

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

Date: 11/24/20

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 11/24/20 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.

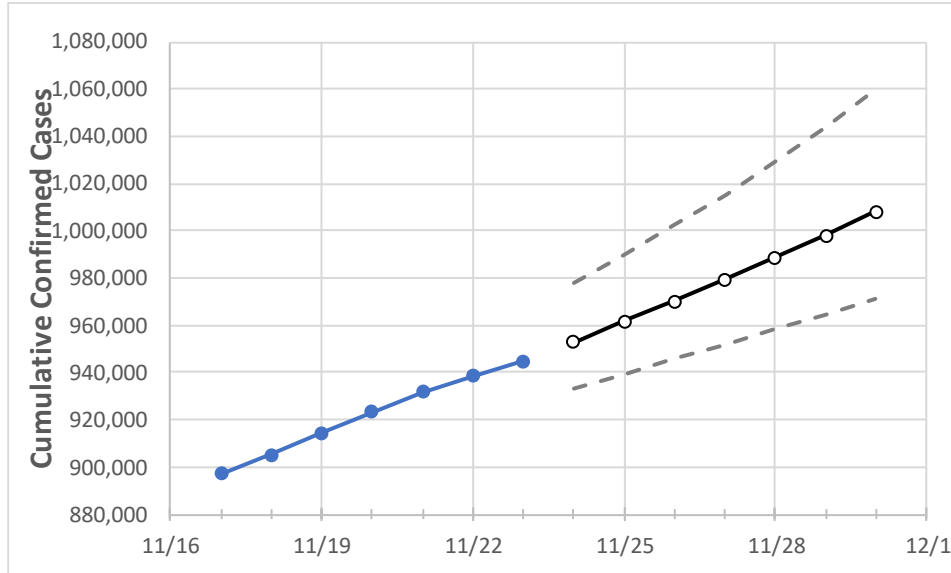
IEM's Modeling Lead

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:					
	11/20	11/21	11/22	11/23	11/24	11/25	11/26	11/27	11/28	11/29	11/30
Florida	923,418	931,827	938,414	944,745	953,023	961,544	970,316	979,346	988,640	998,207	1,008,055

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:						
	11/20	11/21	11/22	11/23	11/24	11/25	11/26	11/27	11/28	11/29	11/30
Alachua	12,176	12,272	12,339	12,395	12,467	12,539	12,611	12,684	12,757	12,830	12,903
Broward	99,320	100,288	101,059	101,747	102,565	103,410	104,281	105,179	106,105	107,061	108,047
Charlotte	4,576	4,624	4,672	4,720	4,778	4,838	4,899	4,963	5,028	5,094	5,163
Collier	16,618	16,749	16,864	16,947	17,077	17,210	17,346	17,486	17,630	17,778	17,930
Duval	39,998	40,369	40,584	40,898	41,201	41,515	41,839	42,175	42,522	42,882	43,253
Hillsborough	54,792	55,257	55,482	55,835	56,201	56,574	56,953	57,338	57,730	58,129	58,535
Lake	9,946	10,012	10,084	10,151	10,221	10,292	10,364	10,437	10,512	10,588	10,665
Lee	27,585	27,891	28,115	28,279	28,566	28,862	29,168	29,484	29,811	30,148	30,497
Manatee	15,511	15,614	15,723	15,904	16,022	16,143	16,268	16,397	16,529	16,665	16,804
Miami-Dade	211,257	213,197	214,943	216,442	218,446	220,554	222,770	225,100	227,549	230,122	232,826
Okaloosa	8,112	8,275	8,323	8,354	8,440	8,527	8,616	8,707	8,799	8,892	8,987
Orange	53,941	54,341	54,636	55,047	55,563	56,095	56,646	57,215	57,803	58,411	59,038
Osceola	16,891	16,989	17,137	17,277	17,456	17,642	17,835	18,034	18,241	18,456	18,679
Palm Beach	60,729	61,305	61,776	62,278	62,815	63,366	63,929	64,507	65,098	65,704	66,324
Pasco	13,373	13,532	13,679	13,809	13,983	14,164	14,351	14,545	14,746	14,954	15,170
Pinellas	30,286	30,611	30,878	31,137	31,417	31,705	32,001	32,306	32,618	32,939	33,268
Polk	26,091	26,253	26,352	26,504	26,678	26,856	27,036	27,220	27,408	27,599	27,793
Sarasota	12,121	12,319	12,419	12,567	12,738	12,918	13,106	13,303	13,511	13,728	13,956
Seminole	11,993	12,075	12,161	12,244	12,345	12,449	12,554	12,662	12,771	12,883	12,997
St. Johns	7,881	7,952	8,030	8,082	8,158	8,235	8,313	8,393	8,475	8,557	8,642
Sumter	3,248	3,279	3,292	3,308	3,321	3,333	3,346	3,359	3,372	3,386	3,399
Volusia	14,811	14,952	15,093	15,245	15,353	15,462	15,574	15,688	15,804	15,922	16,042

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:											
	11/20	11/21	11/22	11/23	11/25			11/27			11/29					
Alachua	12,176	12,272	12,339	12,395	12,539	(2,508)	[602]	{301}	12,684	(2,537)	[609]	{304}	12,830	(2,566)	[616]	{308}
Broward	99,320	100,288	101,059	101,747	103,410	(20,682)	[4,964]	{2,482}	105,179	(21,036)	[5,049]	{2,524}	107,061	(21,412)	[5,139]	{2,569}
Charlotte	4,576	4,624	4,672	4,720	4,838	(968)	[232]	{116}	4,963	(993)	[238]	{119}	5,094	(1,019)	[245]	{122}
Collier	16,618	16,749	16,864	16,947	17,210	(3,442)	[826]	{413}	17,486	(3,497)	[839]	{420}	17,778	(3,556)	[853]	{427}
Duval	39,998	40,369	40,584	40,898	41,515	(8,303)	[1,993]	{996}	42,175	(8,435)	[2,024]	{1,012}	42,882	(8,576)	[2,058]	{1,029}
Hillsborough	54,792	55,257	55,482	55,835	56,574	(11,315)	[2,716]	{1,358}	57,338	(11,468)	[2,752]	{1,376}	58,129	(11,626)	[2,790]	{1,395}
Lake	9,946	10,012	10,084	10,151	10,292	(2,058)	[494]	{247}	10,437	(2,087)	[501]	{250}	10,588	(2,118)	[508]	{254}
Lee	27,585	27,891	28,115	28,279	28,862	(5,772)	[1,385]	{693}	29,484	(5,897)	[1,415]	{708}	30,148	(6,030)	[1,447]	{724}
Manatee	15,511	15,614	15,723	15,904	16,143	(3,229)	[775]	{387}	16,397	(3,279)	[787]	{394}	16,665	(3,333)	[800]	{400}
Miami-Dade	211,257	213,197	214,943	216,442	220,554	(44,111)	[10,587]	{5,293}	225,100	(45,020)	[10,805]	{5,402}	230,122	(46,024)	[11,046]	{5,523}
Okaloosa	8,112	8,275	8,323	8,354	8,527	(1,705)	[409]	{205}	8,707	(1,741)	[418]	{209}	8,892	(1,778)	[427]	{213}
Orange	53,941	54,341	54,636	55,047	56,095	(11,219)	[2,693]	{1,346}	57,215	(11,443)	[2,746]	{1,373}	58,411	(11,682)	[2,804]	{1,402}
Osceola	16,891	16,989	17,137	17,277	17,642	(3,528)	[847]	{423}	18,034	(3,607)	[866]	{433}	18,456	(3,691)	[886]	{443}
Palm Beach	60,729	61,305	61,776	62,278	63,366	(12,673)	[3,042]	{1,521}	64,507	(12,901)	[3,096]	{1,548}	65,704	(13,141)	[3,154]	{1,577}
Pasco	13,373	13,532	13,679	13,809	14,164	(2,833)	[680]	{340}	14,545	(2,909)	[698]	{349}	14,954	(2,991)	[718]	{359}
Pinellas	30,286	30,611	30,878	31,137	31,705	(6,341)	[1,522]	{761}	32,306	(6,461)	[1,551]	{775}	32,939	(6,588)	[1,581]	{791}
Polk	26,091	26,253	26,352	26,504	26,856	(5,371)	[1,289]	{645}	27,220	(5,444)	[1,307]	{653}	27,599	(5,520)	[1,325]	{662}
Sarasota	12,121	12,319	12,419	12,567	12,918	(2,584)	[620]	{310}	13,303	(2,661)	[639]	{319}	13,728	(2,746)	[659]	{329}
Seminole	11,993	12,075	12,161	12,244	12,449	(2,490)	[598]	{299}	12,662	(2,532)	[608]	{304}	12,883	(2,577)	[618]	{309}
St. Johns	7,881	7,952	8,030	8,082	8,235	(1,647)	[395]	{198}	8,393	(1,679)	[403]	{201}	8,557	(1,711)	[411]	{205}
Sumter	3,248	3,279	3,292	3,308	3,333	(667)	[160]	{80}	3,359	(672)	[161]	{81}	3,386	(677)	[163]	{81}
Volusia	14,811	14,952	15,093	15,245	15,462	(3,092)	[742]	{371}	15,688	(3,138)	[753]	{377}	15,922	(3,184)	[764]	{382}

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.