IEM's AI Modeling: Short-term COVID-19 Projections
Date: 9/15/20

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 20%, and are often within 10%, of actual confirmed cases.

The projections shown in this document are based on data pulled in as of 9/15/20 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
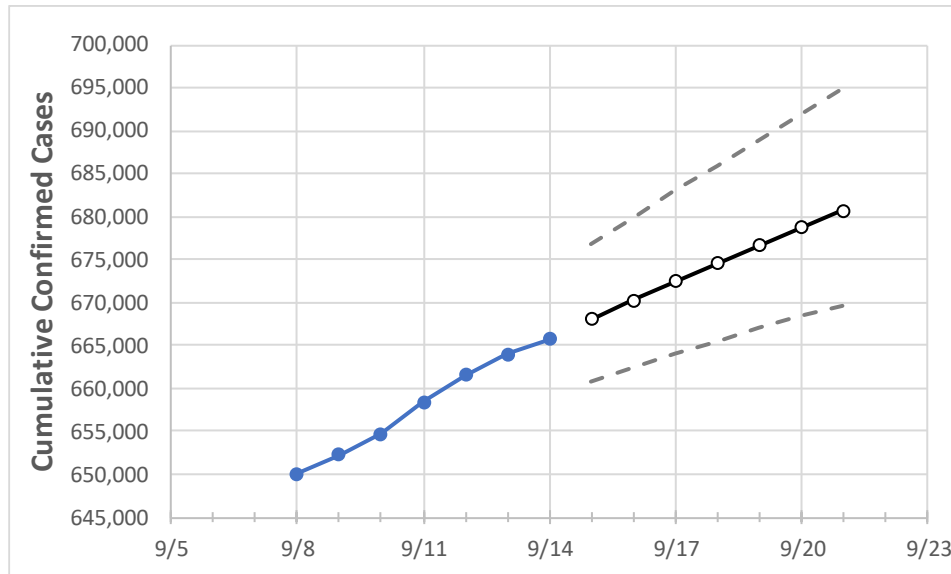
	Actual Confirmed Cases On:				Projected Cases For:						
	9/11	9/12	9/13	9/14	9/15	9/16	9/17	9/18	9/19	9/20	9/21
Florida	658,381	661,571	663,994	665,730	668,008	670,236	672,417	674,552	676,641	678,685	680,686

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:						
	9/11	9/12	9/13	9/14	9/15	9/16	9/17	9/18	9/19	9/20	9/21
Alachua	6,029	6,241	6,401	6,555	6,666	6,783	6,907	7,038	7,177	7,324	7,479
Broward	74,084	74,273	74,434	74,525	74,649	74,768	74,881	74,989	75,092	75,189	75,283
Charlotte	2,849	2,858	2,871	2,877	2,887	2,896	2,906	2,914	2,923	2,931	2,939
Collier	12,132	12,169	12,209	12,234	12,258	12,281	12,304	12,326	12,348	12,369	12,389
Duval	28,230	28,370	28,458	28,525	28,638	28,751	28,862	28,972	29,082	29,190	29,298
Hillsborough	39,138	39,298	39,450	39,600	39,746	39,890	40,033	40,173	40,312	40,450	40,585
Lake	6,972	7,021	7,046	7,063	7,091	7,119	7,146	7,172	7,198	7,223	7,247
Lee	19,370	19,451	19,488	19,525	19,563	19,599	19,633	19,667	19,699	19,729	19,759
Manatee	10,803	10,868	10,886	10,932	10,955	10,978	11,001	11,022	11,044	11,065	11,085
Miami-Dade	163,375	163,790	164,086	164,299	164,576	164,839	165,089	165,327	165,552	165,766	165,970
Okaloosa	4,551	4,579	4,620	4,637	4,668	4,698	4,729	4,760	4,791	4,822	4,853
Orange	37,701	37,846	37,939	38,013	38,117	38,218	38,316	38,413	38,507	38,598	38,688
Osceola	11,684	11,740	11,772	11,807	11,840	11,873	11,905	11,936	11,966	11,996	12,024
Palm Beach	43,724	43,873	44,025	44,139	44,261	44,381	44,498	44,614	44,727	44,838	44,948
Pasco	8,464	8,507	8,527	8,551	8,577	8,603	8,629	8,654	8,678	8,702	8,726
Pinellas	20,795	20,872	20,922	20,988	21,055	21,121	21,187	21,253	21,318	21,383	21,448
Polk	18,228	18,337	18,473	18,523	18,618	18,712	18,805	18,898	18,990	19,082	19,173
Sarasota	7,533	7,585	7,619	7,644	7,671	7,697	7,723	7,749	7,775	7,800	7,826
Seminole	8,492	8,532	8,552	8,568	8,592	8,615	8,638	8,660	8,682	8,703	8,723
St. Johns	4,813	4,858	4,887	4,902	4,941	4,982	5,022	5,064	5,106	5,149	5,193
Sumter	2,086	2,101	2,103	2,107	2,114	2,121	2,127	2,134	2,140	2,145	2,151
Volusia	10,027	10,103	10,160	10,197	10,247	10,296	10,345	10,393	10,442	10,490	10,537

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:		
	9/11	9/12	9/13	9/14	9/16	9/18	9/20
Alachua	6,029	6,241	6,401	6,555	6,783 (1,357) [326] {163}	7,038 (1,408) [338] {169}	7,324 (1,465) [352] {176}
Broward	74,084	74,273	74,434	74,525	74,768 (14,954) [3,589] {1,794}	74,989 (14,998) [3,599] {1,800}	75,189 (15,038) [3,609] {1,805}
Charlotte	2,849	2,858	2,871	2,877	2,896 (579) [139] {70}	2,914 (583) [140] {70}	2,931 (586) [141] {70}
Collier	12,132	12,169	12,209	12,234	12,281 (2,456) [589] {295}	12,326 (2,465) [592] {296}	12,369 (2,474) [594] {297}
Duval	28,230	28,370	28,458	28,525	28,751 (5,750) [1,380] {690}	28,972 (5,794) [1,391] {695}	29,190 (5,838) [1,401] {701}
Hillsborough	39,138	39,298	39,450	39,600	39,890 (7,978) [1,915] {957}	40,173 (8,035) [1,928] {964}	40,450 (8,090) [1,942] {971}
Lake	6,972	7,021	7,046	7,063	7,119 (1,424) [342] {171}	7,172 (1,434) [344] {172}	7,223 (1,445) [347] {173}
Lee	19,370	19,451	19,488	19,525	19,599 (3,920) [941] {470}	19,667 (3,933) [944] {472}	19,729 (3,946) [947] {474}
Manatee	10,803	10,868	10,886	10,932	10,978 (2,196) [527] {263}	11,022 (2,204) [529] {265}	11,065 (2,213) [531] {266}
Miami-Dade	163,375	163,790	164,086	164,299	164,839 (32,968) [7,912] {3,956}	165,327 (33,065) [7,936] {3,968}	165,766 (33,153) [7,957] {3,978}
Okaloosa	4,551	4,579	4,620	4,637	4,698 (940) [226] {113}	4,760 (952) [228] {114}	4,822 (964) [231] {116}
Orange	37,701	37,846	37,939	38,013	38,218 (7,644) [1,834] {917}	38,413 (7,683) [1,844] {922}	38,598 (7,720) [1,853] {926}
Osceola	11,684	11,740	11,772	11,807	11,873 (2,375) [570] {285}	11,936 (2,387) [573] {286}	11,996 (2,399) [576] {288}
Palm Beach	43,724	43,873	44,025	44,139	44,381 (8,876) [2,130] {1,065}	44,614 (8,923) [2,141] {1,071}	44,838 (8,968) [2,152] {1,076}
Pasco	8,464	8,507	8,527	8,551	8,603 (1,721) [413] {206}	8,654 (1,731) [415] {208}	8,702 (1,740) [418] {209}
Pinellas	20,795	20,872	20,922	20,988	21,121 (4,224) [1,014] {507}	21,253 (4,251) [1,020] {510}	21,383 (4,277) [1,026] {513}
Polk	18,228	18,337	18,473	18,523	18,712 (3,742) [898] {449}	18,898 (3,780) [907] {454}	19,082 (3,816) [916] {458}
Sarasota	7,533	7,585	7,619	7,644	7,697 (1,539) [369] {185}	7,749 (1,550) [372] {186}	7,800 (1,560) [374] {187}
Seminole	8,492	8,532	8,552	8,568	8,615 (1,723) [414] {207}	8,660 (1,732) [416] {208}	8,703 (1,741) [418] {209}
St. Johns	4,813	4,858	4,887	4,902	4,982 (996) [239] {120}	5,064 (1,013) [243] {122}	5,149 (1,030) [247] {124}
Sumter	2,086	2,101	2,103	2,107	2,121 (424) [102] {51}	2,134 (427) [102] {51}	2,145 (429) [103] {51}
Volusia	10,027	10,103	10,160	10,197	10,296 (2,059) [494] {247}	10,393 (2,079) [499] {249}	10,490 (2,098) [504] {252}

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.