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

Date: 10/22/21

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 10/22/21 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.

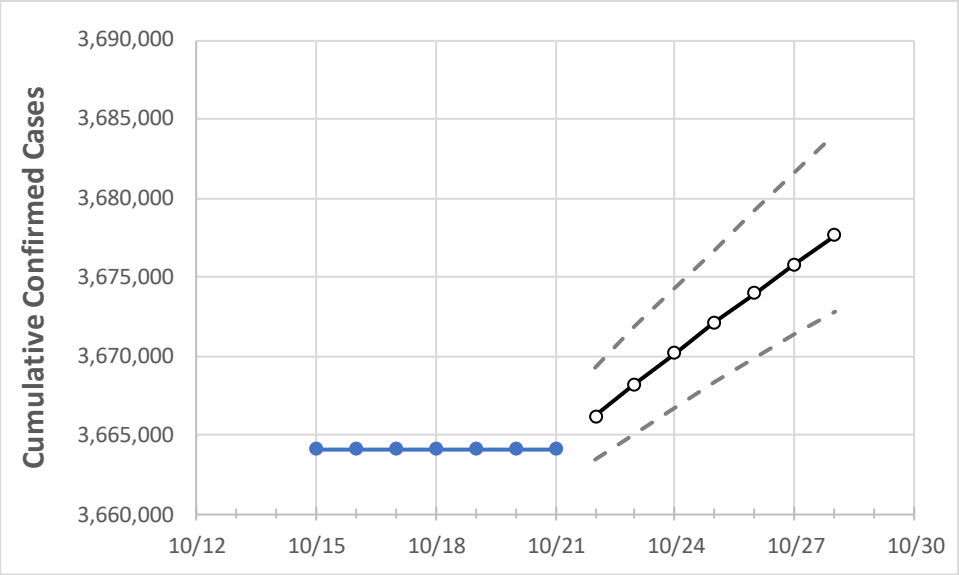
IEM's Modeling Lead

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:						
	10/18	10/19	10/20	10/21	10/22	10/23	10/24	10/25	10/26	10/27	10/28
Florida	3,664,097	3,664,097	3,664,097	3,664,097	3,666,198	3,668,204	3,670,158	3,672,129	3,673,990	3,675,824	3,677,635

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:						
	10/18	10/19	10/20	10/21	10/22	10/23	10/24	10/25	10/26	10/27	10/28
Alachua	39,469	39,469	39,469	39,469	39,515	39,562	39,610	39,658	39,706	39,754	39,803
Broward	357,110	357,110	357,110	357,110	357,322	357,526	357,725	357,923	358,118	358,305	358,490
Charlotte	23,191	23,191	23,191	23,191	23,211	23,230	23,249	23,267	23,285	23,303	23,319
Collier	57,827	57,827	57,827	57,827	57,852	57,877	57,901	57,924	57,946	57,968	57,988
Duval	165,223	165,223	165,223	165,223	165,305	165,386	165,465	165,543	165,619	165,693	165,767
Hillsborough	240,451	240,451	240,451	240,451	240,634	240,812	240,988	241,161	241,329	241,497	241,662
Lake	54,432	54,432	54,432	54,432	54,474	54,515	54,555	54,594	54,632	54,669	54,705
Lee	126,320	126,320	126,320	126,320	126,379	126,434	126,489	126,542	126,593	126,642	126,690
Manatee	65,237	65,237	65,237	65,237	65,271	65,304	65,336	65,367	65,397	65,427	65,455
Miami-Dade	674,857	674,857	674,857	674,857	675,170	675,479	675,772	676,068	676,350	676,636	676,908
Okaloosa	34,414	34,414	34,414	34,414	34,433	34,451	34,469	34,487	34,504	34,520	34,537
Orange	228,543	228,543	228,543	228,543	228,700	228,851	229,004	229,151	229,297	229,441	229,580
Osceola	71,806	71,806	71,806	71,806	71,852	71,897	71,939	71,982	72,024	72,065	72,105
Palm Beach	225,870	225,870	225,870	225,870	226,037	226,201	226,361	226,520	226,678	226,830	226,982
Pasco	79,003	79,003	79,003	79,003	79,044	79,083	79,121	79,157	79,192	79,226	79,259
Pinellas	135,454	135,454	135,454	135,454	135,543	135,628	135,712	135,794	135,874	135,953	136,029
Polk	127,969	127,969	127,969	127,969	128,041	128,110	128,177	128,243	128,305	128,368	128,428
Sarasota	56,497	56,497	56,497	56,497	56,536	56,575	56,613	56,651	56,688	56,726	56,762
Seminole	61,847	61,847	61,847	61,847	61,890	61,932	61,973	62,013	62,053	62,092	62,129
St. Johns	40,676	40,676	40,676	40,676	40,710	40,744	40,778	40,810	40,843	40,874	40,905
Sumter	14,480	14,480	14,480	14,480	14,491	14,501	14,511	14,521	14,531	14,541	14,551
Volusia	75,476	75,476	75,476	75,476	75,527	75,576	75,625	75,671	75,718	75,761	75,804

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:		
	10/18	10/19	10/20	10/21	10/23	10/25	10/27
Alachua	39,469	39,469	39,469	39,469	39,562 (7,912) [1,899] {949}	39,658 (7,932) [1,904] {952}	39,754 (7,951) [1,908] {954}
Broward	357,110	357,110	357,110	357,110	357,526 (71,505) [17,161] {8,581}	357,923 (71,585) [17,180] {8,590}	358,305 (71,661) [17,199] {8,599}
Charlotte	23,191	23,191	23,191	23,191	23,230 (4,646) [1,115] {558}	23,267 (4,653) [1,117] {558}	23,303 (4,661) [1,119] {559}
Collier	57,827	57,827	57,827	57,827	57,877 (11,575) [2,778] {1,389}	57,924 (11,585) [2,780] {1,390}	57,968 (11,594) [2,782] {1,391}
Duval	165,223	165,223	165,223	165,223	165,386 (33,077) [7,939] {3,969}	165,543 (33,109) [7,946] {3,973}	165,693 (33,139) [7,953] {3,977}
Hillsborough	240,451	240,451	240,451	240,451	240,812 (48,162) [11,559] {5,779}	241,161 (48,232) [11,576] {5,788}	241,497 (48,299) [11,592] {5,796}
Lake	54,432	54,432	54,432	54,432	54,515 (10,903) [2,617] {1,308}	54,594 (10,919) [2,621] {1,310}	54,669 (10,934) [2,624] {1,312}
Lee	126,320	126,320	126,320	126,320	126,434 (25,287) [6,069] {3,034}	126,542 (25,308) [6,074] {3,037}	126,642 (25,328) [6,079] {3,039}
Manatee	65,237	65,237	65,237	65,237	65,304 (13,061) [3,135] {1,567}	65,367 (13,073) [3,138] {1,569}	65,427 (13,085) [3,140] {1,570}
Miami-Dade	674,857	674,857	674,857	674,857	675,479 (135,096) [32,423] {16,211}	676,068 (135,214) [32,451] {16,226}	676,636 (135,327) [32,479] {16,239}
Okaloosa	34,414	34,414	34,414	34,414	34,451 (6,890) [1,654] {827}	34,487 (6,897) [1,655] {828}	34,520 (6,904) [1,657] {828}
Orange	228,543	228,543	228,543	228,543	228,851 (45,770) [10,985] {5,492}	229,151 (45,830) [10,999] {5,500}	229,441 (45,888) [11,013] {5,507}
Osceola	71,806	71,806	71,806	71,806	71,897 (14,379) [3,451] {1,726}	71,982 (14,396) [3,455] {1,728}	72,065 (14,413) [3,459] {1,730}
Palm Beach	225,870	225,870	225,870	225,870	226,201 (45,240) [10,858] {5,429}	226,520 (45,304) [10,873] {5,436}	226,830 (45,366) [10,888] {5,444}
Pasco	79,003	79,003	79,003	79,003	79,083 (15,817) [3,796] {1,898}	79,157 (15,831) [3,800] {1,900}	79,226 (15,845) [3,803] {1,901}
Pinellas	135,454	135,454	135,454	135,454	135,628 (27,126) [6,510] {3,255}	135,794 (27,159) [6,518] {3,259}	135,953 (27,191) [6,526] {3,263}
Polk	127,969	127,969	127,969	127,969	128,110 (25,622) [6,149] {3,075}	128,243 (25,649) [6,156] {3,078}	128,368 (25,674) [6,162] {3,081}
Sarasota	56,497	56,497	56,497	56,497	56,575 (11,315) [2,716] {1,358}	56,651 (11,330) [2,719] {1,360}	56,726 (11,345) [2,723] {1,361}
Seminole	61,847	61,847	61,847	61,847	61,932 (12,386) [2,973] {1,486}	62,013 (12,403) [2,977] {1,488}	62,092 (12,418) [2,980] {1,490}
St. Johns	40,676	40,676	40,676	40,676	40,744 (8,149) [1,956] {978}	40,810 (8,162) [1,959] {979}	40,874 (8,175) [1,962] {981}
Sumter	14,480	14,480	14,480	14,480	14,501 (2,900) [696] {348}	14,521 (2,904) [697] {349}	14,541 (2,908) [698] {349}
Volusia	75,476	75,476	75,476	75,476	75,576 (15,115) [3,628] {1,814}	75,671 (15,134) [3,632] {1,816}	75,761 (15,152) [3,637] {1,818}

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.