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

Date: 1/19/21

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 1/19/21 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.

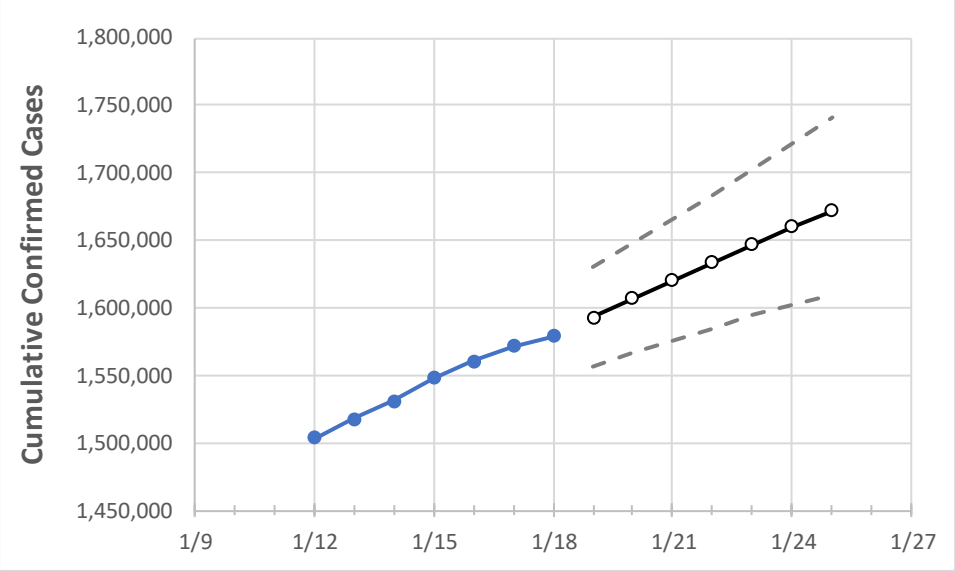
IEM's Modeling Lead

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:						
	1/15	1/16	1/17	1/18	1/19	1/20	1/21	1/22	1/23	1/24	1/25
Florida	1,548,067	1,560,186	1,571,279	1,579,281	1,593,015	1,606,762	1,620,216	1,633,348	1,646,708	1,659,878	1,672,286

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

Florida Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	1/15	1/16	1/17	1/18	1/19	1/20	1/21	1/22	1/23	1/24	1/25
Alachua	18,508	18,655	18,777	18,862	19,043	19,223	19,403	19,592	19,770	19,962	20,154
Broward	156,452	157,590	158,762	159,670	160,886	162,102	163,289	164,500	165,717	166,900	168,109
Charlotte	8,854	8,921	8,965	9,023	9,098	9,172	9,246	9,319	9,392	9,462	9,531
Collier	25,419	25,645	25,782	25,874	26,067	26,264	26,463	26,666	26,869	27,065	27,266
Duval	74,111	74,553	74,910	75,178	75,792	76,408	77,006	77,584	78,168	78,734	79,266
Hillsborough	90,966	91,632	92,438	92,891	93,727	94,563	95,404	96,263	97,123	97,961	98,796
Lake	18,962	19,208	19,387	19,547	19,755	19,960	20,164	20,364	20,563	20,765	20,964
Lee	47,422	47,803	48,145	48,438	48,823	49,199	49,568	49,935	50,292	50,639	50,982
Manatee	25,743	25,881	26,102	26,175	26,365	26,559	26,756	26,939	27,121	27,302	27,481
Miami-Dade	339,434	341,842	344,246	346,090	348,630	351,161	353,682	356,195	358,674	361,130	363,556
Okaloosa	14,997	15,107	15,166	15,227	15,365	15,506	15,648	15,788	15,930	16,070	16,208
Orange	91,626	92,439	93,180	93,599	94,430	95,248	96,045	96,819	97,611	98,369	99,116
Osceola	30,056	30,293	30,579	30,692	30,976	31,253	31,534	31,805	32,089	32,376	32,652
Palm Beach	96,085	96,743	97,542	98,067	98,934	99,815	100,694	101,595	102,496	103,419	104,310
Pasco	26,344	26,584	26,798	27,006	27,269	27,533	27,799	28,063	28,329	28,588	28,845
Pinellas	53,445	53,882	54,212	54,529	55,007	55,479	55,954	56,422	56,883	57,344	57,796
Polk	44,755	45,224	45,550	45,853	46,298	46,745	47,182	47,618	48,045	48,459	48,877
Sarasota	22,393	22,518	22,609	22,705	22,888	23,077	23,261	23,442	23,622	23,798	23,972
Seminole	21,581	21,791	21,923	22,054	22,263	22,468	22,673	22,877	23,082	23,282	23,486
St. Johns	16,306	16,460	16,555	16,673	16,850	17,022	17,193	17,362	17,527	17,698	17,861
Sumter	6,265	6,363	6,422	6,461	6,526	6,592	6,655	6,717	6,779	6,840	6,899
Volusia	27,024	27,250	27,386	27,542	27,807	28,068	28,351	28,608	28,878	29,145	29,417

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:		
	1/15	1/16	1/17	1/18	1/20	1/22	1/24
Alachua	18,508	18,655	18,777	18,862	19,223 (3,845) [923] {461}	19,592 (3,918) [940] {470}	19,962 (3,992) [958] {479}
Broward	156,452	157,590	158,762	159,670	162,102 (32,420) [7,781] {3,890}	164,500 (32,900) [7,896] {3,948}	166,900 (33,380) [8,011] {4,006}
Charlotte	8,854	8,921	8,965	9,023	9,172 (1,834) [440] {220}	9,319 (1,864) [447] {224}	9,462 (1,892) [454] {227}
Collier	25,419	25,645	25,782	25,874	26,264 (5,253) [1,261] {630}	26,666 (5,333) [1,280] {640}	27,065 (5,413) [1,299] {650}
Duval	74,111	74,553	74,910	75,178	76,408 (15,282) [3,668] {1,834}	77,584 (15,517) [3,724] {1,862}	78,734 (15,747) [3,779] {1,890}
Hillsborough	90,966	91,632	92,438	92,891	94,563 (18,913) [4,539] {2,270}	96,263 (19,253) [4,621] {2,310}	97,961 (19,592) [4,702] {2,351}
Lake	18,962	19,208	19,387	19,547	19,960 (3,992) [958] {479}	20,364 (4,073) [977] {489}	20,765 (4,153) [997] {498}
Lee	47,422	47,803	48,145	48,438	49,199 (9,840) [2,362] {1,181}	49,935 (9,987) [2,397] {1,198}	50,639 (10,128) [2,431] {1,215}
Manatee	25,743	25,881	26,102	26,175	26,559 (5,312) [1,275] {637}	26,939 (5,388) [1,293] {647}	27,302 (5,460) [1,311] {655}
Miami-Dade	339,434	341,842	344,246	346,090	351,161 (70,232) [16,856] {8,428}	356,195 (71,239) [17,097] {8,549}	361,130 (72,226) [17,334] {8,667}
Okaloosa	14,997	15,107	15,166	15,227	15,506 (3,101) [744] {372}	15,788 (3,158) [758] {379}	16,070 (3,214) [771] {386}
Orange	91,626	92,439	93,180	93,599	95,248 (19,050) [4,572] {2,286}	96,819 (19,364) [4,647] {2,324}	98,369 (19,674) [4,722] {2,361}
Osceola	30,056	30,293	30,579	30,692	31,253 (6,251) [1,500] {750}	31,805 (6,361) [1,527] {763}	32,376 (6,475) [1,554] {777}
Palm Beach	96,085	96,743	97,542	98,067	99,815 (19,963) [4,791] {2,396}	101,595 (20,319) [4,877] {2,438}	103,419 (20,684) [4,964] {2,482}
Pasco	26,344	26,584	26,798	27,006	27,533 (5,507) [1,322] {661}	28,063 (5,613) [1,347] {674}	28,588 (5,718) [1,372] {686}
Pinellas	53,445	53,882	54,212	54,529	55,479 (11,096) [2,663] {1,332}	56,422 (11,284) [2,708] {1,354}	57,344 (11,469) [2,752] {1,376}
Polk	44,755	45,224	45,550	45,853	46,745 (9,349) [2,244] {1,122}	47,618 (9,524) [2,286] {1,143}	48,459 (9,692) [2,326] {1,163}
Sarasota	22,393	22,518	22,609	22,705	23,077 (4,615) [1,108] {554}	23,442 (4,688) [1,125] {563}	23,798 (4,760) [1,142] {571}
Seminole	21,581	21,791	21,923	22,054	22,468 (4,494) [1,078] {539}	22,877 (4,575) [1,098] {549}	23,282 (4,656) [1,118] {559}
St. Johns	16,306	16,460	16,555	16,673	17,022 (3,404) [817] {409}	17,362 (3,472) [833] {417}	17,698 (3,540) [850] {425}
Sumter	6,265	6,363	6,422	6,461	6,592 (1,318) [316] {158}	6,717 (1,343) [322] {161}	6,840 (1,368) [328] {164}
Volusia	27,024	27,250	27,386	27,542	28,068 (5,614) [1,347] {674}	28,608 (5,722) [1,373] {687}	29,145 (5,829) [1,399] {699}

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.