

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

Date: 9/23/20

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 9/23/20 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.

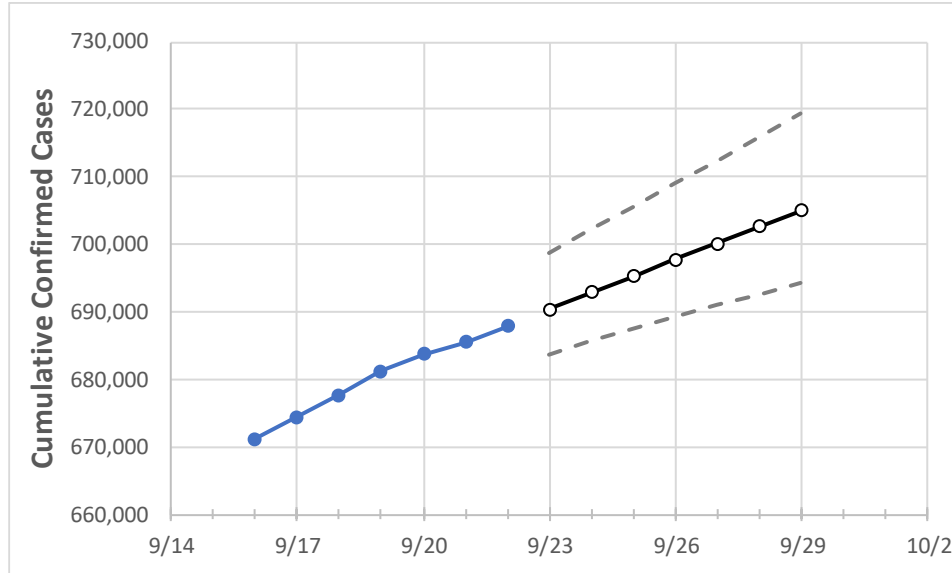
IEM's Modeling Lead

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:						
	9/19	9/20	9/21	9/22	9/23	9/24	9/25	9/26	9/27	9/28	9/29
Florida	681,233	683,754	685,439	687,909	690,386	692,849	695,298	697,734	700,157	702,567	704,963

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:						
	9/19	9/20	9/21	9/22	9/23	9/24	9/25	9/26	9/27	9/28	9/29
Alachua	7,382	7,502	7,581	7,651	7,726	7,857	7,999	8,130	8,278	8,426	8,575
Broward	75,499	75,682	75,801	75,944	76,091	76,236	76,379	76,521	76,660	76,798	76,934
Charlotte	2,943	2,953	2,957	2,965	2,972	2,978	2,984	2,990	2,995	3,001	3,006
Collier	12,423	12,466	12,487	12,520	12,550	12,580	12,610	12,640	12,669	12,699	12,729
Duval	29,241	29,381	29,449	29,580	29,694	29,809	29,923	30,038	30,152	30,267	30,381
Hillsborough	40,587	40,751	40,898	41,016	41,179	41,342	41,505	41,668	41,831	41,995	42,158
Lake	7,262	7,293	7,313	7,339	7,366	7,393	7,419	7,445	7,470	7,495	7,519
Lee	19,884	19,964	20,025	20,063	20,120	20,177	20,235	20,292	20,350	20,408	20,466
Manatee	11,158	11,210	11,241	11,279	11,318	11,358	11,398	11,439	11,481	11,523	11,565
Miami-Dade	166,516	166,881	167,153	167,515	167,843	168,165	168,481	168,792	169,097	169,397	169,692
Okaloosa	4,733	4,746	4,750	4,769	4,781	4,792	4,803	4,813	4,823	4,832	4,841
Orange	38,818	38,971	39,056	39,232	39,361	39,490	39,619	39,749	39,878	40,009	40,139
Osceola	12,049	12,107	12,139	12,209	12,255	12,302	12,349	12,397	12,445	12,493	12,542
Palm Beach	45,156	45,329	45,425	45,602	45,765	45,929	46,094	46,261	46,429	46,599	46,770
Pasco	8,816	8,865	8,893	8,934	8,972	9,011	9,050	9,089	9,129	9,169	9,210
Pinellas	21,440	21,498	21,561	21,620	21,696	21,772	21,848	21,925	22,002	22,080	22,158
Polk	19,035	19,126	19,243	19,339	19,433	19,527	19,620	19,714	19,808	19,901	19,995
Sarasota	7,848	7,877	7,903	7,912	7,941	7,970	7,999	8,028	8,057	8,086	8,115
Seminole	8,794	8,836	8,860	8,887	8,918	8,949	8,980	9,011	9,042	9,073	9,104
St. Johns	5,070	5,102	5,112	5,143	5,167	5,191	5,214	5,237	5,259	5,282	5,303
Sumter	2,154	2,163	2,164	2,180	2,185	2,190	2,194	2,199	2,203	2,207	2,211
Volusia	10,495	10,519	10,537	10,614	10,654	10,694	10,733	10,772	10,811	10,849	10,887

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:											
	9/19	9/20	9/21	9/22	9/24				9/26				9/28			
Alachua	7,382	7,502	7,581	7,651	7,857	(1,571)	[377]	{189}	8,130	(1,626)	[390]	{195}	8,426	(1,685)	[404]	{202}
Broward	75,499	75,682	75,801	75,944	76,236	(15,247)	[3,659]	{1,830}	76,521	(15,304)	[3,673]	{1,836}	76,798	(15,360)	[3,686]	{1,843}
Charlotte	2,943	2,953	2,957	2,965	2,978	(596)	[143]	{71}	2,990	(598)	[144]	{72}	3,001	(600)	[144]	{72}
Collier	12,423	12,466	12,487	12,520	12,580	(2,516)	[604]	{302}	12,640	(2,528)	[607]	{303}	12,699	(2,540)	[610]	{305}
Duval	29,241	29,381	29,449	29,580	29,809	(5,962)	[1,431]	{715}	30,038	(6,008)	[1,442]	{721}	30,267	(6,053)	[1,453]	{726}
Hillsborough	40,587	40,751	40,898	41,016	41,342	(8,268)	[1,984]	{992}	41,668	(8,334)	[2,000]	{1,000}	41,995	(8,399)	[2,016]	{1,008}
Lake	7,262	7,293	7,313	7,339	7,393	(1,479)	[355]	{177}	7,445	(1,489)	[357]	{179}	7,495	(1,499)	[360]	{180}
Lee	19,884	19,964	20,025	20,063	20,177	(4,035)	[969]	{484}	20,292	(4,058)	[974]	{487}	20,408	(4,082)	[980]	{490}
Manatee	11,158	11,210	11,241	11,279	11,358	(2,272)	[545]	{273}	11,439	(2,288)	[549]	{275}	11,523	(2,305)	[553]	{277}
Miami-Dade	166,516	166,881	167,153	167,515	168,165	(33,633)	[8,072]	{4,036}	168,792	(33,758)	[8,102]	{4,051}	169,397	(33,879)	[8,131]	{4,066}
Okaloosa	4,733	4,746	4,750	4,769	4,792	(958)	[230]	{115}	4,813	(963)	[231]	{116}	4,832	(966)	[232]	{116}
Orange	38,818	38,971	39,056	39,232	39,490	(7,898)	[1,896]	{948}	39,749	(7,950)	[1,908]	{954}	40,009	(8,002)	[1,920]	{960}
Osceola	12,049	12,107	12,139	12,209	12,302	(2,460)	[590]	{295}	12,397	(2,479)	[595]	{298}	12,493	(2,499)	[600]	{300}
Palm Beach	45,156	45,329	45,425	45,602	45,929	(9,186)	[2,205]	{1,102}	46,261	(9,252)	[2,221]	{1,110}	46,599	(9,320)	[2,237]	{1,118}
Pasco	8,816	8,865	8,893	8,934	9,011	(1,802)	[433]	{216}	9,089	(1,818)	[436]	{218}	9,169	(1,834)	[440]	{220}
Pinellas	21,440	21,498	21,561	21,620	21,772	(4,354)	[1,045]	{523}	21,925	(4,385)	[1,052]	{526}	22,080	(4,416)	[1,060]	{530}
Polk	19,035	19,126	19,243	19,339	19,527	(3,905)	[937]	{469}	19,714	(3,943)	[946]	{473}	19,901	(3,980)	[955]	{478}
Sarasota	7,848	7,877	7,903	7,912	7,970	(1,594)	[383]	{191}	8,028	(1,606)	[385]	{193}	8,086	(1,617)	[388]	{194}
Seminole	8,794	8,836	8,860	8,887	8,949	(1,790)	[430]	{215}	9,011	(1,802)	[433]	{216}	9,073	(1,815)	[435]	{218}
St. Johns	5,070	5,102	5,112	5,143	5,191	(1,038)	[249]	{125}	5,237	(1,047)	[251]	{126}	5,282	(1,056)	[254]	{127}
Sumter	2,154	2,163	2,164	2,180	2,190	(438)	[105]	{53}	2,199	(440)	[106]	{53}	2,207	(441)	[106]	{53}
Volusia	10,495	10,519	10,537	10,614	10,694	(2,139)	[513]	{257}	10,772	(2,154)	[517]	{259}	10,849	(2,170)	[521]	{260}

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.