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

Date: 11/19/20

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 10%, and are often within 5%, of actual confirmed cases.

The projections shown in this document are based on data pulled in as of 11/19/20 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.

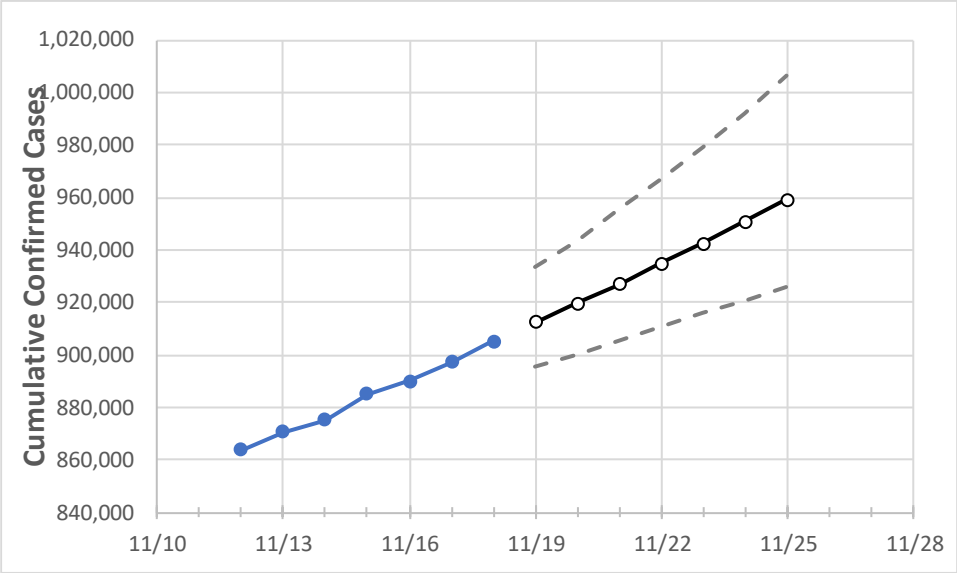
IEM's Modeling Lead

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:						
	11/15	11/16	11/17	11/18	11/19	11/20	11/21	11/22	11/23	11/24	11/25
Florida	885,201	889,864	897,323	905,248	912,289	919,539	927,002	934,686	942,596	950,738	959,119

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:						
	11/15	11/16	11/17	11/18	11/19	11/20	11/21	11/22	11/23	11/24	11/25
Alachua	11,740	11,807	11,854	11,994	12,063	12,132	12,201	12,271	12,341	12,411	12,482
Broward	95,311	95,734	96,700	97,475	98,129	98,800	99,487	100,192	100,914	101,653	102,411
Charlotte	4,292	4,333	4,383	4,425	4,473	4,522	4,572	4,623	4,675	4,729	4,785
Collier	15,938	16,019	16,117	16,308	16,420	16,536	16,654	16,776	16,901	17,029	17,161
Duval	38,569	38,677	39,052	39,305	39,544	39,792	40,048	40,312	40,586	40,868	41,160
Hillsborough	52,907	53,187	53,432	53,900	54,223	54,549	54,878	55,211	55,547	55,886	56,229
Lake	9,623	9,665	9,721	9,815	9,878	9,941	10,005	10,070	10,136	10,202	10,270
Lee	26,226	26,438	26,702	26,989	27,239	27,498	27,767	28,046	28,336	28,636	28,949
Manatee	14,772	14,855	15,040	15,147	15,242	15,340	15,440	15,542	15,647	15,754	15,864
Miami-Dade	202,644	203,654	205,536	207,221	208,715	210,277	211,911	213,618	215,403	217,268	219,216
Okaloosa	7,615	7,669	7,757	7,864	7,951	8,041	8,132	8,225	8,319	8,416	8,515
Orange	51,575	51,888	52,298	52,862	53,331	53,823	54,339	54,879	55,446	56,039	56,661
Osceola	15,988	16,158	16,266	16,491	16,657	16,830	17,012	17,201	17,400	17,608	17,825
Palm Beach	58,396	58,754	59,154	59,656	60,115	60,583	61,060	61,546	62,041	62,546	63,060
Pasco	12,547	12,666	12,771	12,968	13,106	13,248	13,395	13,546	13,702	13,862	14,027
Pinellas	29,106	29,297	29,509	29,737	29,959	30,183	30,410	30,639	30,870	31,104	31,340
Polk	25,252	25,379	25,531	25,696	25,864	26,037	26,215	26,397	26,583	26,775	26,972
Sarasota	11,198	11,274	11,528	11,620	11,739	11,864	11,993	12,128	12,268	12,413	12,565
Seminole	11,490	11,575	11,666	11,786	11,885	11,988	12,094	12,203	12,315	12,431	12,551
St. Johns	7,524	7,569	7,644	7,699	7,763	7,829	7,895	7,963	8,032	8,101	8,172
Sumter	3,160	3,164	3,184	3,212	3,221	3,229	3,237	3,245	3,253	3,261	3,269
Volusia	14,238	14,303	14,460	14,563	14,647	14,731	14,815	14,900	14,985	15,070	15,155

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:		
	11/15	11/16	11/17	11/18	11/20	11/22	11/24
Alachua	11,740	11,807	11,854	11,994	12,132 (2,426) [582] {291}	12,271 (2,454) [589] {295}	12,411 (2,482) [596] {298}
Broward	95,311	95,734	96,700	97,475	98,800 (19,760) [4,742] {2,371}	100,192 (20,038) [4,809] {2,405}	101,653 (20,331) [4,879] {2,440}
Charlotte	4,292	4,333	4,383	4,425	4,522 (904) [217] {109}	4,623 (925) [222] {111}	4,729 (946) [227] {114}
Collier	15,938	16,019	16,117	16,308	16,536 (3,307) [794] {397}	16,776 (3,355) [805] {403}	17,029 (3,406) [817] {409}
Duval	38,569	38,677	39,052	39,305	39,792 (7,958) [1,910] {955}	40,312 (8,062) [1,935] {967}	40,868 (8,174) [1,962] {981}
Hillsborough	52,907	53,187	53,432	53,900	54,549 (10,910) [2,618] {1,309}	55,211 (11,042) [2,650] {1,325}	55,886 (11,177) [2,683] {1,341}
Lake	9,623	9,665	9,721	9,815	9,941 (1,988) [477] {239}	10,070 (2,014) [483] {242}	10,202 (2,040) [490] {245}
Lee	26,226	26,438	26,702	26,989	27,498 (5,500) [1,320] {660}	28,046 (5,609) [1,346] {673}	28,636 (5,727) [1,375] {687}
Manatee	14,772	14,855	15,040	15,147	15,340 (3,068) [736] {368}	15,542 (3,108) [746] {373}	15,754 (3,151) [756] {378}
Miami-Dade	202,644	203,654	205,536	207,221	210,277 (42,055) [10,093] {5,047}	213,618 (42,724) [10,254] {5,127}	217,268 (43,454) [10,429] {5,214}
Okaloosa	7,615	7,669	7,757	7,864	8,041 (1,608) [386] {193}	8,225 (1,645) [395] {197}	8,416 (1,683) [404] {202}
Orange	51,575	51,888	52,298	52,862	53,823 (10,765) [2,584] {1,292}	54,879 (10,976) [2,634] {1,317}	56,039 (11,208) [2,690] {1,345}
Osceola	15,988	16,158	16,266	16,491	16,830 (3,366) [808] {404}	17,201 (3,440) [826] {413}	17,608 (3,522) [845] {423}
Palm Beach	58,396	58,754	59,154	59,656	60,583 (12,117) [2,908] {1,454}	61,546 (12,309) [2,954] {1,477}	62,546 (12,509) [3,002] {1,501}
Pasco	12,547	12,666	12,771	12,968	13,248 (2,650) [636] {318}	13,546 (2,709) [650] {325}	13,862 (2,772) [665] {333}
Pinellas	29,106	29,297	29,509	29,737	30,183 (6,037) [1,449] {724}	30,639 (6,128) [1,471] {735}	31,104 (6,221) [1,493] {746}
Polk	25,252	25,379	25,531	25,696	26,037 (5,207) [1,250] {625}	26,397 (5,279) [1,267] {634}	26,775 (5,355) [1,285] {643}
Sarasota	11,198	11,274	11,528	11,620	11,864 (2,373) [569] {285}	12,128 (2,426) [582] {291}	12,413 (2,483) [596] {298}
Seminole	11,490	11,575	11,666	11,786	11,988 (2,398) [575] {288}	12,203 (2,441) [586] {293}	12,431 (2,486) [597] {298}
St. Johns	7,524	7,569	7,644	7,699	7,829 (1,566) [376] {188}	7,963 (1,593) [382] {191}	8,101 (1,620) [389] {194}
Sumter	3,160	3,164	3,184	3,212	3,229 (646) [155] {77}	3,245 (649) [156] {78}	3,261 (652) [157] {78}
Volusia	14,238	14,303	14,460	14,563	14,731 (2,946) [707] {354}	14,900 (2,980) [715] {358}	15,070 (3,014) [723] {362}

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.