

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

Date: 1/15/21

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 1/15/21 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.

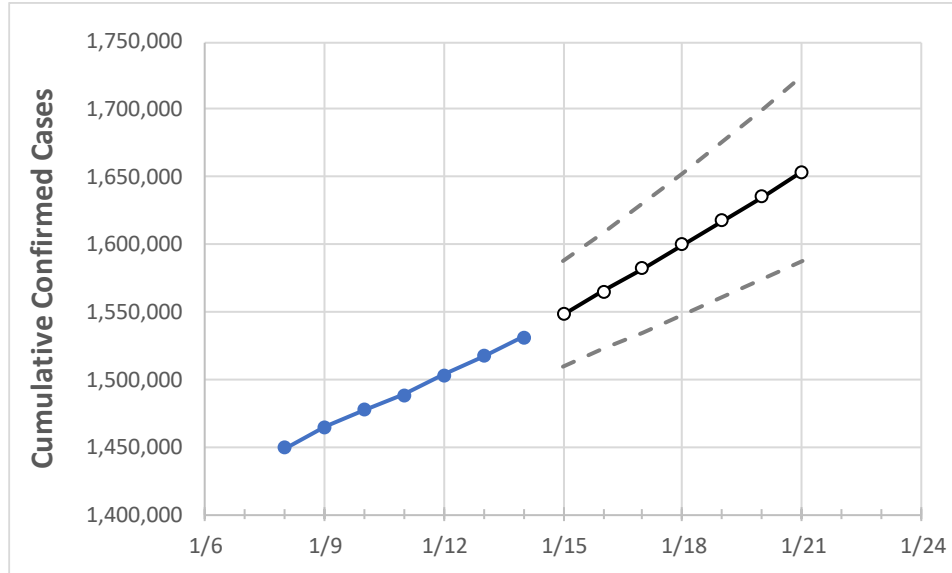
IEM's Modeling Lead

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:						
	1/11	1/12	1/13	1/14	1/15	1/16	1/17	1/18	1/19	1/20	1/21
Florida	1,488,586	1,503,482	1,517,472	1,531,192	1,547,888	1,564,868	1,582,186	1,599,833	1,617,507	1,635,401	1,653,599

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:						
	1/11	1/12	1/13	1/14	1/15	1/16	1/17	1/18	1/19	1/20	1/21
Alachua	17,727	17,878	18,103	18,291	18,503	18,722	18,948	19,182	19,419	19,663	19,917
Broward	151,524	152,645	153,715	155,066	156,421	157,817	159,236	160,687	162,131	163,611	165,098
Charlotte	8,522	8,599	8,681	8,749	8,849	8,948	9,048	9,151	9,253	9,356	9,458
Collier	24,575	24,814	25,046	25,220	25,437	25,658	25,882	26,117	26,346	26,577	26,817
Duval	70,905	71,854	72,579	73,138	74,038	74,962	75,881	76,832	77,776	78,725	79,667
Hillsborough	87,511	88,217	89,043	89,989	91,030	92,067	93,108	94,162	95,261	96,353	97,469
Lake	18,142	18,333	18,537	18,753	18,997	19,242	19,492	19,742	20,002	20,252	20,501
Lee	45,650	46,104	46,551	46,981	47,484	47,987	48,489	48,992	49,504	50,022	50,557
Manatee	24,871	25,134	25,379	25,542	25,801	26,061	26,322	26,592	26,862	27,132	27,409
Miami-Dade	328,701	331,649	334,217	336,749	339,594	342,488	345,378	348,255	351,131	354,082	357,070
Okaloosa	14,313	14,507	14,642	14,812	14,964	15,121	15,279	15,443	15,606	15,768	15,939
Orange	87,688	88,697	89,701	90,601	91,752	92,952	94,160	95,362	96,622	97,923	99,214
Osceola	28,827	29,106	29,412	29,733	30,081	30,436	30,803	31,171	31,545	31,923	32,316
Palm Beach	92,542	93,295	93,994	94,872	95,851	96,835	97,844	98,884	99,946	101,023	102,110
Pasco	25,224	25,483	25,785	26,053	26,365	26,676	26,995	27,322	27,640	27,967	28,300
Pinellas	51,384	51,874	52,357	52,739	53,324	53,920	54,514	55,116	55,728	56,333	56,958
Polk	42,880	43,363	43,839	44,252	44,793	45,346	45,911	46,465	47,045	47,622	48,205
Sarasota	21,328	21,626	21,898	22,021	22,294	22,579	22,859	23,146	23,436	23,740	24,047
Seminole	20,616	20,852	21,072	21,334	21,602	21,867	22,140	22,420	22,703	22,991	23,283
St. Johns	15,492	15,700	15,906	16,073	16,300	16,528	16,765	17,003	17,239	17,475	17,715
Sumter	6,029	6,108	6,165	6,214	6,302	6,391	6,483	6,576	6,673	6,770	6,864
Volusia	25,624	25,970	26,321	26,531	26,870	27,216	27,571	27,927	28,284	28,661	29,028

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:											
	1/11	1/12	1/13	1/14	1/16				1/18				1/20			
Alachua	17,727	17,878	18,103	18,291	18,722	(3,744)	[899]	{449}	19,182	(3,836)	[921]	{460}	19,663	(3,933)	[944]	{472}
Broward	151,524	152,645	153,715	155,066	157,817	(31,563)	[7,575]	{3,788}	160,687	(32,137)	[7,713]	{3,856}	163,611	(32,722)	[7,853]	{3,927}
Charlotte	8,522	8,599	8,681	8,749	8,948	(1,790)	[430]	{215}	9,151	(1,830)	[439]	{220}	9,356	(1,871)	[449]	{225}
Collier	24,575	24,814	25,046	25,220	25,658	(5,132)	[1,232]	{616}	26,117	(5,223)	[1,254]	{627}	26,577	(5,315)	[1,276]	{638}
Duval	70,905	71,854	72,579	73,138	74,962	(14,992)	[3,598]	{1,799}	76,832	(15,366)	[3,688]	{1,844}	78,725	(15,745)	[3,779]	{1,889}
Hillsborough	87,511	88,217	89,043	89,989	92,067	(18,413)	[4,419]	{2,210}	94,162	(18,832)	[4,520]	{2,260}	96,353	(19,271)	[4,625]	{2,312}
Lake	18,142	18,333	18,537	18,753	19,242	(3,848)	[924]	{462}	19,742	(3,948)	[948]	{474}	20,252	(4,050)	[972]	{486}
Lee	45,650	46,104	46,551	46,981	47,987	(9,597)	[2,303]	{1,152}	48,992	(9,798)	[2,352]	{1,176}	50,022	(10,004)	[2,401]	{1,201}
Manatee	24,871	25,134	25,379	25,542	26,061	(5,212)	[1,251]	{625}	26,592	(5,318)	[1,276]	{638}	27,132	(5,426)	[1,302]	{651}
Miami-Dade	328,701	331,649	334,217	336,749	342,488	(68,498)	[16,439]	{8,220}	348,255	(69,651)	[16,716]	{8,358}	354,082	(70,816)	[16,996]	{8,498}
Okaloosa	14,313	14,507	14,642	14,812	15,121	(3,024)	[726]	{363}	15,443	(3,089)	[741]	{371}	15,768	(3,154)	[757]	{378}
Orange	87,688	88,697	89,701	90,601	92,952	(18,590)	[4,462]	{2,231}	95,362	(19,072)	[4,577]	{2,289}	97,923	(19,585)	[4,700]	{2,350}
Osceola	28,827	29,106	29,412	29,733	30,436	(6,087)	[1,461]	{730}	31,171	(6,234)	[1,496]	{748}	31,923	(6,385)	[1,532]	{766}
Palm Beach	92,542	93,295	93,994	94,872	96,835	(19,367)	[4,648]	{2,324}	98,884	(19,777)	[4,746]	{2,373}	101,023	(20,205)	[4,849]	{2,425}
Pasco	25,224	25,483	25,785	26,053	26,676	(5,335)	[1,280]	{640}	27,322	(5,464)	[1,311]	{656}	27,967	(5,593)	[1,342]	{671}
Pinellas	51,384	51,874	52,357	52,739	53,920	(10,784)	[2,588]	{1,294}	55,116	(11,023)	[2,646]	{1,323}	56,333	(11,267)	[2,704]	{1,352}
Polk	42,880	43,363	43,839	44,252	45,346	(9,069)	[2,177]	{1,088}	46,465	(9,293)	[2,230]	{1,115}	47,622	(9,524)	[2,286]	{1,143}
Sarasota	21,328	21,626	21,898	22,021	22,579	(4,516)	[1,084]	{542}	23,146	(4,629)	[1,111]	{556}	23,740	(4,748)	[1,140]	{570}
Seminole	20,616	20,852	21,072	21,334	21,867	(4,373)	[1,050]	{525}	22,420	(4,484)	[1,076]	{538}	22,991	(4,598)	[1,104]	{552}
St. Johns	15,492	15,700	15,906	16,073	16,528	(3,306)	[793]	{397}	17,003	(3,401)	[816]	{408}	17,475	(3,495)	[839]	{419}
Sumter	6,029	6,108	6,165	6,214	6,391	(1,278)	[307]	{153}	6,576	(1,315)	[316]	{158}	6,770	(1,354)	[325]	{162}
Volusia	25,624	25,970	26,321	26,531	27,216	(5,443)	[1,306]	{653}	27,927	(5,585)	[1,340]	{670}	28,661	(5,732)	[1,376]	{688}

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.