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

Date: 6/10/21

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 6/10/21 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.

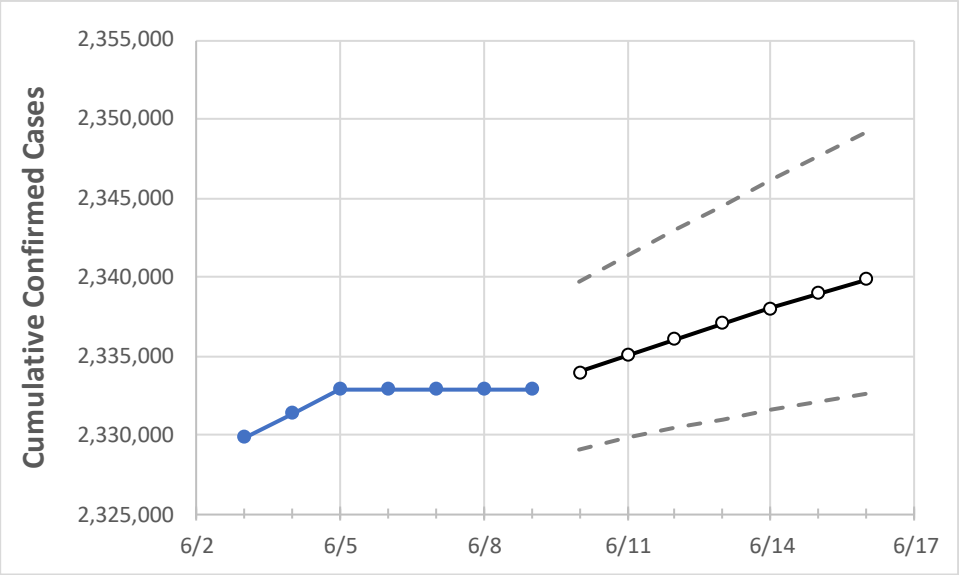
IEM's Modeling Lead

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:						
	6/6	6/7	6/8	6/9	6/10	6/11	6/12	6/13	6/14	6/15	6/16
Florida	2,332,867	2,332,867	2,332,867	2,332,867	2,333,967	2,335,046	2,336,072	2,337,065	2,338,027	2,338,958	2,339,850

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:						
	6/6	6/7	6/8	6/9	6/10	6/11	6/12	6/13	6/14	6/15	6/16
Alachua	25,534	25,534	25,534	25,534	25,545	25,554	25,563	25,572	25,581	25,589	25,598
Broward	245,552	245,552	245,552	245,552	245,647	245,735	245,820	245,907	245,982	246,056	246,128
Charlotte	13,454	13,454	13,454	13,454	13,462	13,471	13,478	13,486	13,493	13,499	13,506
Collier	37,247	37,247	37,247	37,247	37,270	37,293	37,314	37,335	37,355	37,374	37,392
Duval	101,139	101,139	101,139	101,139	101,210	101,279	101,345	101,411	101,476	101,543	101,607
Hillsborough	143,980	143,980	143,980	143,980	144,126	144,268	144,410	144,552	144,692	144,827	144,959
Lake	31,168	31,168	31,168	31,168	31,184	31,200	31,215	31,229	31,241	31,253	31,264
Lee	73,880	73,880	73,880	73,880	73,913	73,942	73,970	73,997	74,021	74,044	74,066
Manatee	40,015	40,015	40,015	40,015	40,036	40,057	40,078	40,097	40,116	40,134	40,152
Miami-Dade	502,548	502,548	502,548	502,548	502,754	502,942	503,129	503,308	503,481	503,650	503,811
Okaloosa	20,930	20,930	20,930	20,930	20,937	20,943	20,949	20,956	20,962	20,968	20,973
Orange	143,356	143,356	143,356	143,356	143,428	143,498	143,566	143,631	143,692	143,753	143,809
Osceola	46,374	46,374	46,374	46,374	46,410	46,445	46,479	46,511	46,543	46,573	46,604
Palm Beach	149,006	149,006	149,006	149,006	149,080	149,151	149,218	149,286	149,351	149,418	149,480
Pasco	42,986	42,986	42,986	42,986	43,006	43,026	43,044	43,062	43,078	43,094	43,109
Pinellas	81,606	81,606	81,606	81,606	81,635	81,662	81,689	81,715	81,740	81,765	81,788
Polk	71,381	71,381	71,381	71,381	71,430	71,478	71,526	71,570	71,613	71,655	71,696
Sarasota	33,800	33,800	33,800	33,800	33,818	33,836	33,854	33,871	33,887	33,903	33,918
Seminole	35,464	35,464	35,464	35,464	35,485	35,505	35,523	35,542	35,560	35,577	35,593
St. Johns	23,336	23,336	23,336	23,336	23,345	23,354	23,362	23,370	23,377	23,384	23,390
Sumter	9,511	9,511	9,511	9,511	9,513	9,515	9,517	9,519	9,521	9,523	9,524
Volusia	45,025	45,025	45,025	45,025	45,051	45,075	45,099	45,121	45,143	45,164	45,184

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:		
	6/6	6/7	6/8	6/9	6/11	6/13	6/15
Alachua	25,534	25,534	25,534	25,534	25,554 (5,111) [1,227] {613}	25,572 (5,114) [1,227] {614}	25,589 (5,118) [1,228] {614}
Broward	245,552	245,552	245,552	245,552	245,735 (49,147) [11,795] {5,898}	245,907 (49,181) [11,804] {5,902}	246,056 (49,211) [11,811] {5,905}
Charlotte	13,454	13,454	13,454	13,454	13,471 (2,694) [647] {323}	13,486 (2,697) [647] {324}	13,499 (2,700) [648] {324}
Collier	37,247	37,247	37,247	37,247	37,293 (7,459) [1,790] {895}	37,335 (7,467) [1,792] {896}	37,374 (7,475) [1,794] {897}
Duval	101,139	101,139	101,139	101,139	101,279 (20,256) [4,861] {2,431}	101,411 (20,282) [4,868] {2,434}	101,543 (20,309) [4,874] {2,437}
Hillsborough	143,980	143,980	143,980	143,980	144,268 (28,854) [6,925] {3,462}	144,552 (28,910) [6,939] {3,469}	144,827 (28,965) [6,952] {3,476}
Lake	31,168	31,168	31,168	31,168	31,200 (6,240) [1,498] {749}	31,229 (6,246) [1,499] {749}	31,253 (6,251) [1,500] {750}
Lee	73,880	73,880	73,880	73,880	73,942 (14,788) [3,549] {1,775}	73,997 (14,799) [3,552] {1,776}	74,044 (14,809) [3,554] {1,777}
Manatee	40,015	40,015	40,015	40,015	40,057 (8,011) [1,923] {961}	40,097 (8,019) [1,925] {962}	40,134 (8,027) [1,926] {963}
Miami-Dade	502,548	502,548	502,548	502,548	502,942 (100,588) [24,141] {12,071}	503,308 (100,662) [24,159] {12,079}	503,650 (100,730) [24,175] {12,088}
Okaloosa	20,930	20,930	20,930	20,930	20,943 (4,189) [1,005] {503}	20,956 (4,191) [1,006] {503}	20,968 (4,194) [1,006] {503}
Orange	143,356	143,356	143,356	143,356	143,498 (28,700) [6,888] {3,444}	143,631 (28,726) [6,894] {3,447}	143,753 (28,751) [6,900] {3,450}
Osceola	46,374	46,374	46,374	46,374	46,445 (9,289) [2,229] {1,115}	46,511 (9,302) [2,233] {1,116}	46,573 (9,315) [2,236] {1,118}
Palm Beach	149,006	149,006	149,006	149,006	149,151 (29,830) [7,159] {3,580}	149,286 (29,857) [7,166] {3,583}	149,418 (29,884) [7,172] {3,586}
Pasco	42,986	42,986	42,986	42,986	43,026 (8,605) [2,065] {1,033}	43,062 (8,612) [2,067] {1,033}	43,094 (8,619) [2,069] {1,034}
Pinellas	81,606	81,606	81,606	81,606	81,662 (16,332) [3,920] {1,960}	81,715 (16,343) [3,922] {1,961}	81,765 (16,353) [3,925] {1,962}
Polk	71,381	71,381	71,381	71,381	71,478 (14,296) [3,431] {1,715}	71,570 (14,314) [3,435] {1,718}	71,655 (14,331) [3,439] {1,720}
Sarasota	33,800	33,800	33,800	33,800	33,836 (6,767) [1,624] {812}	33,871 (6,774) [1,626] {813}	33,903 (6,781) [1,627] {814}
Seminole	35,464	35,464	35,464	35,464	35,505 (7,101) [1,704] {852}	35,542 (7,108) [1,706] {853}	35,577 (7,115) [1,708] {854}
St. Johns	23,336	23,336	23,336	23,336	23,354 (4,671) [1,121] {560}	23,370 (4,674) [1,122] {561}	23,384 (4,677) [1,122] {561}
Sumter	9,511	9,511	9,511	9,511	9,515 (1,903) [457] {228}	9,519 (1,904) [457] {228}	9,523 (1,905) [457] {229}
Volusia	45,025	45,025	45,025	45,025	45,075 (9,015) [2,164] {1,082}	45,121 (9,024) [2,166] {1,083}	45,164 (9,033) [2,168] {1,084}

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.