IEM's AI Modeling: Short-term COVID-19 Projections
Date: 9/16/20

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 <u>not</u> 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 20%, and are often within 10%, of actual confirmed cases.

The projections shown in this document are based on data pulled in as of 9/16/20 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
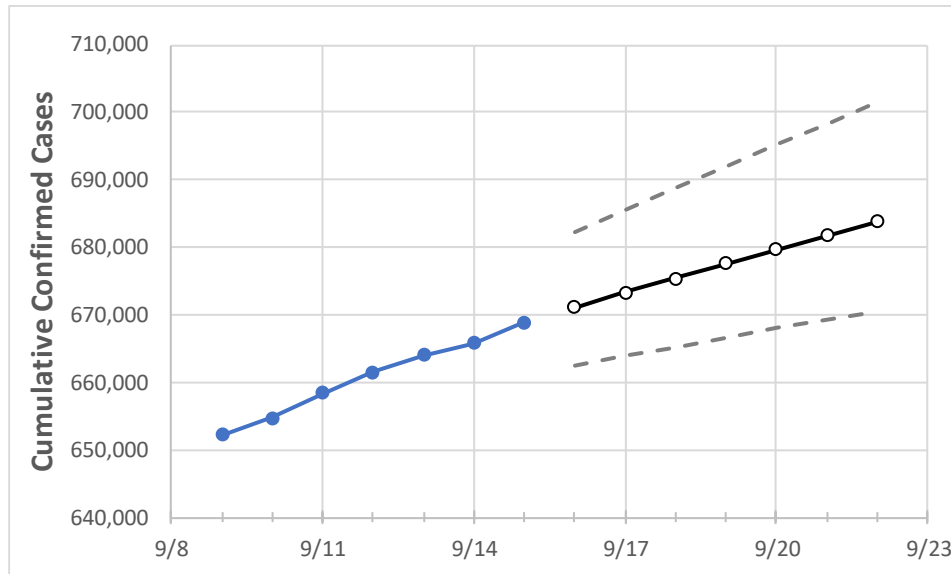
	Actual Confirmed Cases On:				**Projected Cases For:**						
	9/12	9/13	9/14	9/15	9/16	9/17	9/18	9/19	9/20	9/21	9/22
Florida	661,571	663,994	665,730	668,846	671,094	673,301	675,468	677,595	679,684	681,734	683,747

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:						
	9/12	9/13	9/14	9/15	9/16	9/17	9/18	9/19	9/20	9/21	9/22
Alachua	6,241	6,401	6,555	6,657	6,775	6,900	7,033	7,173	7,322	7,480	7,646
Broward	74,273	74,434	74,525	74,689	74,801	74,908	75,011	75,109	75,202	75,291	75,376
Charlotte	2,858	2,871	2,877	2,881	2,889	2,896	2,903	2,910	2,917	2,923	2,929
Collier	12,169	12,209	12,234	12,254	12,280	12,306	12,331	12,355	12,379	12,402	12,425
Duval	28,370	28,458	28,525	28,632	28,741	28,850	28,957	29,063	29,169	29,273	29,377
Hillsborough	39,298	39,450	39,600	39,751	39,894	40,034	40,173	40,311	40,446	40,580	40,713
Lake	7,021	7,046	7,063	7,092	7,121	7,149	7,176	7,203	7,230	7,255	7,281
Lee	19,451	19,488	19,525	19,566	19,603	19,638	19,672	19,705	19,736	19,767	19,796
Manatee	10,868	10,886	10,932	10,972	10,999	11,025	11,052	11,078	11,103	11,128	11,153
Miami-Dade	163,790	164,086	164,299	164,688	164,938	165,176	165,403	165,618	165,822	166,017	166,202
Okaloosa	4,579	4,620	4,637	4,676	4,707	4,738	4,769	4,800	4,832	4,863	4,895
Orange	37,846	37,939	38,013	38,147	38,245	38,342	38,436	38,528	38,618	38,707	38,793
Osceola	11,740	11,772	11,807	11,846	11,879	11,911	11,942	11,973	12,003	12,032	12,061
Palm Beach	43,873	44,025	44,139	44,305	44,422	44,537	44,650	44,762	44,872	44,981	45,087
Pasco	8,507	8,527	8,551	8,600	8,628	8,657	8,684	8,712	8,739	8,766	8,792
Pinellas	20,872	20,922	20,988	21,081	21,151	21,220	21,290	21,359	21,429	21,498	21,568
Polk	18,337	18,473	18,523	18,612	18,705	18,798	18,890	18,981	19,072	19,162	19,251
Sarasota	7,585	7,619	7,644	7,671	7,698	7,724	7,750	7,776	7,802	7,827	7,853
Seminole	8,532	8,552	8,568	8,613	8,639	8,664	8,688	8,713	8,736	8,760	8,783
St. Johns	4,858	4,887	4,902	4,928	4,966	5,004	5,043	5,083	5,123	5,163	5,204
Sumter	2,101	2,103	2,107	2,121	2,128	2,135	2,142	2,148	2,155	2,161	2,167
Volusia	10,103	10,160	10,197	10,262	10,313	10,365	10,416	10,467	10,518	10,568	10,619

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:		
	9/12	9/13	9/14	9/15	9/17	9/19	9/21
Alachua	6,241	6,401	6,555	6,657	6,900 (1,380) [331] {166}	7,173 (1,435) [344] {172}	7,480 (1,496) [359] {180}
Broward	74,273	74,434	74,525	74,689	74,908 (14,982) [3,596] {1,798}	75,109 (15,022) [3,605] {1,803}	75,291 (15,058) [3,614] {1,807}
Charlotte	2,858	2,871	2,877	2,881	2,896 (579) [139] {70}	2,910 (582) [140] {70}	2,923 (585) [140] {70}
Collier	12,169	12,209	12,234	12,254	12,306 (2,461) [591] {295}	12,355 (2,471) [593] {297}	12,402 (2,480) [595] {298}
Duval	28,370	28,458	28,525	28,632	28,850 (5,770) [1,385] {692}	29,063 (5,813) [1,395] {698}	29,273 (5,855) [1,405] {703}
Hillsborough	39,298	39,450	39,600	39,751	40,034 (8,007) [1,922] {961}	40,311 (8,062) [1,935] {967}	40,580 (8,116) [1,948] {974}
Lake	7,021	7,046	7,063	7,092	7,149 (1,430) [343] {172}	7,203 (1,441) [346] {173}	7,255 (1,451) [348] {174}
Lee	19,451	19,488	19,525	19,566	19,638 (3,928) [943] {471}	19,705 (3,941) [946] {473}	19,767 (3,953) [949] {474}
Manatee	10,868	10,886	10,932	10,972	11,025 (2,205) [529] {265}	11,078 (2,216) [532] {266}	11,128 (2,226) [534] {267}
Miami-Dade	163,790	164,086	164,299	164,688	165,176 (33,035) [7,928] {3,964}	165,618 (33,124) [7,950] {3,975}	166,017 (33,203) [7,969] {3,984}
Okaloosa	4,579	4,620	4,637	4,676	4,738 (948) [227] {114}	4,800 (960) [230] {115}	4,863 (973) [233] {117}
Orange	37,846	37,939	38,013	38,147	38,342 (7,668) [1,840] {920}	38,528 (7,706) [1,849] {925}	38,707 (7,741) [1,858] {929}
Osceola	11,740	11,772	11,807	11,846	11,911 (2,382) [572] {286}	11,973 (2,395) [575] {287}	12,032 (2,406) [578] {289}
Palm Beach	43,873	44,025	44,139	44,305	44,537 (8,907) [2,138] {1,069}	44,762 (8,952) [2,149] {1,074}	44,981 (8,996) [2,159] {1,080}
Pasco	8,507	8,527	8,551	8,600	8,657 (1,731) [416] {208}	8,712 (1,742) [418] {209}	8,766 (1,753) [421] {210}
Pinellas	20,872	20,922	20,988	21,081	21,220 (4,244) [1,019] {509}	21,359 (4,272) [1,025] {513}	21,498 (4,300) [1,032] {516}
Polk	18,337	18,473	18,523	18,612	18,798 (3,760) [902] {451}	18,981 (3,796) [911] {456}	19,162 (3,832) [920] {460}
Sarasota	7,585	7,619	7,644	7,671	7,724 (1,545) [371] {185}	7,776 (1,555) [373] {187}	7,827 (1,565) [376] {188}
Seminole	8,532	8,552	8,568	8,613	8,664 (1,733) [416] {208}	8,713 (1,743) [418] {209}	8,760 (1,752) [420] {210}
St. Johns	4,858	4,887	4,902	4,928	5,004 (1,001) [240] {120}	5,083 (1,017) [244] {122}	5,163 (1,033) [248] {124}
Sumter	2,101	2,103	2,107	2,121	2,135 (427) [102] {51}	2,148 (430) [103] {52}	2,161 (432) [104] {52}
Volusia	10,103	10,160	10,197	10,262	10,365 (2,073) [498] {249}	10,467 (2,093) [502] {251}	10,568 (2,114) [507] {254}

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.