,558	(18,312)	[4,395]	{2,197}	94,221	(18,844)	[4,523]	{2,261}
Osceola	27,569	27,934	28,251	28,480	29,184	(5,837)	[1,401]	{700}	29,925	(5,985)	[1,436]	{718}	30,710	(6,142)	[1,474]	{737}
Palm Beach	88,852	90,058	91,049	91,711	93,775	(18,755)	[4,501]	{2,251}	95,969	(19,194)	[4,606]	{2,303}	98,306	(19,661)	[4,719]	{2,359}
Pasco	23,948	24,363	24,663	24,942	25,581	(5,116)	[1,228]	{614}	26,250	(5,250)	[1,260]	{630}	26,933	(5,387)	[1,293]	{646}
Pinellas	48,998	49,771	50,491	50,978	52,375	(10,475)	[2,514]	{1,257}	53,864	(10,773)	[2,585]	{1,293}	55,444	(11,089)	[2,661]	{1,331}
Polk	40,983	41,620	42,056	42,422	43,619	(8,724)	[2,094]	{1,047}	44,872	(8,974)	[2,154]	{1,077}	46,191	(9,238)	[2,217]	{1,109}
Sarasota	20,512	20,774	21,017	21,223	21,853	(4,371)	[1,049]	{524}	22,531	(4,506)	[1,081]	{541}	23,263	(4,653)	[1,117]	{558}
Seminole	19,803	20,103	20,328	20,464	21,013	(4,203)	[1,009]	{504}	21,594	(4,319)	[1,036]	{518}	22,209	(4,442)	[1,066]	{533}
St. Johns	14,697	15,000	15,165	15,329	15,841	(3,168)	[760]	{380}	16,380	(3,276)	[786]	{393}	16,944	(3,389)	[813]	{407}
Sumter	5,720	5,829	5,904	5,975	6,189	(1,238)	[297]	{149}	6,419	(1,284)	[308]	{154}	6,661	(1,332)	[320]	{160}
Volusia	24,553	24,890	25,200	25,461	26,209	(5,242)	[1,258]	{629}	26,990	(5,398)	[1,296]	{648}	27,818	(5,564)	[1,335]	{668}

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.