

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

Date: 2/17/21

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 2/17/21 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.

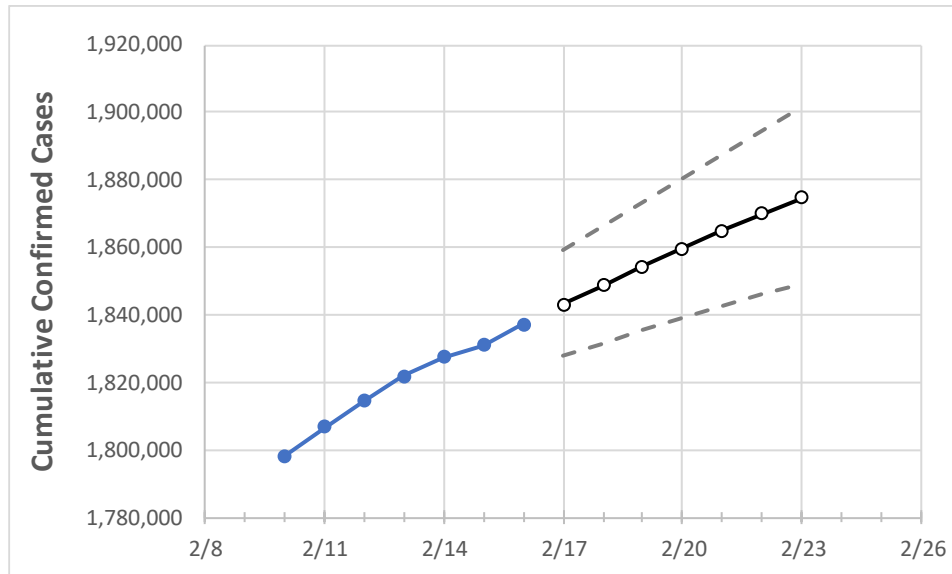
IEM's Modeling Lead

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:							
	2/13	2/14	2/15	2/16	2/17	2/18	2/19	2/20	2/21	2/22	2/23	
Florida	1,821,937	1,827,373	1,830,988	1,837,285	1,843,068	1,848,739	1,854,287	1,859,660	1,864,910	1,869,878	1,874,761	

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:						
	2/13	2/14	2/15	2/16	2/17	2/18	2/19	2/20	2/21	2/22	2/23
Alachua	21,756	21,791	21,830	21,887	21,932	21,973	22,013	22,050	22,087	22,119	22,153
Broward	184,110	184,773	185,310	186,063	186,808	187,545	188,272	188,988	189,685	190,385	191,069
Charlotte	10,236	10,280	10,322	10,346	10,380	10,413	10,446	10,478	10,510	10,542	10,574
Collier	29,058	29,136	29,195	29,250	29,317	29,382	29,443	29,505	29,563	29,622	29,673
Duval	86,024	86,163	86,283	86,562	86,790	87,018	87,234	87,454	87,659	87,861	88,061
Hillsborough	106,060	106,420	106,661	106,996	107,328	107,660	107,975	108,288	108,595	108,895	109,183
Lake	23,346	23,442	23,498	23,587	23,668	23,746	23,819	23,893	23,960	24,028	24,092
Lee	55,346	55,513	55,652	55,830	55,984	56,133	56,278	56,419	56,557	56,689	56,821
Manatee	30,256	30,333	30,384	30,557	30,670	30,784	30,900	31,011	31,123	31,232	31,338
Miami-Dade	392,842	393,971	394,492	395,828	397,068	398,264	399,466	400,602	401,743	402,875	403,988
Okaloosa	17,879	17,927	17,983	18,024	18,075	18,121	18,162	18,205	18,244	18,282	18,317
Orange	109,087	109,453	109,650	110,124	110,471	110,797	111,120	111,434	111,747	112,038	112,327
Osceola	35,276	35,394	35,429	35,576	35,671	35,761	35,846	35,930	36,014	36,095	36,172
Palm Beach	114,083	114,467	114,800	115,145	115,567	115,978	116,370	116,758	117,129	117,505	117,868
Pasco	31,508	31,631	31,744	31,872	31,992	32,110	32,225	32,340	32,450	32,558	32,665
Pinellas	63,023	63,171	63,326	63,568	63,767	63,958	64,145	64,325	64,505	64,678	64,839
Polk	54,235	54,435	54,573	54,829	55,062	55,292	55,516	55,732	55,945	56,157	56,363
Sarasota	25,948	25,982	26,011	26,071	26,127	26,182	26,231	26,278	26,328	26,374	26,419
Seminole	25,714	25,821	25,879	26,025	26,128	26,232	26,333	26,431	26,529	26,629	26,725
St. Johns	19,457	19,532	19,568	19,610	19,657	19,701	19,746	19,787	19,826	19,865	19,901
Sumter	7,576	7,597	7,608	7,634	7,656	7,677	7,697	7,716	7,736	7,754	7,771
Volusia	33,196	33,264	33,308	33,092	33,208	33,320	33,430	33,533	33,636	33,734	33,829

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:											
	2/13	2/14	2/15	2/16	2/18				2/20				2/22			
Alachua	21,756	21,791	21,830	21,887	21,973	(4,395)	[1,055]	{527}	22,050	(4,410)	[1,058]	{529}	22,119	(4,424)	[1,062]	{531}
Broward	184,110	184,773	185,310	186,063	187,545	(37,509)	[9,002]	{4,501}	188,988	(37,798)	[9,071]	{4,536}	190,385	(38,077)	[9,138]	{4,569}
Charlotte	10,236	10,280	10,322	10,346	10,413	(2,083)	[500]	{250}	10,478	(2,096)	[503]	{251}	10,542	(2,108)	[506]	{253}
Collier	29,058	29,136	29,195	29,250	29,382	(5,876)	[1,410]	{705}	29,505	(5,901)	[1,416]	{708}	29,622	(5,924)	[1,422]	{711}
Duval	86,024	86,163	86,283	86,562	87,018	(17,404)	[4,177]	{2,088}	87,454	(17,491)	[4,198]	{2,099}	87,861	(17,572)	[4,217]	{2,109}
Hillsborough	106,060	106,420	106,661	106,996	107,660	(21,532)	[5,168]	{2,584}	108,288	(21,658)	[5,198]	{2,599}	108,895	(21,779)	[5,227]	{2,613}
Lake	23,346	23,442	23,498	23,587	23,746	(4,749)	[1,140]	{570}	23,893	(4,779)	[1,147]	{573}	24,028	(4,806)	[1,153]	{577}
Lee	55,346	55,513	55,652	55,830	56,133	(11,227)	[2,694]	{1,347}	56,419	(11,284)	[2,708]	{1,354}	56,689	(11,338)	[2,721]	{1,361}
Manatee	30,256	30,333	30,384	30,557	30,784	(6,157)	[1,478]	{739}	31,011	(6,202)	[1,489]	{744}	31,232	(6,246)	[1,499]	{750}
Miami-Dade	392,842	393,971	394,492	395,828	398,264	(79,653)	[19,117]	{9,558}	400,602	(80,120)	[19,229]	{9,614}	402,875	(80,575)	[19,338]	{9,669}
Okaloosa	17,879	17,927	17,983	18,024	18,121	(3,624)	[870]	{435}	18,205	(3,641)	[874]	{437}	18,282	(3,656)	[878]	{439}
Orange	109,087	109,453	109,650	110,124	110,797	(22,159)	[5,318]	{2,659}	111,434	(22,287)	[5,349]	{2,674}	112,038	(22,408)	[5,378]	{2,689}
Osceola	35,276	35,394	35,429	35,576	35,761	(7,152)	[1,717]	{858}	35,930	(7,186)	[1,725]	{862}	36,095	(7,219)	[1,733]	{866}
Palm Beach	114,083	114,467	114,800	115,145	115,978	(23,196)	[5,567]	{2,783}	116,758	(23,352)	[5,604]	{2,802}	117,505	(23,501)	[5,640]	{2,820}
Pasco	31,508	31,631	31,744	31,872	32,110	(6,422)	[1,541]	{771}	32,340	(6,468)	[1,552]	{776}	32,558	(6,512)	[1,563]	{781}
Pinellas	63,023	63,171	63,326	63,568	63,958	(12,792)	[3,070]	{1,535}	64,325	(12,865)	[3,088]	{1,544}	64,678	(12,936)	[3,105]	{1,552}
Polk	54,235	54,435	54,573	54,829	55,292	(11,058)	[2,654]	{1,327}	55,732	(11,146)	[2,675]	{1,338}	56,157	(11,231)	[2,696]	{1,348}
Sarasota	25,948	25,982	26,011	26,071	26,182	(5,236)	[1,257]	{628}	26,278	(5,256)	[1,261]	{631}	26,374	(5,275)	[1,266]	{633}
Seminole	25,714	25,821	25,879	26,025	26,232	(5,246)	[1,259]	{630}	26,431	(5,286)	[1,269]	{634}	26,629	(5,326)	[1,278]	{639}
St. Johns	19,457	19,532	19,568	19,610	19,701	(3,940)	[946]	{473}	19,787	(3,957)	[950]	{475}	19,865	(3,973)	[954]	{477}
Sumter	7,576	7,597	7,608	7,634	7,677	(1,535)	[368]	{184}	7,716	(1,543)	[370]	{185}	7,754	(1,551)	[372]	{186}
Volusia	33,196	33,264	33,308	33,092	33,320	(6,664)	[1,599]	{800}	33,533	(6,707)	[1,610]	{805}	33,734	(6,747)	[1,619]	{810}

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.