

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

Date: 7/17/20

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 20%, and are often within 10%, of actual confirmed cases.

The projections shown in this document are based on data pulled in as of 7/17/20 11 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.

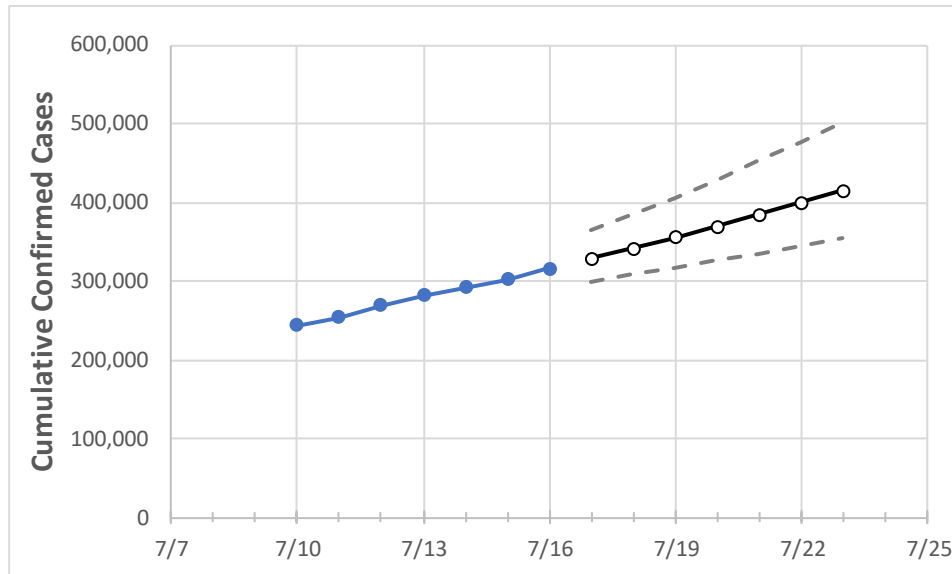
IEM's Modeling Lead

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:						
	7/13	7/14	7/15	7/16	7/17	7/18	7/19	7/20	7/21	7/22	7/23
Florida	282,435	291,629	301,810	315,548	328,391	341,685	355,443	369,676	384,397	399,620	415,358

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 20%, and are often within 10%, of actual confirmed cases.

Florida Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	7/13	7/14	7/15	7/16	7/17	7/18	7/19	7/20	7/21	7/22	7/23
Alachua	2,173	2,258	2,322	2,397	2,467	2,537	2,607	2,677	2,747	2,817	2,887
Broward	31,484	32,814	34,153	35,566	37,272	39,065	40,951	42,932	45,015	47,204	49,504
Charlotte	1,158	1,212	1,281	1,313	1,353	1,394	1,437	1,482	1,528	1,577	1,627
Collier	6,465	6,731	6,872	7,076	7,302	7,537	7,783	8,038	8,304	8,581	8,869
Duval	13,370	13,724	14,152	14,992	15,532	16,077	16,630	17,188	17,754	18,326	18,905
Hillsborough	19,828	20,508	21,018	21,557	22,194	22,834	23,478	24,124	24,774	25,427	26,083
Lake	2,645	2,783	2,882	3,009	3,132	3,260	3,391	3,526	3,665	3,809	3,957
Lee	10,344	10,631	10,849	11,721	12,087	12,462	12,847	13,241	13,646	14,062	14,489
Manatee	5,266	5,419	5,564	5,914	6,142	6,380	6,629	6,888	7,158	7,439	7,733
Miami-Dade	67,713	69,803	72,317	75,425	78,534	81,771	85,141	88,648	92,297	96,095	100,046
Okaloosa	1,385	1,445	1,532	1,623	1,707	1,796	1,893	1,996	2,106	2,224	2,351
Orange	18,937	19,377	19,909	21,299	21,989	22,686	23,389	24,098	24,814	25,537	26,268
Osceola	4,442	4,575	4,751	5,270	5,529	5,799	6,082	6,378	6,687	7,011	7,350
Palm Beach	21,806	22,279	22,788	23,711	24,390	25,086	25,799	26,529	27,277	28,044	28,830
Pasco	4,060	4,189	4,363	4,489	4,640	4,793	4,947	5,103	5,260	5,418	5,578
Pinellas	11,442	11,754	12,080	12,368	12,692	13,016	13,338	13,660	13,980	14,299	14,618
Polk	7,630	7,881	8,206	8,498	8,825	9,159	9,500	9,848	10,204	10,568	10,939
Sarasota	3,219	3,334	3,447	3,724	3,888	4,060	4,241	4,431	4,631	4,841	5,062
Seminole	4,466	4,536	4,665	4,842	4,975	5,108	5,241	5,374	5,506	5,638	5,770
St. Johns	1,905	2,019	2,079	2,178	2,254	2,331	2,408	2,486	2,564	2,643	2,723
Sumter	679	681	721	757	785	815	847	880	916	954	995
Volusia	3,972	4,163	4,355	4,572	4,781	4,999	5,228	5,467	5,717	5,979	6,253

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:											
	7/13	7/14	7/15	7/16	7/18				7/20				7/22			
Alachua	2,173	2,258	2,322	2,397	2,537	(507)	[122]	{61}	2,677	(535)	[128]	{64}	2,817	(563)	[135]	{68}
Broward	31,484	32,814	34,153	35,566	39,065	(7,813)	[1,875]	{938}	42,932	(8,586)	[2,061]	{1,030}	47,204	(9,441)	[2,266]	{1,133}
Charlotte	1,158	1,212	1,281	1,313	1,394	(279)	[67]	{33}	1,482	(296)	[71]	{36}	1,577	(315)	[76]	{38}
Collier	6,465	6,731	6,872	7,076	7,537	(1,507)	[362]	{181}	8,038	(1,608)	[386]	{193}	8,581	(1,716)	[412]	{206}
Duval	13,370	13,724	14,152	14,992	16,077	(3,215)	[772]	{386}	17,188	(3,438)	[825]	{413}	18,326	(3,665)	[880]	{440}
Hillsborough	19,828	20,508	21,018	21,557	22,834	(4,567)	[1,096]	{548}	24,124	(4,825)	[1,158]	{579}	25,427	(5,085)	[1,220]	{610}
Lake	2,645	2,783	2,882	3,009	3,260	(652)	[156]	{78}	3,526	(705)	[169]	{85}	3,809	(762)	[183]	{91}
Lee	10,344	10,631	10,849	11,721	12,462	(2,492)	[598]	{299}	13,241	(2,648)	[636]	{318}	14,062	(2,812)	[675]	{337}
Manatee	5,266	5,419	5,564	5,914	6,380	(1,276)	[306]	{153}	6,888	(1,378)	[331]	{165}	7,439	(1,488)	[357]	{179}
Miami-Dade	67,713	69,803	72,317	75,425	81,771	(16,354)	[3,925]	{1,963}	88,648	(17,730)	[4,255]	{2,128}	96,095	(19,219)	[4,613]	{2,306}
Okaloosa	1,385	1,445	1,532	1,623	1,796	(359)	[86]	{43}	1,996	(399)	[96]	{48}	2,224	(445)	[107]	{53}
Orange	18,937	19,377	19,909	21,299	22,686	(4,537)	[1,089]	{544}	24,098	(4,820)	[1,157]	{578}	25,537	(5,107)	[1,226]	{613}
Osceola	4,442	4,575	4,751	5,270	5,799	(1,160)	[278]	{139}	6,378	(1,276)	[306]	{153}	7,011	(1,402)	[337]	{168}
Palm Beach	21,806	22,279	22,788	23,711	25,086	(5,017)	[1,204]	{602}	26,529	(5,306)	[1,273]	{637}	28,044	(5,609)	[1,346]	{673}
Pasco	4,060	4,189	4,363	4,489	4,793	(959)	[230]	{115}	5,103	(1,021)	[245]	{122}	5,418	(1,084)	[260]	{130}
Pinellas	11,442	11,754	12,080	12,368	13,016	(2,603)	[625]	{312}	13,660	(2,732)	[656]	{328}	14,299	(2,860)	[686]	{343}
Polk	7,630	7,881	8,206	8,498	9,159	(1,832)	[440]	{220}	9,848	(1,970)	[473]	{236}	10,568	(2,114)	[507]	{254}
Sarasota	3,219	3,334	3,447	3,724	4,060	(812)	[195]	{97}	4,431	(886)	[213]	{106}	4,841	(968)	[232]	{116}
Seminole	4,466	4,536	4,665	4,842	5,108	(1,022)	[245]	{123}	5,374	(1,075)	[258]	{129}	5,638	(1,128)	[271]	{135}
St. Johns	1,905	2,019	2,079	2,178	2,331	(466)	[112]	{56}	2,486	(497)	[119]	{60}	2,643	(529)	[127]	{63}
Sumter	679	681	721	757	815	(163)	[39]	{20}	880	(176)	[42]	{21}	954	(191)	[46]	{23}
Volusia	3,972	4,163	4,355	4,572	4,999	(1,000)	[240]	{120}	5,467	(1,093)	[262]	{131}	5,979	(1,196)	[287]	{143}

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.