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

Date: 10/13/21

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 10/13/21 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.

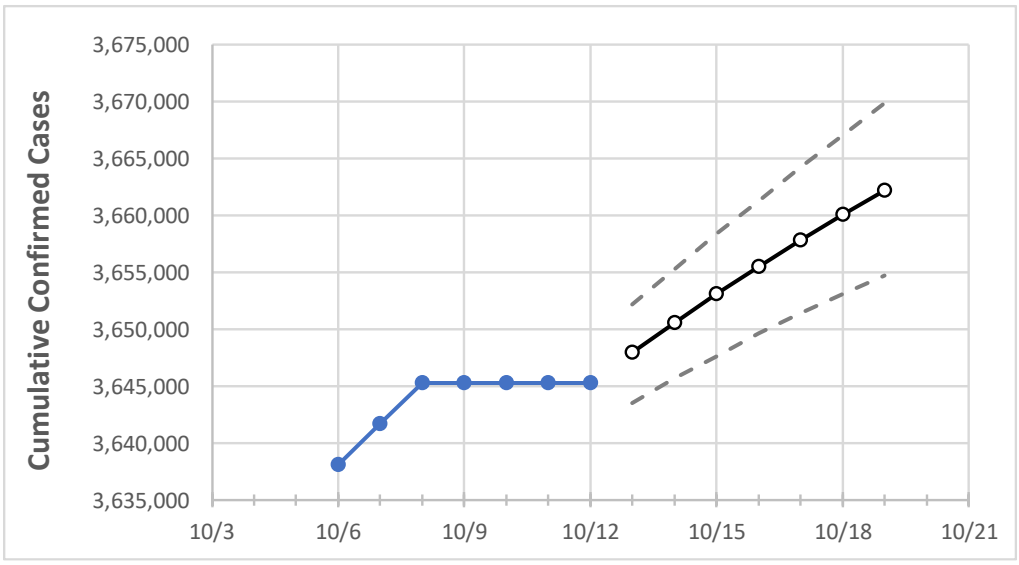
IEM's Modeling Lead

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:						
	10/9	10/10	10/11	10/12	10/13	10/14	10/15	10/16	10/17	10/18	10/19
Florida	3,645,290	3,645,290	3,645,290	3,645,290	3,647,955	3,650,557	3,653,083	3,655,512	3,657,831	3,660,048	3,662,197

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:						
	10/9	10/10	10/11	10/12	10/13	10/14	10/15	10/16	10/17	10/18	10/19
Alachua	39,174	39,174	39,174	39,174	39,206	39,237	39,267	39,296	39,323	39,351	39,378
Broward	355,259	355,259	355,259	355,259	355,559	355,849	356,137	356,413	356,684	356,951	357,215
Charlotte	23,011	23,011	23,011	23,011	23,046	23,081	23,115	23,148	23,181	23,213	23,245
Collier	57,575	57,575	57,575	57,575	57,622	57,665	57,707	57,749	57,788	57,826	57,863
Duval	164,520	164,520	164,520	164,520	164,629	164,736	164,838	164,937	165,035	165,130	165,222
Hillsborough	238,897	238,897	238,897	238,897	239,129	239,347	239,559	239,767	239,968	240,166	240,360
Lake	54,040	54,040	54,040	54,040	54,114	54,183	54,251	54,316	54,382	54,445	54,505
Lee	125,761	125,761	125,761	125,761	125,853	125,940	126,021	126,102	126,180	126,254	126,326
Manatee	64,912	64,912	64,912	64,912	64,968	65,022	65,073	65,124	65,172	65,219	65,265
Miami-Dade	672,126	672,126	672,126	672,126	672,541	672,948	673,341	673,716	674,088	674,451	674,800
Okaloosa	34,241	34,241	34,241	34,241	34,267	34,293	34,317	34,340	34,363	34,385	34,406
Orange	227,228	227,228	227,228	227,228	227,419	227,598	227,773	227,943	228,112	228,273	228,426
Osceola	71,408	71,408	71,408	71,408	71,469	71,529	71,587	71,642	71,698	71,752	71,804
Palm Beach	224,493	224,493	224,493	224,493	224,701	224,900	225,094	225,286	225,474	225,657	225,833
Pasco	78,606	78,606	78,606	78,606	78,675	78,743	78,807	78,868	78,926	78,984	79,039
Pinellas	134,669	134,669	134,669	134,669	134,793	134,915	135,031	135,144	135,255	135,363	135,467
Polk	127,305	127,305	127,305	127,305	127,405	127,502	127,593	127,685	127,770	127,851	127,935
Sarasota	56,193	56,193	56,193	56,193	56,231	56,269	56,303	56,338	56,370	56,403	56,432
Seminole	61,474	61,474	61,474	61,474	61,532	61,590	61,644	61,698	61,750	61,801	61,851
St. Johns	40,387	40,387	40,387	40,387	40,428	40,469	40,506	40,543	40,578	40,613	40,646
Sumter	14,389	14,389	14,389	14,389	14,402	14,416	14,428	14,440	14,452	14,464	14,475
Volusia	75,012	75,012	75,012	75,012	75,099	75,184	75,268	75,349	75,429	75,506	75,582

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:		
	10/9	10/10	10/11	10/12	10/14	10/16	10/18
Alachua	39,174	39,174	39,174	39,174	39,237 (7,847) [1,883] {942}	39,296 (7,859) [1,886] {943}	39,351 (7,870) [1,889] {944}
Broward	355,259	355,259	355,259	355,259	355,849 (71,170) [17,081] {8,540}	356,413 (71,283) [17,108] {8,554}	356,951 (71,390) [17,134] {8,567}
Charlotte	23,011	23,011	23,011	23,011	23,081 (4,616) [1,108] {554}	23,148 (4,630) [1,111] {556}	23,213 (4,643) [1,114] {557}
Collier	57,575	57,575	57,575	57,575	57,665 (11,533) [2,768] {1,384}	57,749 (11,550) [2,772] {1,386}	57,826 (11,565) [2,776] {1,388}
Duval	164,520	164,520	164,520	164,520	164,736 (32,947) [7,907] {3,954}	164,937 (32,987) [7,917] {3,958}	165,130 (33,026) [7,926] {3,963}
Hillsborough	238,897	238,897	238,897	238,897	239,347 (47,869) [11,489] {5,744}	239,767 (47,953) [11,509] {5,754}	240,166 (48,033) [11,528] {5,764}
Lake	54,040	54,040	54,040	54,040	54,183 (10,837) [2,601] {1,300}	54,316 (10,863) [2,607] {1,304}	54,445 (10,889) [2,613] {1,307}
Lee	125,761	125,761	125,761	125,761	125,940 (25,188) [6,045] {3,023}	126,102 (25,220) [6,053] {3,026}	126,254 (25,251) [6,060] {3,030}
Manatee	64,912	64,912	64,912	64,912	65,022 (13,004) [3,121] {1,561}	65,124 (13,025) [3,126] {1,563}	65,219 (13,044) [3,131] {1,565}
Miami-Dade	672,126	672,126	672,126	672,126	672,948 (134,590) [32,302] {16,151}	673,716 (134,743) [32,338] {16,169}	674,451 (134,890) [32,374] {16,187}
Okaloosa	34,241	34,241	34,241	34,241	34,293 (6,859) [1,646] {823}	34,340 (6,868) [1,648] {824}	34,385 (6,877) [1,650] {825}
Orange	227,228	227,228	227,228	227,228	227,598 (45,520) [10,925] {5,462}	227,943 (45,589) [10,941] {5,471}	228,273 (45,655) [10,957] {5,479}
Osceola	71,408	71,408	71,408	71,408	71,529 (14,306) [3,433] {1,717}	71,642 (14,328) [3,439] {1,719}	71,752 (14,350) [3,444] {1,722}
Palm Beach	224,493	224,493	224,493	224,493	224,900 (44,980) [10,795] {5,398}	225,286 (45,057) [10,814] {5,407}	225,657 (45,131) [10,832] {5,416}
Pasco	78,606	78,606	78,606	78,606	78,743 (15,749) [3,780] {1,890}	78,868 (15,774) [3,786] {1,893}	78,984 (15,797) [3,791] {1,896}
Pinellas	134,669	134,669	134,669	134,669	134,915 (26,983) [6,476] {3,238}	135,144 (27,029) [6,487] {3,243}	135,363 (27,073) [6,497] {3,249}
Polk	127,305	127,305	127,305	127,305	127,502 (25,500) [6,120] {3,060}	127,685 (25,537) [6,129] {3,064}	127,851 (25,570) [6,137] {3,068}
Sarasota	56,193	56,193	56,193	56,193	56,269 (11,254) [2,701] {1,350}	56,338 (11,268) [2,704] {1,352}	56,403 (11,281) [2,707] {1,354}
Seminole	61,474	61,474	61,474	61,474	61,590 (12,318) [2,956] {1,478}	61,698 (12,340) [2,962] {1,481}	61,801 (12,360) [2,966] {1,483}
St. Johns	40,387	40,387	40,387	40,387	40,469 (8,094) [1,943] {971}	40,543 (8,109) [1,946] {973}	40,613 (8,123) [1,949] {975}
Sumter	14,389	14,389	14,389	14,389	14,416 (2,883) [692] {346}	14,440 (2,888) [693] {347}	14,464 (2,893) [694] {347}
Volusia	75,012	75,012	75,012	75,012	75,184 (15,037) [3,609] {1,804}	75,349 (15,070) [3,617] {1,808}	75,506 (15,101) [3,624] {1,812}

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.