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

Date: 8/4/20

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 8/4/20 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.

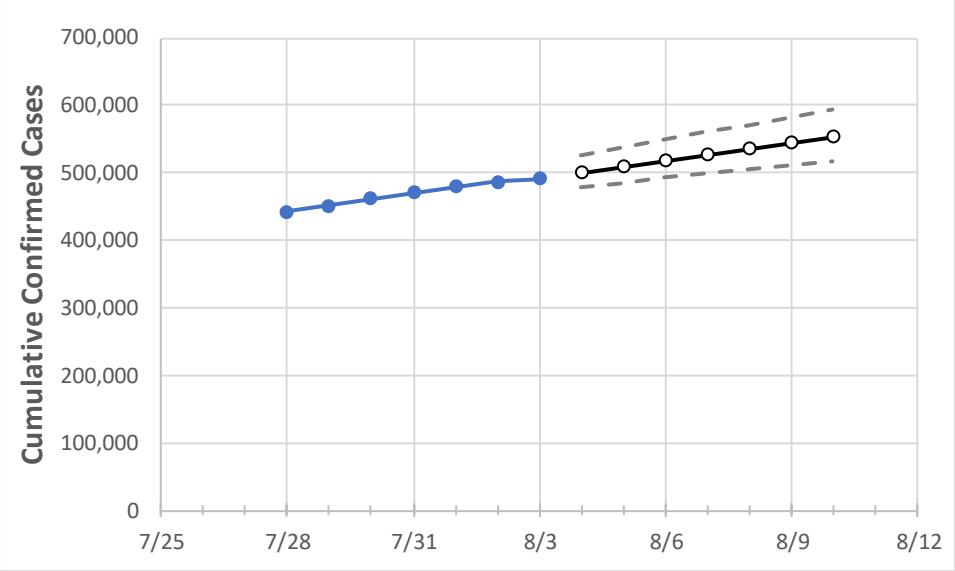
IEM's Modeling Lead

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:						
	7/31	8/1	8/2	8/3	8/4	8/5	8/6	8/7	8/8	8/9	8/10
Florida	470,386	480,027	487,128	491,884	500,830	509,726	518,570	527,364	536,107	544,799	553,440

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:						
	7/31	8/1	8/2	8/3	8/4	8/5	8/6	8/7	8/8	8/9	8/10
Alachua	3,526	3,590	3,662	3,749	3,825	3,902	3,980	4,060	4,140	4,221	4,304
Broward	55,411	56,797	57,975	58,531	59,743	60,960	62,183	63,411	64,645	65,884	67,129
Charlotte	1,946	1,984	2,024	2,062	2,107	2,152	2,199	2,247	2,296	2,347	2,398
Collier	9,581	9,662	9,734	9,811	9,922	10,032	10,141	10,249	10,356	10,462	10,566
Duval	21,038	21,322	21,665	21,830	22,073	22,311	22,545	22,774	22,999	23,220	23,436
Hillsborough	29,116	29,589	30,118	30,450	30,844	31,233	31,618	31,998	32,374	32,745	33,113
Lake	4,516	4,612	4,661	4,708	4,791	4,874	4,957	5,041	5,125	5,210	5,295
Lee	15,416	15,551	15,674	15,799	15,962	16,122	16,279	16,433	16,585	16,734	16,881
Manatee	8,517	8,655	8,733	8,825	8,955	9,084	9,213	9,342	9,470	9,597	9,725
Miami-Dade	118,462	121,207	122,690	123,644	126,125	128,633	131,166	133,725	136,309	138,919	141,554
Okaloosa	2,765	2,850	2,931	3,031	3,120	3,211	3,306	3,404	3,505	3,610	3,718
Orange	29,011	29,466	29,699	29,927	30,286	30,641	30,992	31,340	31,684	32,024	32,360
Osceola	8,470	8,649	8,782	8,894	9,073	9,254	9,437	9,622	9,810	9,999	10,190
Palm Beach	33,274	33,854	34,226	34,550	35,109	35,672	36,239	36,810	37,385	37,963	38,545
Pasco	6,299	6,394	6,479	6,548	6,637	6,725	6,812	6,898	6,983	7,067	7,150
Pinellas	16,356	16,604	16,774	16,886	17,072	17,255	17,437	17,615	17,792	17,965	18,137
Polk	12,488	12,735	12,991	13,137	13,351	13,566	13,780	13,994	14,208	14,422	14,636
Sarasota	5,588	5,672	5,724	5,814	5,914	6,015	6,116	6,218	6,320	6,423	6,526
Seminole	6,487	6,566	6,639	6,687	6,760	6,831	6,901	6,969	7,037	7,103	7,168
St. Johns	3,216	3,264	3,323	3,362	3,413	3,465	3,516	3,568	3,619	3,670	3,722
Sumter	1,077	1,091	1,131	1,142	1,161	1,180	1,200	1,220	1,240	1,260	1,281
Volusia	6,834	6,959	7,097	7,194	7,319	7,444	7,569	7,695	7,821	7,947	8,074

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:		
	7/31	8/1	8/2	8/3	8/5	8/7	8/9
Alachua	3,526	3,590	3,662	3,749	3,902 (780) [187] {94}	4,060 (812) [195] {97}	4,221 (844) [203] {101}
Broward	55,411	56,797	57,975	58,531	60,960 (12,192) [2,926] {1,463}	63,411 (12,682) [3,044] {1,522}	65,884 (13,177) [3,162] {1,581}
Charlotte	1,946	1,984	2,024	2,062	2,152 (430) [103] {52}	2,247 (449) [108] {54}	2,347 (469) [113] {56}
Collier	9,581	9,662	9,734	9,811	10,032 (2,006) [482] {241}	10,249 (2,050) [492] {246}	10,462 (2,092) [502] {251}
Duval	21,038	21,322	21,665	21,830	22,311 (4,462) [1,071] {535}	22,774 (4,555) [1,093] {547}	23,220 (4,644) [1,115] {557}
Hillsborough	29,116	29,589	30,118	30,450	31,233 (6,247) [1,499] {750}	31,998 (6,400) [1,536] {768}	32,745 (6,549) [1,572] {786}
Lake	4,516	4,612	4,661	4,708	4,874 (975) [234] {117}	5,041 (1,008) [242] {121}	5,210 (1,042) [250] {125}
Lee	15,416	15,551	15,674	15,799	16,122 (3,224) [774] {387}	16,433 (3,287) [789] {394}	16,734 (3,347) [803] {402}
Manatee	8,517	8,655	8,733	8,825	9,084 (1,817) [436] {218}	9,342 (1,868) [448] {224}	9,597 (1,919) [461] {230}
Miami-Dade	118,462	121,207	122,690	123,644	128,633 (25,727) [6,174] {3,087}	133,725 (26,745) [6,419] {3,209}	138,919 (27,784) [6,668] {3,334}
Okaloosa	2,765	2,850	2,931	3,031	3,211 (642) [154] {77}	3,404 (681) [163] {82}	3,610 (722) [173] {87}
Orange	29,011	29,466	29,699	29,927	30,641 (6,128) [1,471] {735}	31,340 (6,268) [1,504] {752}	32,024 (6,405) [1,537] {769}
Osceola	8,470	8,649	8,782	8,894	9,254 (1,851) [444] {222}	9,622 (1,924) [462] {231}	9,999 (2,000) [480] {240}
Palm Beach	33,274	33,854	34,226	34,550	35,672 (7,134) [1,712] {856}	36,810 (7,362) [1,767] {883}	37,963 (7,593) [1,822] {911}
Pasco	6,299	6,394	6,479	6,548	6,725 (1,345) [323] {161}	6,898 (1,380) [331] {166}	7,067 (1,413) [339] {170}
Pinellas	16,356	16,604	16,774	16,886	17,255 (3,451) [828] {414}	17,615 (3,523) [846] {423}	17,965 (3,593) [862] {431}
Polk	12,488	12,735	12,991	13,137	13,566 (2,713) [651] {326}	13,994 (2,799) [672] {336}	14,422 (2,884) [692] {346}
Sarasota	5,588	5,672	5,724	5,814	6,015 (1,203) [289] {144}	6,218 (1,244) [298] {149}	6,423 (1,285) [308] {154}
Seminole	6,487	6,566	6,639	6,687	6,831 (1,366) [328] {164}	6,969 (1,394) [335] {167}	7,103 (1,421) [341] {170}
St. Johns	3,216	3,264	3,323	3,362	3,465 (693) [166] {83}	3,568 (714) [171] {86}	3,670 (734) [176] {88}
Sumter	1,077	1,091	1,131	1,142	1,180 (236) [57] {28}	1,220 (244) [59] {29}	1,260 (252) [60] {30}
Volusia	6,834	6,959	7,097	7,194	7,444 (1,489) [357] {179}	7,695 (1,539) [369] {185}	7,947 (1,589) [381] {191}

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.