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

Date: 5/28/21

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 5/28/21 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.

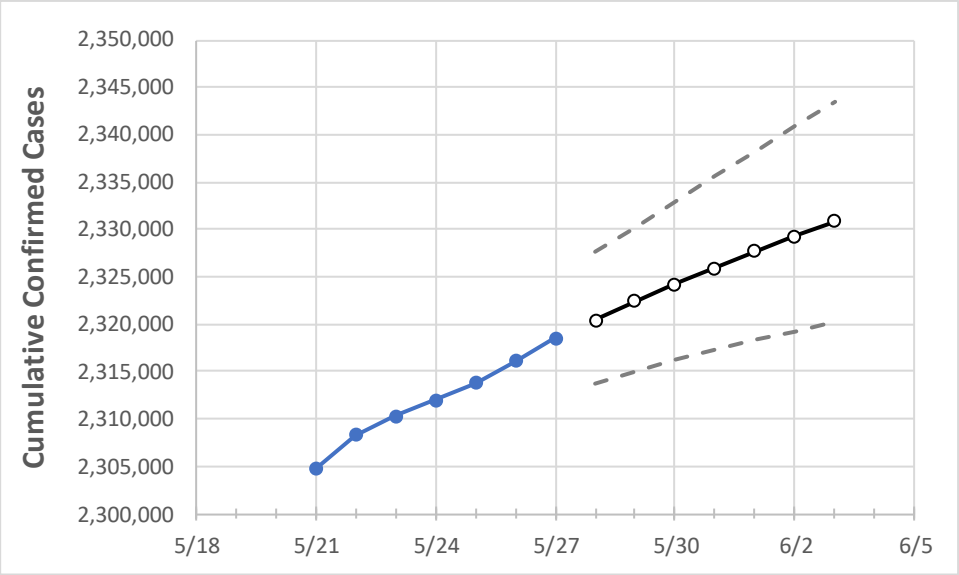
IEM's Modeling Lead

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:						
	5/24	5/25	5/26	5/27	5/28	5/29	5/30	5/31	6/1	6/2	6/3
Florida	2,311,941	2,313,815	2,316,142	2,318,480	2,320,452	2,322,392	2,324,212	2,325,957	2,327,666	2,329,309	2,330,890

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:						
	5/24	5/25	5/26	5/27	5/28	5/29	5/30	5/31	6/1	6/2	6/3
Alachua	25,304	25,323	25,377	25,400	25,425	25,450	25,474	25,498	25,523	25,547	25,570
Broward	243,788	243,931	244,130	244,358	244,530	244,692	244,848	244,999	245,140	245,282	245,412
Charlotte	13,289	13,301	13,321	13,335	13,351	13,366	13,381	13,396	13,410	13,423	13,436
Collier	36,842	36,891	36,938	36,976	37,017	37,058	37,097	37,136	37,174	37,214	37,250
Duval	100,131	100,211	100,303	100,408	100,493	100,576	100,656	100,734	100,812	100,890	100,966
Hillsborough	141,833	142,014	142,259	142,487	142,665	142,840	143,010	143,178	143,335	143,491	143,640
Lake	30,759	30,848	30,893	30,924	30,976	31,027	31,077	31,129	31,178	31,226	31,274
Lee	73,148	73,199	73,278	73,361	73,444	73,524	73,599	73,673	73,743	73,808	73,875
Manatee	39,626	39,673	39,711	39,758	39,791	39,823	39,854	39,882	39,911	39,938	39,964
Miami-Dade	498,953	499,201	499,512	499,956	500,323	500,677	501,024	501,358	501,680	501,986	502,278
Okaloosa	20,814	20,829	20,841	20,850	20,862	20,873	20,884	20,896	20,907	20,918	20,930
Orange	141,856	142,020	142,217	142,370	142,508	142,641	142,767	142,893	143,012	143,124	143,236
Osceola	45,808	45,858	45,921	45,977	46,019	46,060	46,099	46,137	46,174	46,209	46,243
Palm Beach	147,786	147,870	148,004	148,119	148,219	148,316	148,407	148,495	148,577	148,654	148,730
Pasco	42,542	42,594	42,645	42,709	42,754	42,799	42,843	42,885	42,927	42,969	43,009
Pinellas	81,077	81,120	81,175	81,234	81,282	81,330	81,375	81,418	81,459	81,500	81,538
Polk	70,544	70,617	70,724	70,810	70,880	70,947	71,012	71,072	71,132	71,190	71,245
Sarasota	33,483	33,519	33,551	33,585	33,613	33,638	33,663	33,689	33,712	33,736	33,759
Seminole	35,056	35,088	35,140	35,187	35,228	35,268	35,308	35,346	35,384	35,421	35,457
St. Johns	23,144	23,163	23,184	23,208	23,232	23,255	23,279	23,303	23,325	23,347	23,369
Sumter	9,456	9,458	9,467	9,477	9,485	9,493	9,501	9,509	9,517	9,526	9,535
Volusia	44,511	44,555	44,629	44,698	44,749	44,802	44,852	44,901	44,949	44,999	45,044

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:		
	5/24	5/25	5/26	5/27	5/29	5/31	6/2
Alachua	25,304	25,323	25,377	25,400	25,450 (5,090) [1,222] {611}	25,498 (5,100) [1,224] {612}	25,547 (5,109) [1,226] {613}
Broward	243,788	243,931	244,130	244,358	244,692 (48,938) [11,745] {5,873}	244,999 (49,000) [11,760] {5,880}	245,282 (49,056) [11,774] {5,887}
Charlotte	13,289	13,301	13,321	13,335	13,366 (2,673) [642] {321}	13,396 (2,679) [643] {321}	13,423 (2,685) [644] {322}
Collier	36,842	36,891	36,938	36,976	37,058 (7,412) [1,779] {889}	37,136 (7,427) [1,783] {891}	37,214 (7,443) [1,786] {893}
Duval	100,131	100,211	100,303	100,408	100,576 (20,115) [4,828] {2,414}	100,734 (20,147) [4,835] {2,418}	100,890 (20,178) [4,843] {2,421}
Hillsborough	141,833	142,014	142,259	142,487	142,840 (28,568) [6,856] {3,428}	143,178 (28,636) [6,873] {3,436}	143,491 (28,698) [6,888] {3,444}
Lake	30,759	30,848	30,893	30,924	31,027 (6,205) [1,489] {745}	31,129 (6,226) [1,494] {747}	31,226 (6,245) [1,499] {749}
Lee	73,148	73,199	73,278	73,361	73,524 (14,705) [3,529] {1,765}	73,673 (14,735) [3,536] {1,768}	73,808 (14,762) [3,543] {1,771}
Manatee	39,626	39,673	39,711	39,758	39,823 (7,965) [1,911] {956}	39,882 (7,976) [1,914] {957}	39,938 (7,988) [1,917] {959}
Miami-Dade	498,953	499,201	499,512	499,956	500,677 (100,135) [24,032] {12,016}	501,358 (100,272) [24,065] {12,033}	501,986 (100,397) [24,095] {12,048}
Okaloosa	20,814	20,829	20,841	20,850	20,873 (4,175) [1,002] {501}	20,896 (4,179) [1,003] {501}	20,918 (4,184) [1,004] {502}
Orange	141,856	142,020	142,217	142,370	142,641 (28,528) [6,847] {3,423}	142,893 (28,579) [6,859] {3,429}	143,124 (28,625) [6,870] {3,435}
Osceola	45,808	45,858	45,921	45,977	46,060 (9,212) [2,211] {1,105}	46,137 (9,227) [2,215] {1,107}	46,209 (9,242) [2,218] {1,109}
Palm Beach	147,786	147,870	148,004	148,119	148,316 (29,663) [7,119] {3,560}	148,495 (29,699) [7,128] {3,564}	148,654 (29,731) [7,135] {3,568}
Pasco	42,542	42,594	42,645	42,709	42,799 (8,560) [2,054] {1,027}	42,885 (8,577) [2,058] {1,029}	42,969 (8,594) [2,062] {1,031}
Pinellas	81,077	81,120	81,175	81,234	81,330 (16,266) [3,904] {1,952}	81,418 (16,284) [3,908] {1,954}	81,500 (16,300) [3,912] {1,956}
Polk	70,544	70,617	70,724	70,810	70,947 (14,189) [3,405] {1,703}	71,072 (14,214) [3,411] {1,706}	71,190 (14,238) [3,417] {1,709}
Sarasota	33,483	33,519	33,551	33,585	33,638 (6,728) [1,615] {807}	33,689 (6,738) [1,617] {809}	33,736 (6,747) [1,619] {810}
Seminole	35,056	35,088	35,140	35,187	35,268 (7,054) [1,693] {846}	35,346 (7,069) [1,697] {848}	35,421 (7,084) [1,700] {850}
St. Johns	23,144	23,163	23,184	23,208	23,255 (4,651) [1,116] {558}	23,303 (4,661) [1,119] {559}	23,347 (4,669) [1,121] {560}
Sumter	9,456	9,458	9,467	9,477	9,493 (1,899) [456] {228}	9,509 (1,902) [456] {228}	9,526 (1,905) [457] {229}
Volusia	44,511	44,555	44,629	44,698	44,802 (8,960) [2,150] {1,075}	44,901 (8,980) [2,155] {1,078}	44,999 (9,000) [2,160] {1,080}

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.