

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

Date: 10/9/20

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 10%, and are often within 5%, of actual confirmed cases.

The projections shown in this document are based on data pulled in as of 10/9/20 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.

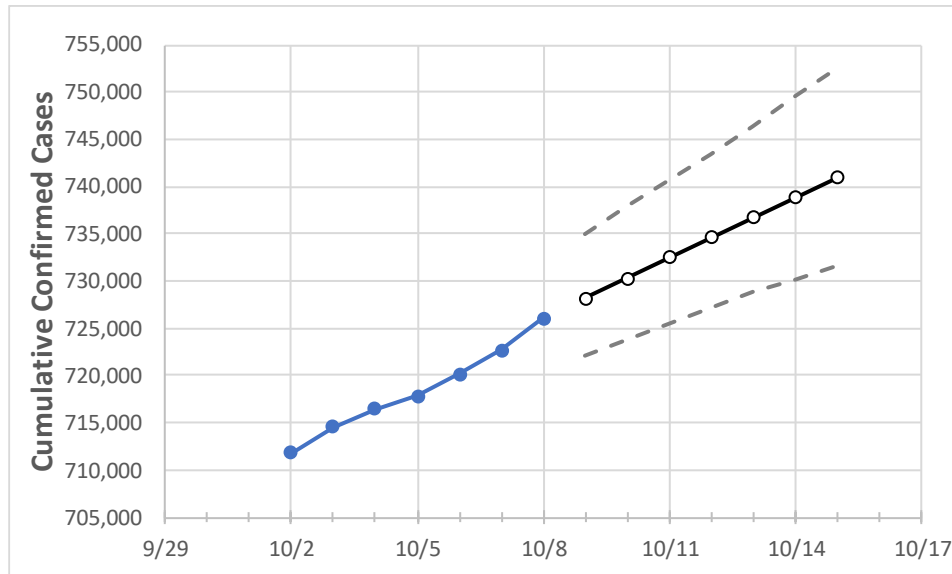
IEM's Modeling Lead

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:						
	10/5	10/6	10/7	10/8	10/9	10/10	10/11	10/12	10/13	10/14	10/15
Florida	717,874	720,125	722,707	726,013	728,162	730,307	732,447	734,583	736,715	738,842	740,964

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:						
	10/5	10/6	10/7	10/8	10/9	10/10	10/11	10/12	10/13	10/14	10/15
Alachua	8,570	8,619	8,642	8,733	8,771	8,806	8,841	8,874	8,905	8,935	8,964
Broward	78,012	78,136	78,374	78,614	78,753	78,892	79,031	79,170	79,308	79,447	79,585
Charlotte	3,152	3,159	3,175	3,186	3,196	3,207	3,217	3,227	3,238	3,248	3,258
Collier	12,920	12,961	13,010	13,089	13,122	13,155	13,189	13,222	13,257	13,291	13,326
Duval	31,056	31,195	31,383	31,500	31,613	31,726	31,839	31,953	32,067	32,182	32,296
Hillsborough	43,027	43,166	43,304	43,578	43,734	43,890	44,046	44,203	44,361	44,519	44,677
Lake	7,712	7,729	7,770	7,818	7,845	7,871	7,898	7,925	7,951	7,978	8,005
Lee	20,824	20,862	20,944	21,089	21,149	21,209	21,270	21,332	21,394	21,457	21,520
Manatee	11,785	11,848	11,878	11,943	11,986	12,030	12,074	12,118	12,163	12,209	12,255
Miami-Dade	172,398	172,849	173,280	173,721	174,056	174,392	174,728	175,065	175,402	175,740	176,078
Okaloosa	5,181	5,206	5,232	5,265	5,292	5,319	5,346	5,374	5,401	5,429	5,457
Orange	41,055	41,218	41,409	41,571	41,708	41,846	41,985	42,126	42,267	42,410	42,555
Osceola	12,798	12,846	12,899	12,957	13,004	13,052	13,099	13,147	13,196	13,244	13,293
Palm Beach	47,153	47,244	47,384	47,525	47,623	47,720	47,815	47,909	48,003	48,095	48,186
Pasco	9,499	9,538	9,569	9,652	9,694	9,736	9,778	9,820	9,863	9,905	9,948
Pinellas	22,548	22,603	22,697	22,822	22,891	22,961	23,031	23,101	23,170	23,240	23,310
Polk	20,500	20,587	20,687	20,814	20,901	20,988	21,075	21,162	21,250	21,337	21,425
Sarasota	8,376	8,407	8,457	8,518	8,548	8,579	8,610	8,641	8,672	8,704	8,736
Seminole	9,250	9,278	9,309	9,343	9,369	9,394	9,420	9,445	9,471	9,496	9,521
St. Johns	5,526	5,565	5,589	5,618	5,643	5,668	5,693	5,718	5,742	5,767	5,791
Sumter	2,458	2,481	2,495	2,593	2,614	2,637	2,660	2,685	2,711	2,738	2,767
Volusia	11,150	11,190	11,235	11,325	11,370	11,416	11,461	11,508	11,554	11,601	11,649

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:											
	10/5	10/6	10/7	10/8	10/10				10/12				10/14			
Alachua	8,570	8,619	8,642	8,733	8,806	(1,761)	[423]	{211}	8,874	(1,775)	[426]	{213}	8,935	(1,787)	[429]	{214}
Broward	78,012	78,136	78,374	78,614	78,892	(15,778)	[3,787]	{1,893}	79,170	(15,834)	[3,800]	{1,900}	79,447	(15,889)	[3,813]	{1,907}
Charlotte	3,152	3,159	3,175	3,186	3,207	(641)	[154]	{77}	3,227	(645)	[155]	{77}	3,248	(650)	[156]	{78}
Collier	12,920	12,961	13,010	13,089	13,155	(2,631)	[631]	{316}	13,222	(2,644)	[635]	{317}	13,291	(2,658)	[638]	{319}
Duval	31,056	31,195	31,383	31,500	31,726	(6,345)	[1,523]	{761}	31,953	(6,391)	[1,534]	{767}	32,182	(6,436)	[1,545]	{772}
Hillsborough	43,027	43,166	43,304	43,578	43,890	(8,778)	[2,107]	{1,053}	44,203	(8,841)	[2,122]	{1,061}	44,519	(8,904)	[2,137]	{1,068}
Lake	7,712	7,729	7,770	7,818	7,871	(1,574)	[378]	{189}	7,925	(1,585)	[380]	{190}	7,978	(1,596)	[383]	{191}
Lee	20,824	20,862	20,944	21,089	21,209	(4,242)	[1,018]	{509}	21,332	(4,266)	[1,024]	{512}	21,457	(4,291)	[1,030]	{515}
Manatee	11,785	11,848	11,878	11,943	12,030	(2,406)	[577]	{289}	12,118	(2,424)	[582]	{291}	12,209	(2,442)	[586]	{293}
Miami-Dade	172,398	172,849	173,280	173,721	174,392	(34,878)	[8,371]	{4,185}	175,065	(35,013)	[8,403]	{4,202}	175,740	(35,148)	[8,436]	{4,218}
Okaloosa	5,181	5,206	5,232	5,265	5,319	(1,064)	[255]	{128}	5,374	(1,075)	[258]	{129}	5,429	(1,086)	[261]	{130}
Orange	41,055	41,218	41,409	41,571	41,846	(8,369)	[2,009]	{1,004}	42,126	(8,425)	[2,022]	{1,011}	42,410	(8,482)	[2,036]	{1,018}
Osceola	12,798	12,846	12,899	12,957	13,052	(2,610)	[626]	{313}	13,147	(2,629)	[631]	{316}	13,244	(2,649)	[636]	{318}
Palm Beach	47,153	47,244	47,384	47,525	47,720	(9,544)	[2,291]	{1,145}	47,909	(9,582)	[2,300]	{1,150}	48,095	(9,619)	[2,309]	{1,154}
Pasco	9,499	9,538	9,569	9,652	9,736	(1,947)	[467]	{234}	9,820	(1,964)	[471]	{236}	9,905	(1,981)	[475]	{238}
Pinellas	22,548	22,603	22,697	22,822	22,961	(4,592)	[1,102]	{551}	23,101	(4,620)	[1,109]	{554}	23,240	(4,648)	[1,116]	{558}
Polk	20,500	20,587	20,687	20,814	20,988	(4,198)	[1,007]	{504}	21,162	(4,232)	[1,016]	{508}	21,337	(4,267)	[1,024]	{512}
Sarasota	8,376	8,407	8,457	8,518	8,579	(1,716)	[412]	{206}	8,641	(1,728)	[415]	{207}	8,704	(1,741)	[418]	{209}
Seminole	9,250	9,278	9,309	9,343	9,394	(1,879)	[451]	{225}	9,445	(1,889)	[453]	{227}	9,496	(1,899)	[456]	{228}
St. Johns	5,526	5,565	5,589	5,618	5,668	(1,134)	[272]	{136}	5,718	(1,144)	[274]	{137}	5,767	(1,153)	[277]	{138}
Sumter	2,458	2,481	2,495	2,593	2,637	(537)	[127]	{63}	2,685	(537)	[129]	{64}	2,738	(548)	[131]	{66}
Volusia	11,150	11,190	11,235	11,325	11,416	(2,283)	[548]	{274}	11,508	(2,302)	[552]	{276}	11,601	(2,320)	[557]	{278}

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.