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

Date: 7/14/20

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 7/14/20 11 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.

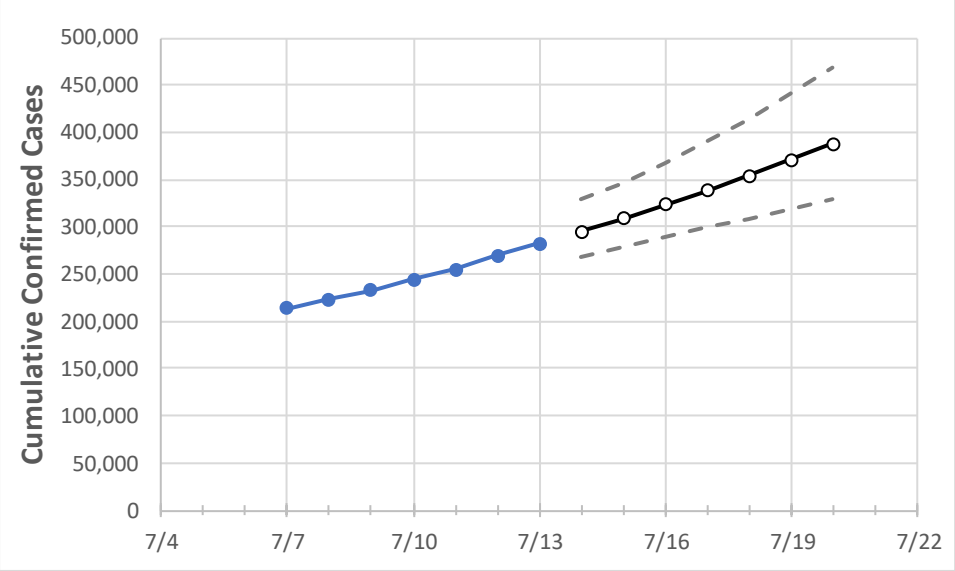
IEM's Modeling Lead

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:						
	7/10	7/11	7/12	7/13	7/14	7/15	7/16	7/17	7/18	7/19	7/20
Florida	244,151	254,511	269,799	282,435	295,545	309,274	323,648	338,697	354,448	370,933	388,183

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:						
	7/10	7/11	7/12	7/13	7/14	7/15	7/16	7/17	7/18	7/19	7/20
Alachua	1,978	2,043	2,098	2,173	2,253	2,336	2,422	2,510	2,600	2,694	2,791
Broward	26,705	28,253	30,025	31,484	33,021	34,425	36,060	37,631	39,026	40,529	41,962
Charlotte	1,048	1,074	1,117	1,158	1,191	1,225	1,261	1,299	1,338	1,379	1,422
Collier	5,777	5,968	6,220	6,465	6,697	6,942	7,199	7,470	7,755	8,054	8,369
Duval	11,772	12,287	12,864	13,370	13,997	14,650	15,330	16,038	16,774	17,541	18,340
Hillsborough	17,662	18,360	19,150	19,828	20,614	21,424	22,257	23,116	24,001	24,913	25,853
Lake	2,298	2,394	2,517	2,645	2,770	2,902	3,039	3,182	3,333	3,490	3,655
Lee	8,574	8,848	10,123	10,344	10,715	11,100	11,501	11,916	12,348	12,797	13,263
Manatee	4,432	4,632	5,112	5,266	5,498	5,744	6,005	6,281	6,573	6,883	7,212
Miami-Dade	58,341	60,868	64,444	67,713	71,239	75,009	79,039	83,345	87,943	92,854	98,094
Okaloosa	1,083	1,130	1,285	1,385	1,456	1,532	1,613	1,701	1,795	1,896	2,004
Orange	16,148	16,630	18,001	18,937	19,635	20,353	21,093	21,853	22,634	23,438	24,264
Osceola	3,658	3,861	4,167	4,442	4,683	4,940	5,212	5,502	5,810	6,137	6,485
Palm Beach	19,233	19,847	21,018	21,806	22,563	23,358	24,191	25,065	25,982	26,944	27,952
Pasco	3,559	3,748	3,875	4,060	4,250	4,448	4,654	4,868	5,091	5,322	5,563
Pinellas	10,293	10,596	10,844	11,442	11,820	12,204	12,596	12,993	13,398	13,810	14,230
Polk	6,611	6,983	7,246	7,630	7,997	8,383	8,789	9,215	9,663	10,133	10,628
Sarasota	2,548	2,641	3,106	3,219	3,360	3,509	3,668	3,835	4,012	4,200	4,398
Seminole	3,967	4,083	4,229	4,466	4,612	4,759	4,909	5,061	5,215	5,371	5,530
St. Johns	1,730	1,788	1,843	1,905	1,978	2,052	2,129	2,207	2,288	2,370	2,455
Sumter	589	622	655	679	706	740	775	810	841	875	909
Volusia	3,454	3,634	3,805	3,972	4,149	4,334	4,529	4,733	4,948	5,174	5,410

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:		
	7/10	7/11	7/12	7/13	7/15	7/17	7/19
Alachua	1,978	2,043	2,098	2,173	2,336 (467) [112] {56}	2,510 (502) [120] {60}	2,694 (539) [129] {65}
Broward	26,705	28,253	30,025	31,484	34,425 (6,885) [1,652] {826}	37,631 (7,526) [1,806] {903}	40,529 (8,106) [1,945] {973}
Charlotte	1,048	1,074	1,117	1,158	1,225 (245) [59] {29}	1,299 (260) [62] {31}	1,379 (276) [66] {33}
Collier	5,777	5,968	6,220	6,465	6,942 (1,388) [333] {167}	7,470 (1,494) [359] {179}	8,054 (1,611) [387] {193}
Duval	11,772	12,287	12,864	13,370	14,650 (2,930) [703] {352}	16,038 (3,208) [770] {385}	17,541 (3,508) [842] {421}
Hillsborough	17,662	18,360	19,150	19,828	21,424 (4,285) [1,028] {514}	23,116 (4,623) [1,110] {555}	24,913 (4,983) [1,196] {598}
Lake	2,298	2,394	2,517	2,645	2,902 (580) [139] {70}	3,182 (636) [153] {76}	3,490 (698) [168] {84}
Lee	8,574	8,848	10,123	10,344	11,100 (2,220) [533] {266}	11,916 (2,383) [572] {286}	12,797 (2,559) [614] {307}
Manatee	4,432	4,632	5,112	5,266	5,744 (1,149) [276] {138}	6,281 (1,256) [301] {151}	6,883 (1,377) [330] {165}
Miami-Dade	58,341	60,868	64,444	67,713	75,009 (15,002) [3,600] {1,800}	83,345 (16,669) [4,001] {2,000}	92,854 (18,571) [4,457] {2,228}
Okaloosa	1,083	1,130	1,285	1,385	1,532 (306) [74] {37}	1,701 (340) [82] {41}	1,896 (379) [91] {45}
Orange	16,148	16,630	18,001	18,937	20,353 (4,071) [977] {488}	21,853 (4,371) [1,049] {524}	23,438 (4,688) [1,125] {563}
Osceola	3,658	3,861	4,167	4,442	4,940 (988) [237] {119}	5,502 (1,100) [264] {132}	6,137 (1,227) [295] {147}
Palm Beach	19,233	19,847	21,018	21,806	23,358 (4,672) [1,121] {561}	25,065 (5,013) [1,203] {602}	26,944 (5,389) [1,293] {647}
Pasco	3,559	3,748	3,875	4,060	4,448 (890) [214] {107}	4,868 (974) [234] {117}	5,322 (1,064) [255] {128}
Pinellas	10,293	10,596	10,844	11,442	12,204 (2,441) [586] {293}	12,993 (2,599) [624] {312}	13,810 (2,762) [663] {331}
Polk	6,611	6,983	7,246	7,630	8,383 (1,677) [402] {201}	9,215 (1,843) [442] {221}	10,133 (2,027) [486] {243}
Sarasota	2,548	2,641	3,106	3,219	3,509 (702) [168] {84}	3,835 (767) [184] {92}	4,200 (840) [202] {101}
Seminole	3,967	4,083	4,229	4,466	4,759 (952) [228] {114}	5,061 (1,012) [243] {121}	5,371 (1,074) [258] {129}
St. Johns	1,730	1,788	1,843	1,905	2,052 (410) [99] {49}	2,207 (441) [106] {53}	2,370 (474) [114] {57}
Sumter	589	622	655	679	740 (148) [36] {18}	810 (162) [39] {19}	875 (175) [42] {21}
Volusia	3,454	3,634	3,805	3,972	4,334 (867) [208] {104}	4,733 (947) [227] {114}	5,174 (1,035) [248] {124}

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.