

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 12/22/20**

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 12/22/20 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.

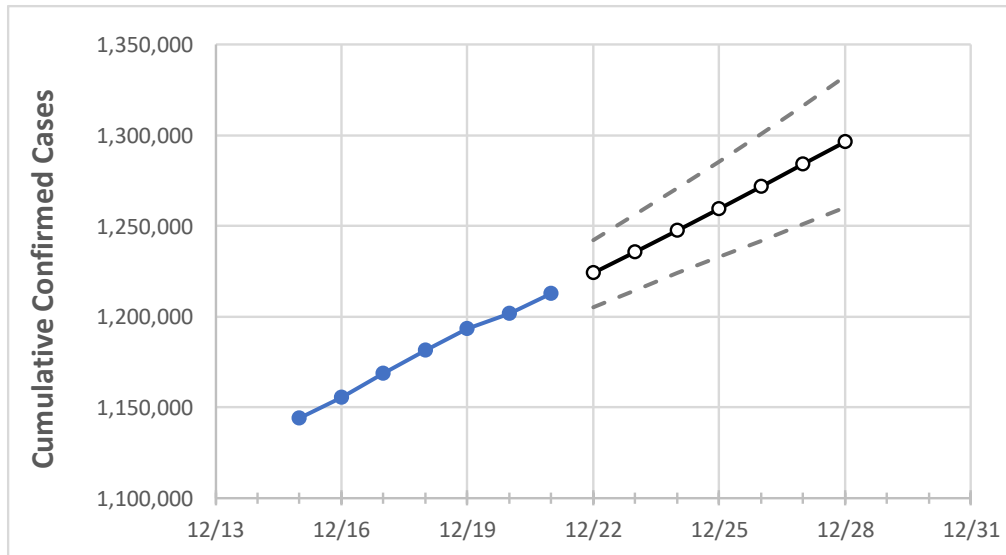
IEM's Modeling Lead

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:						
	12/18	12/19	12/20	12/21	12/22	12/23	12/24	12/25	12/26	12/27	12/28
Florida	1,181,483	1,193,165	1,201,566	1,212,581	1,224,098	1,235,762	1,247,576	1,259,540	1,271,655	1,283,921	1,296,342

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:						
	12/18	12/19	12/20	12/21	12/22	12/23	12/24	12/25	12/26	12/27	12/28
Alachua	14,585	14,716	14,768	14,890	15,005	15,122	15,241	15,362	15,486	15,611	15,739
Broward	125,338	126,402	127,240	128,157	129,151	130,149	131,151	132,157	133,167	134,181	135,199
Charlotte	6,384	6,475	6,531	6,610	6,696	6,783	6,872	6,962	7,053	7,145	7,238
Collier	20,629	20,770	20,825	20,971	21,095	21,218	21,339	21,459	21,579	21,696	21,813
Duval	53,275	53,885	54,359	54,956	55,548	56,149	56,759	57,377	58,006	58,643	59,289
Hillsborough	68,739	69,530	70,027	70,849	71,635	72,442	73,272	74,125	75,000	75,900	76,823
Lake	13,157	13,341	13,492	13,698	13,921	14,152	14,394	14,645	14,906	15,178	15,461
Lee	36,145	36,520	36,795	37,170	37,526	37,884	38,246	38,610	38,978	39,348	39,722
Manatee	19,879	20,058	20,171	20,355	20,553	20,755	20,960	21,168	21,380	21,595	21,814
Miami-Dade	269,716	272,098	274,117	276,414	278,794	281,192	283,610	286,047	288,503	290,978	293,471
Okaloosa	11,260	11,380	11,456	11,574	11,683	11,791	11,898	12,005	12,111	12,217	12,322
Orange	67,577	68,367	68,858	69,491	70,264	71,046	71,838	72,640	73,452	74,274	75,105
Osceola	22,593	22,863	23,024	23,251	23,493	23,736	23,980	24,224	24,470	24,715	24,962
Palm Beach	75,572	76,143	76,602	77,241	77,825	78,413	79,006	79,603	80,204	80,809	81,418
Pasco	19,017	19,291	19,496	19,787	20,067	20,353	20,645	20,943	21,246	21,555	21,870
Pinellas	39,846	40,299	40,560	40,987	41,452	41,926	42,409	42,900	43,401	43,910	44,429
Polk	32,809	33,142	33,384	33,741	34,099	34,465	34,838	35,220	35,610	36,008	36,414
Sarasota	16,537	16,689	16,817	16,975	17,122	17,269	17,415	17,561	17,707	17,852	17,997
Seminole	16,097	16,241	16,358	16,480	16,650	16,819	16,986	17,153	17,317	17,481	17,643
St. Johns	11,025	11,172	11,300	11,491	11,648	11,807	11,969	12,134	12,301	12,471	12,643
Sumter	4,313	4,357	4,379	4,421	4,473	4,526	4,580	4,636	4,693	4,751	4,810
Volusia	19,569	19,794	19,961	20,157	20,374	20,596	20,823	21,055	21,291	21,532	21,778

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:											
	12/18	12/19	12/20	12/21	12/23				12/25				12/27			
Alachua	14,585	14,716	14,768	14,890	15,122	(3,024)	[726]	{363}	15,362	(3,072)	[737]	{369}	15,611	(3,122)	[749]	{375}
Broward	125,338	126,402	127,240	128,157	130,149	(26,030)	[6,247]	{3,124}	132,157	(26,431)	[6,344]	{3,172}	134,181	(26,836)	[6,441]	{3,220}
Charlotte	6,384	6,475	6,531	6,610	6,783	(1,357)	[326]	{163}	6,962	(1,392)	[334]	{167}	7,145	(1,429)	[343]	{171}
Collier	20,629	20,770	20,825	20,971	21,218	(4,244)	[1,018]	{509}	21,459	(4,292)	[1,030]	{515}	21,696	(4,339)	[1,041]	{521}
Duval	53,275	53,885	54,359	54,956	56,149	(11,230)	[2,695]	{1,348}	57,377	(11,475)	[2,754]	{1,377}	58,643	(11,729)	[2,815]	{1,407}
Hillsborough	68,739	69,530	70,027	70,849	72,442	(14,488)	[3,477]	{1,739}	74,125	(14,825)	[3,558]	{1,779}	75,900	(15,180)	[3,643]	{1,822}
Lake	13,157	13,341	13,492	13,698	14,152	(2,830)	[679]	{340}	14,645	(2,929)	[703]	{351}	15,178	(3,036)	[729]	{364}
Lee	36,145	36,520	36,795	37,170	37,884	(7,577)	[1,818]	{909}	38,610	(7,722)	[1,853]	{927}	39,348	(7,870)	[1,889]	{944}
Manatee	19,879	20,058	20,171	20,355	20,755	(4,151)	[996]	{498}	21,168	(4,234)	[1,016]	{508}	21,595	(4,319)	[1,037]	{518}
Miami-Dade	269,716	272,098	274,117	276,414	281,192	(56,238)	[13,497]	{6,749}	286,047	(57,209)	[13,730]	{6,865}	290,978	(58,196)	[13,967]	{6,983}
Okaloosa	11,260	11,380	11,456	11,574	11,791	(2,358)	[566]	{283}	12,005	(2,401)	[576]	{288}	12,217	(2,443)	[586]	{293}
Orange	67,577	68,367	68,858	69,491	71,046	(14,209)	[3,410]	{1,705}	72,640	(14,528)	[3,487]	{1,743}	74,274	(14,855)	[3,565]	{1,783}
Osceola	22,593	22,863	23,024	23,251	23,736	(4,747)	[1,139]	{570}	24,224	(4,845)	[1,163]	{581}	24,715	(4,943)	[1,186]	{593}
Palm Beach	75,572	76,143	76,602	77,241	78,413	(15,683)	[3,764]	{1,882}	79,603	(15,921)	[3,821]	{1,910}	80,809	(16,162)	[3,879]	{1,939}
Pasco	19,017	19,291	19,496	19,787	20,353	(4,071)	[977]	{488}	20,943	(4,189)	[1,005]	{503}	21,555	(4,311)	[1,035]	{517}
Pinellas	39,846	40,299	40,560	40,987	41,926	(8,385)	[2,012]	{1,006}	42,900	(8,580)	[2,059]	{1,030}	43,910	(8,782)	[2,108]	{1,054}
Polk	32,809	33,142	33,384	33,741	34,465	(6,893)	[1,654]	{827}	35,220	(7,044)	[1,691]	{845}	36,008	(7,202)	[1,728]	{864}
Sarasota	16,537	16,689	16,817	16,975	17,269	(3,454)	[829]	{414}	17,561	(3,512)	[843]	{421}	17,852	(3,570)	[857]	{428}
Seminole	16,097	16,241	16,358	16,480	16,819	(3,364)	[807]	{404}	17,153	(3,431)	[823]	{412}	17,481	(3,496)	[839]	{420}
St. Johns	11,025	11,172	11,300	11,491	11,807	(2,361)	[567]	{283}	12,134	(2,427)	[582]	{291}	12,471	(2,494)	[599]	{299}
Sumter	4,313	4,357	4,379	4,421	4,526	(905)	[217]	{109}	4,636	(927)	[223]	{111}	4,751	(950)	[228]	{114}
Volusia	19,569	19,794	19,961	20,157	20,596	(4,119)	[989]	{494}	21,055	(4,211)	[1,011]	{505}	21,532	(4,306)	[1,034]	{517}

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.