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

Date: 3/31/21

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 3/31/21 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.

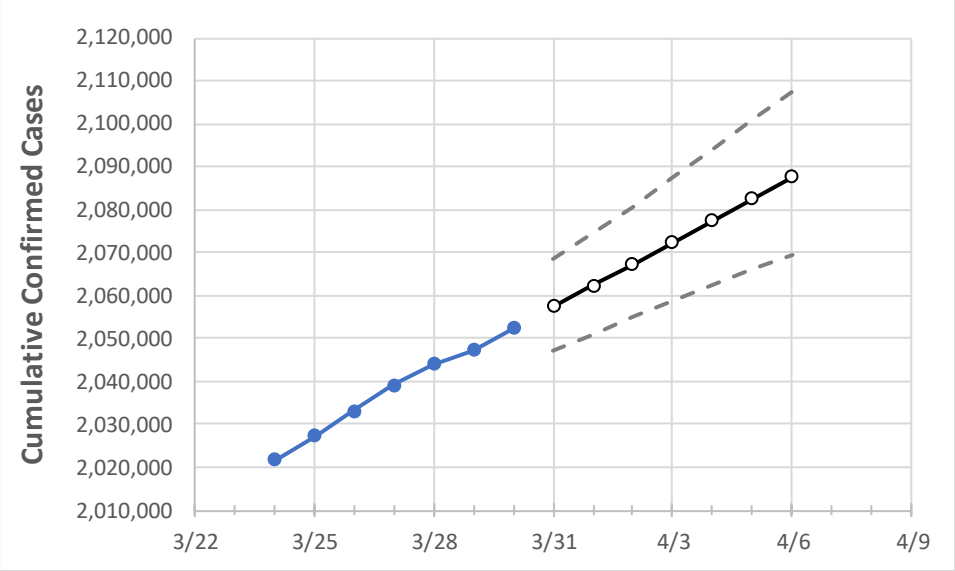
IEM's Modeling Lead

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:						
	3/27	3/28	3/29	3/30	3/31	4/1	4/2	4/3	4/4	4/5	4/6
Florida	2,039,062	2,044,005	2,047,379	2,052,441	2,057,418	2,062,382	2,067,337	2,072,348	2,077,417	2,082,507	2,087,661

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:						
	3/27	3/28	3/29	3/30	3/31	4/1	4/2	4/3	4/4	4/5	4/6
Alachua	23,239	23,273	23,283	23,339	23,378	23,419	23,460	23,503	23,546	23,591	23,636
Broward	211,935	212,641	213,158	213,880	214,552	215,233	215,922	216,600	217,290	217,989	218,688
Charlotte	11,402	11,436	11,475	11,508	11,550	11,592	11,637	11,682	11,728	11,777	11,827
Collier	32,191	32,253	32,315	32,414	32,494	32,572	32,650	32,728	32,808	32,888	32,967
Duval	92,143	92,242	92,305	92,440	92,547	92,652	92,758	92,861	92,965	93,067	93,170
Hillsborough	120,274	120,680	120,893	121,150	121,512	121,874	122,245	122,615	122,981	123,357	123,723
Lake	26,418	26,470	26,507	26,604	26,670	26,738	26,804	26,871	26,938	27,005	27,074
Lee	61,968	62,143	62,300	62,483	62,668	62,855	63,044	63,235	63,428	63,624	63,819
Manatee	34,487	34,567	34,620	34,697	34,790	34,882	34,974	35,068	35,159	35,254	35,349
Miami-Dade	441,275	442,337	443,207	444,487	445,664	446,829	448,022	449,212	450,399	451,601	452,821
Okaloosa	19,704	19,719	19,722	19,734	19,745	19,757	19,768	19,778	19,788	19,797	19,806
Orange	122,410	122,800	123,018	123,352	123,736	124,131	124,522	124,932	125,346	125,765	126,186
Osceola	39,271	39,356	39,411	39,521	39,618	39,717	39,816	39,917	40,018	40,121	40,225
Palm Beach	130,358	130,727	130,904	131,235	131,575	131,921	132,255	132,604	132,953	133,289	133,634
Pasco	35,990	36,074	36,147	36,265	36,375	36,486	36,597	36,710	36,824	36,939	37,057
Pinellas	71,499	71,696	71,839	72,005	72,210	72,421	72,634	72,842	73,055	73,272	73,491
Polk	60,602	60,765	60,852	61,019	61,166	61,315	61,464	61,616	61,769	61,927	62,083
Sarasota	28,997	29,096	29,178	29,248	29,342	29,437	29,534	29,632	29,734	29,837	29,941
Seminole	29,653	29,751	29,816	29,955	30,074	30,194	30,318	30,442	30,570	30,699	30,832
St. Johns	21,025	21,062	21,080	21,127	21,167	21,208	21,250	21,292	21,336	21,380	21,424
Sumter	8,730	8,751	8,755	8,780	8,809	8,840	8,870	8,902	8,932	8,965	8,997
Volusia	37,623	37,763	37,895	38,069	38,240	38,422	38,609	38,799	38,993	39,194	39,402

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:		
	3/27	3/28	3/29	3/30	4/1	4/3	4/5
Alachua	23,239	23,273	23,283	23,339	23,419 (4,684) [1,124] {562}	23,503 (4,701) [1,128] {564}	23,591 (4,718) [1,132] {566}
Broward	211,935	212,641	213,158	213,880	215,233 (43,047) [10,331] {5,166}	216,600 (43,320) [10,397] {5,198}	217,989 (43,598) [10,463] {5,232}
Charlotte	11,402	11,436	11,475	11,508	11,592 (2,318) [556] {278}	11,682 (2,336) [561] {280}	11,777 (2,355) [565] {283}
Collier	32,191	32,253	32,315	32,414	32,572 (6,514) [1,563] {782}	32,728 (6,546) [1,571] {785}	32,888 (6,578) [1,579] {789}
Duval	92,143	92,242	92,305	92,440	92,652 (18,530) [4,447] {2,224}	92,861 (18,572) [4,457] {2,229}	93,067 (18,613) [4,467] {2,234}
Hillsborough	120,274	120,680	120,893	121,150	121,874 (24,375) [5,850] {2,925}	122,615 (24,523) [5,886] {2,943}	123,357 (24,671) [5,921] {2,961}
Lake	26,418	26,470	26,507	26,604	26,738 (5,348) [1,283] {642}	26,871 (5,374) [1,290] {645}	27,005 (5,401) [1,296] {648}
Lee	61,968	62,143	62,300	62,483	62,855 (12,571) [3,017] {1,509}	63,235 (12,647) [3,035] {1,518}	63,624 (12,725) [3,054] {1,527}
Manatee	34,487	34,567	34,620	34,697	34,882 (6,976) [1,674] {837}	35,068 (7,014) [1,683] {842}	35,254 (7,051) [1,692] {846}
Miami-Dade	441,275	442,337	443,207	444,487	446,829 (89,366) [21,448] {10,724}	449,212 (89,842) [21,562] {10,781}	451,601 (90,320) [21,677] {10,838}
Okaloosa	19,704	19,719	19,722	19,734	19,757 (3,951) [948] {474}	19,778 (3,956) [949] {475}	19,797 (3,959) [950] {475}
Orange	122,410	122,800	123,018	123,352	124,131 (24,826) [5,958] {2,979}	124,932 (24,986) [5,997] {2,998}	125,765 (25,153) [6,037] {3,018}
Osceola	39,271	39,356	39,411	39,521	39,717 (7,943) [1,906] {953}	39,917 (7,983) [1,916] {958}	40,121 (8,024) [1,926] {963}
Palm Beach	130,358	130,727	130,904	131,235	131,921 (26,384) [6,332] {3,166}	132,604 (26,521) [6,365] {3,183}	133,289 (26,658) [6,398] {3,199}
Pasco	35,990	36,074	36,147	36,265	36,486 (7,297) [1,751] {876}	36,710 (7,342) [1,762] {881}	36,939 (7,388) [1,773] {887}
Pinellas	71,499	71,696	71,839	72,005	72,421 (14,484) [3,476] {1,738}	72,842 (14,568) [3,496] {1,748}	73,272 (14,654) [3,517] {1,759}
Polk	60,602	60,765	60,852	61,019	61,315 (12,263) [2,943] {1,472}	61,616 (12,323) [2,958] {1,479}	61,927 (12,385) [2,972] {1,486}
Sarasota	28,997	29,096	29,178	29,248	29,437 (5,887) [1,413] {706}	29,632 (5,926) [1,422] {711}	29,837 (5,967) [1,432] {716}
Seminole	29,653	29,751	29,816	29,955	30,194 (6,039) [1,449] {725}	30,442 (6,088) [1,461] {731}	30,699 (6,140) [1,474] {737}
St. Johns	21,025	21,062	21,080	21,127	21,208 (4,242) [1,018] {509}	21,292 (4,258) [1,022] {511}	21,380 (4,276) [1,026] {513}
Sumter	8,730	8,751	8,755	8,780	8,840 (1,768) [424] {212}	8,902 (1,780) [427] {214}	8,965 (1,793) [430] {215}
Volusia	37,623	37,763	37,895	38,069	38,422 (7,684) [1,844] {922}	38,799 (7,760) [1,862] {931}	39,194 (7,839) [1,881] {941}

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.