IEM's AI Modeling: Short-term COVID-19 Projections
Date: 8/11/20

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 8/11/20 12 p.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
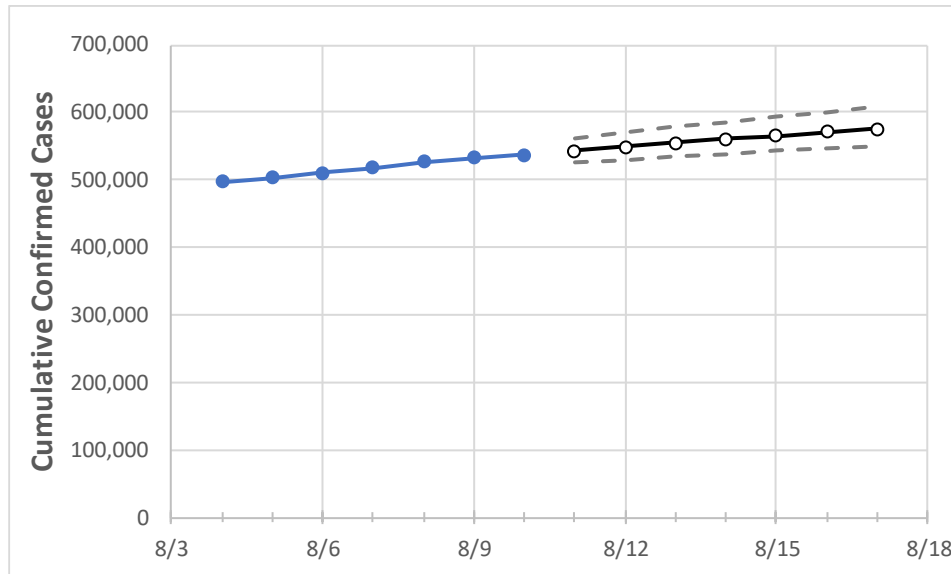
	Actual Confirmed Cases On:				Projected Cases For:						
	8/7	8/8	8/9	8/10	8/11	8/12	8/13	8/14	8/15	8/16	8/17
Florida	518,060	526,577	532,806	536,961	542,945	548,790	554,500	560,077	565,525	570,847	576,045

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:						
	8/7	8/8	8/9	8/10	8/11	8/12	8/13	8/14	8/15	8/16	8/17
Alachua	4,006	4,088	4,142	4,171	4,228	4,285	4,341	4,398	4,454	4,511	4,567
Broward	60,746	61,614	62,268	62,898	63,521	64,128	64,719	65,295	65,856	66,401	66,933
Charlotte	2,174	2,214	2,238	2,257	2,287	2,317	2,347	2,377	2,407	2,437	2,467
Collier	10,202	10,265	10,334	10,448	10,522	10,594	10,664	10,732	10,799	10,863	10,926
Duval	22,889	23,166	23,437	23,530	23,697	23,858	24,015	24,166	24,312	24,454	24,591
Hillsborough	31,865	32,268	32,587	32,731	33,006	33,274	33,536	33,792	34,041	34,284	34,521
Lake	4,958	5,073	5,161	5,177	5,224	5,271	5,316	5,361	5,404	5,447	5,489
Lee	16,248	16,431	16,529	16,632	16,728	16,820	16,909	16,994	17,077	17,157	17,233
Manatee	9,124	9,199	9,288	9,340	9,402	9,461	9,518	9,573	9,626	9,676	9,725
Miami-Dade	129,409	131,217	132,461	133,623	134,945	136,239	137,505	138,744	139,956	141,142	142,303
Okaloosa	3,391	3,448	3,502	3,541	3,614	3,687	3,762	3,837	3,914	3,991	4,069
Orange	31,026	31,395	31,719	31,851	32,069	32,280	32,486	32,684	32,877	33,064	33,246
Osceola	9,401	9,568	9,696	9,769	9,878	9,985	10,090	10,193	10,295	10,394	10,492
Palm Beach	36,114	36,600	37,020	37,297	37,649	37,995	38,336	38,671	39,001	39,326	39,646
Pasco	6,893	6,982	7,080	7,114	7,179	7,242	7,305	7,365	7,425	7,483	7,539
Pinellas	17,541	17,725	17,879	17,941	18,065	18,185	18,302	18,415	18,525	18,632	18,735
Polk	13,839	14,124	14,301	14,475	14,632	14,788	14,941	15,093	15,243	15,391	15,537
Sarasota	6,095	6,164	6,231	6,256	6,306	6,355	6,403	6,449	6,493	6,536	6,578
Seminole	6,976	7,048	7,118	7,152	7,202	7,251	7,299	7,345	7,389	7,433	7,475
St. Johns	3,552	3,593	3,635	3,660	3,694	3,727	3,760	3,792	3,823	3,854	3,884
Sumter	1,237	1,284	1,303	1,307	1,324	1,340	1,357	1,374	1,391	1,408	1,426
Volusia	7,654	7,779	7,876	7,960	8,055	8,149	8,242	8,334	8,425	8,514	8,603

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:		
	8/7	8/8	8/9	8/10	8/12	8/14	8/16
Alachua	4,006	4,088	4,142	4,171	4,285 (857) [206] {103}	4,398 (880) [211] {106}	4,511 (902) [217] {108}
Broward	60,746	61,614	62,268	62,898	64,128 (12,826) [3,078] {1,539}	65,295 (13,059) [3,134] {1,567}	66,401 (13,280) [3,187] {1,594}
Charlotte	2,174	2,214	2,238	2,257	2,317 (463) [111] {56}	2,377 (475) [114] {57}	2,437 (487) [117] {58}
Collier	10,202	10,265	10,334	10,448	10,594 (2,119) [509] {254}	10,732 (2,146) [515] {258}	10,863 (2,173) [521] {261}
Duval	22,889	23,166	23,437	23,530	23,858 (4,772) [1,145] {573}	24,166 (4,833) [1,160] {580}	24,454 (4,891) [1,174] {587}
Hillsborough	31,865	32,268	32,587	32,731	33,274 (6,655) [1,597] {799}	33,792 (6,758) [1,622] {811}	34,284 (6,857) [1,646] {823}
Lake	4,958	5,073	5,161	5,177	5,271 (1,054) [253] {126}	5,361 (1,072) [257] {129}	5,447 (1,089) [261] {131}
Lee	16,248	16,431	16,529	16,632	16,820 (3,364) [807] {404}	16,994 (3,399) [816] {408}	17,157 (3,431) [824] {412}
Manatee	9,124	9,199	9,288	9,340	9,461 (1,892) [454] {227}	9,573 (1,915) [459] {230}	9,676 (1,935) [464] {232}
Miami-Dade	129,409	131,217	132,461	133,623	136,239 (27,248) [6,539] {3,270}	138,744 (27,749) [6,660] {3,330}	141,142 (28,228) [6,775] {3,387}
Okaloosa	3,391	3,448	3,502	3,541	3,687 (737) [177] {88}	3,837 (767) [184] {92}	3,991 (798) [192] {96}
Orange	31,026	31,395	31,719	31,851	32,280 (6,456) [1,549] {775}	32,684 (6,537) [1,569] {784}	33,064 (6,613) [1,587] {794}
Osceola	9,401	9,568	9,696	9,769	9,985 (1,997) [479] {240}	10,193 (2,039) [489] {245}	10,394 (2,079) [499] {249}
Palm Beach	36,114	36,600	37,020	37,297	37,995 (7,599) [1,824] {912}	38,671 (7,734) [1,856] {928}	39,326 (7,865) [1,888] {944}
Pasco	6,893	6,982	7,080	7,114	7,242 (1,448) [348] {174}	7,365 (1,473) [354] {177}	7,483 (1,497) [359] {180}
Pinellas	17,541	17,725	17,879	17,941	18,185 (3,637) [873] {436}	18,415 (3,683) [884] {442}	18,632 (3,726) [894] {447}
Polk	13,839	14,124	14,301	14,475	14,788 (2,958) [710] {355}	15,093 (3,019) [724] {362}	15,391 (3,078) [739] {369}
Sarasota	6,095	6,164	6,231	6,256	6,355 (1,271) [305] {153}	6,449 (1,290) [310] {155}	6,536 (1,307) [314] {157}
Seminole	6,976	7,048	7,118	7,152	7,251 (1,450) [348] {174}	7,345 (1,469) [353] {176}	7,433 (1,487) [357] {178}
St. Johns	3,552	3,593	3,635	3,660	3,727 (745) [179] {89}	3,792 (758) [182] {91}	3,854 (771) [185] {92}
Sumter	1,237	1,284	1,303	1,307	1,340 (268) [64] {32}	1,374 (275) [66] {33}	1,408 (282) [68] {34}
Volusia	7,654	7,779	7,876	7,960	8,149 (1,630) [391] {196}	8,334 (1,667) [400] {200}	8,514 (1,703) [409] {204}

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.