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

Date: 9/20/21

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 9/20/21 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.

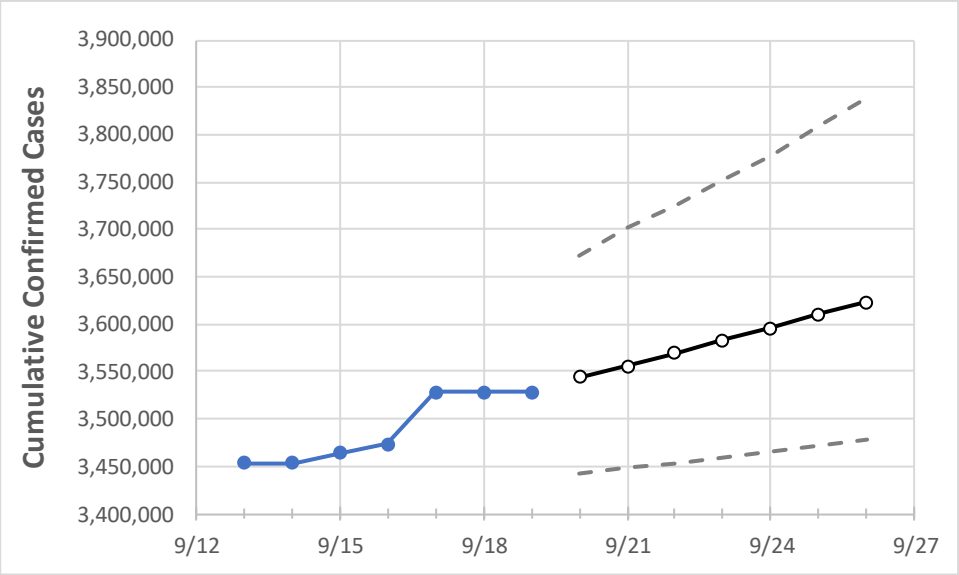
IEM's Modeling Lead

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:						
	9/16	9/17	9/18	9/19	9/20	9/21	9/22	9/23	9/24	9/25	9/26
Florida	3,473,873	3,528,698	3,528,698	3,528,698	3,543,900	3,555,847	3,569,945	3,583,137	3,595,683	3,610,383	3,623,803

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

Florida Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	9/16	9/17	9/18	9/19	9/20	9/21	9/22	9/23	9/24	9/25	9/26
Alachua	37,766	37,906	37,906	37,906	38,037	38,165	38,292	38,415	38,538	38,660	38,781
Broward	344,426	345,206	345,206	345,206	345,897	346,567	347,228	347,873	348,498	349,125	349,736
Charlotte	21,822	21,936	21,936	21,936	22,039	22,141	22,240	22,339	22,434	22,529	22,623
Collier	55,121	55,311	55,311	55,311	55,487	55,657	55,827	55,990	56,152	56,312	56,466
Duval	160,123	160,486	160,486	160,486	160,816	161,141	161,459	161,772	162,080	162,383	162,679
Hillsborough	229,426	230,210	230,210	230,210	230,938	231,630	232,319	232,989	233,622	234,256	234,892
Lake	51,068	51,277	51,277	51,277	51,469	51,656	51,842	52,025	52,203	52,380	52,552
Lee	120,941	121,402	121,402	121,402	121,811	122,208	122,585	122,957	123,310	123,651	123,990
Manatee	62,317	62,533	62,533	62,533	62,746	62,952	63,154	63,348	63,535	63,726	63,904
Miami-Dade	655,437	656,489	656,489	656,489	657,418	658,324	659,207	660,066	660,910	661,724	662,527
Okaloosa	32,884	33,008	33,008	33,008	33,139	33,265	33,384	33,504	33,624	33,737	33,850
Orange	219,351	220,018	220,018	220,018	220,611	221,194	221,761	222,311	222,858	223,396	223,916
Osceola	68,932	69,138	69,138	69,138	69,322	69,502	69,679	69,850	70,022	70,189	70,352
Palm Beach	216,810	217,465	217,465	217,465	218,063	218,646	219,218	219,784	220,334	220,884	221,419
Pasco	74,894	75,274	75,274	75,274	75,620	75,960	76,291	76,619	76,939	77,260	77,571
Pinellas	129,404	129,906	129,906	129,906	130,355	130,797	131,229	131,651	132,064	132,472	132,866
Polk	122,111	122,575	122,575	122,575	122,989	123,389	123,779	124,162	124,532	124,900	125,249
Sarasota	54,059	54,266	54,266	54,266	54,452	54,636	54,808	54,979	55,148	55,308	55,466
Seminole	59,240	59,447	59,447	59,447	59,636	59,821	60,003	60,181	60,358	60,530	60,699
St. Johns	38,298	38,471	38,471	38,471	38,632	38,789	38,944	39,097	39,250	39,401	39,551
Sumter	13,800	13,861	13,861	13,861	13,918	13,974	14,030	14,085	14,139	14,193	14,247
Volusia	71,764	72,032	72,032	72,032	72,297	72,561	72,825	73,087	73,348	73,607	73,863

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:		
	9/16	9/17	9/18	9/19	9/21	9/23	9/25
Alachua	37,766	37,906	37,906	37,906	38,165 (7,633) [1,832] {916}	38,415 (7,683) [1,844] {922}	38,660 (7,732) [1,856] {928}
Broward	344,426	345,206	345,206	345,206	346,567 (69,313) [16,635] {8,318}	347,873 (69,575) [16,698] {8,349}	349,125 (69,825) [16,758] {8,379}
Charlotte	21,822	21,936	21,936	21,936	22,141 (4,428) [1,063] {531}	22,339 (4,468) [1,072] {536}	22,529 (4,506) [1,081] {541}
Collier	55,121	55,311	55,311	55,311	55,657 (11,131) [2,672] {1,336}	55,990 (11,198) [2,688] {1,344}	56,312 (11,262) [2,703] {1,351}
Duval	160,123	160,486	160,486	160,486	161,141 (32,228) [7,735] {3,867}	161,772 (32,354) [7,765] {3,883}	162,383 (32,477) [7,794] {3,897}
Hillsborough	229,426	230,210	230,210	230,210	231,630 (46,326) [11,118] {5,559}	232,989 (46,598) [11,183] {5,592}	234,256 (46,851) [11,244] {5,622}
Lake	51,068	51,277	51,277	51,277	51,656 (10,331) [2,480] {1,240}	52,025 (10,405) [2,497] {1,249}	52,380 (10,476) [2,514] {1,257}
Lee	120,941	121,402	121,402	121,402	122,208 (24,442) [5,866] {2,933}	122,957 (24,591) [5,902] {2,951}	123,651 (24,730) [5,935] {2,968}
Manatee	62,317	62,533	62,533	62,533	62,952 (12,590) [3,022] {1,511}	63,348 (12,670) [3,041] {1,520}	63,726 (12,745) [3,059] {1,529}
Miami-Dade	655,437	656,489	656,489	656,489	658,324 (131,665) [31,600] {15,800}	660,066 (132,013) [31,683] {15,842}	661,724 (132,345) [31,763] {15,881}
Okaloosa	32,884	33,008	33,008	33,008	33,265 (6,653) [1,597] {798}	33,504 (6,701) [1,608] {804}	33,737 (6,747) [1,619] {810}
Orange	219,351	220,018	220,018	220,018	221,194 (44,239) [10,617] {5,309}	222,311 (44,462) [10,671] {5,335}	223,396 (44,679) [10,723] {5,362}
Osceola	68,932	69,138	69,138	69,138	69,502 (13,900) [3,336] {1,668}	69,850 (13,970) [3,353] {1,676}	70,189 (14,038) [3,369] {1,685}
Palm Beach	216,810	217,465	217,465	217,465	218,646 (43,729) [10,495] {5,248}	219,784 (43,957) [10,550] {5,275}	220,884 (44,177) [10,602] {5,301}
Pasco	74,894	75,274	75,274	75,274	75,960 (15,192) [3,646] {1,823}	76,619 (15,324) [3,678] {1,839}	77,260 (15,452) [3,708] {1,854}
Pinellas	129,404	129,906	129,906	129,906	130,797 (26,159) [6,278] {3,139}	131,651 (26,330) [6,319] {3,160}	132,472 (26,494) [6,359] {3,179}
Polk	122,111	122,575	122,575	122,575	123,389 (24,678) [5,923] {2,961}	124,162 (24,832) [5,960] {2,980}	124,900 (24,980) [5,995] {2,998}
Sarasota	54,059	54,266	54,266	54,266	54,636 (10,927) [2,623] {1,311}	54,979 (10,996) [2,639] {1,319}	55,308 (11,062) [2,655] {1,327}
Seminole	59,240	59,447	59,447	59,447	59,821 (11,964) [2,871] {1,436}	60,181 (12,036) [2,889] {1,444}	60,530 (12,106) [2,905] {1,453}
St. Johns	38,298	38,471	38,471	38,471	38,789 (7,758) [1,862] {931}	39,097 (7,819) [1,877] {938}	39,401 (7,880) [1,891] {946}
Sumter	13,800	13,861	13,861	13,861	13,974 (2,795) [671] {335}	14,085 (2,817) [676] {338}	14,193 (2,839) [681] {341}
Volusia	71,764	72,032	72,032	72,032	72,561 (14,512) [3,483] {1,741}	73,087 (14,617) [3,508] {1,754}	73,607 (14,721) [3,533] {1,767}

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.