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

Date: 12/3/21

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 12/3/21 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.

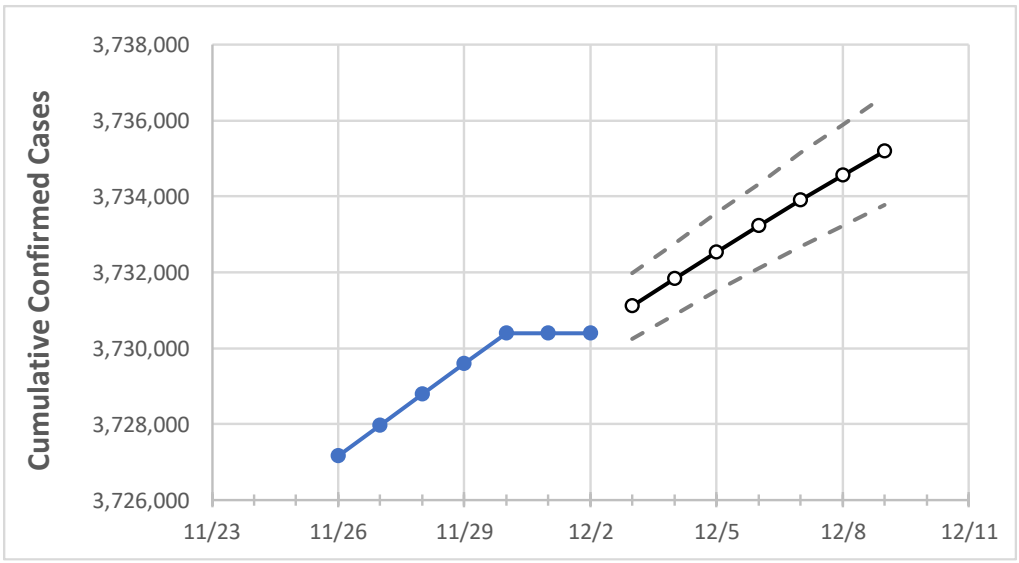
IEM's Modeling Lead

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:						
	11/29	11/30	12/1	12/2	12/3	12/4	12/5	12/6	12/7	12/8	12/9
Florida	3,729,587	3,730,395	3,730,395	3,730,395	3,731,121	3,731,838	3,732,530	3,733,224	3,733,899	3,734,560	3,735,195

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:						
	11/29	11/30	12/1	12/2	12/3	12/4	12/5	12/6	12/7	12/8	12/9
Alachua	40,371	40,383	40,383	40,383	40,393	40,404	40,414	40,423	40,433	40,443	40,452
Broward	363,439	363,511	363,511	363,511	363,575	363,638	363,699	363,760	363,817	363,873	363,929
Charlotte	23,768	23,775	23,775	23,775	23,782	23,789	23,795	23,802	23,809	23,815	23,821
Collier	58,802	58,819	58,819	58,819	58,834	58,850	58,865	58,879	58,894	58,908	58,923
Duval	167,125	167,148	167,148	167,148	167,168	167,188	167,208	167,227	167,245	167,264	167,282
Hillsborough	246,365	246,433	246,433	246,433	246,500	246,570	246,633	246,698	246,761	246,823	246,882
Lake	55,882	55,896	55,896	55,896	55,910	55,924	55,936	55,949	55,962	55,974	55,986
Lee	128,478	128,502	128,502	128,502	128,522	128,542	128,561	128,579	128,597	128,615	128,632
Manatee	66,323	66,337	66,337	66,337	66,349	66,362	66,373	66,385	66,396	66,408	66,419
Miami-Dade	685,976	686,124	686,124	686,124	686,254	686,384	686,508	686,631	686,750	686,869	686,983
Okaloosa	35,002	35,007	35,007	35,007	35,011	35,016	35,020	35,024	35,028	35,032	35,035
Orange	232,462	232,511	232,511	232,511	232,562	232,613	232,665	232,716	232,768	232,819	232,870
Osceola	73,363	73,384	73,384	73,384	73,404	73,424	73,443	73,462	73,481	73,499	73,516
Palm Beach	230,278	230,329	230,329	230,329	230,377	230,422	230,468	230,511	230,555	230,597	230,637
Pasco	80,287	80,303	80,303	80,303	80,318	80,332	80,347	80,360	80,374	80,387	80,400
Pinellas	137,712	137,742	137,742	137,742	137,769	137,796	137,822	137,847	137,873	137,897	137,922
Polk	130,294	130,322	130,322	130,322	130,347	130,372	130,395	130,419	130,443	130,466	130,488
Sarasota	57,519	57,539	57,539	57,539	57,558	57,577	57,596	57,615	57,633	57,652	57,670
Seminole	63,412	63,435	63,435	63,435	63,456	63,476	63,496	63,515	63,534	63,553	63,572
St. Johns	41,556	41,569	41,569	41,569	41,582	41,594	41,606	41,618	41,630	41,642	41,653
Sumter	14,866	14,871	14,871	14,871	14,876	14,880	14,885	14,889	14,894	14,898	14,903
Volusia	77,819	77,844	77,844	77,844	77,867	77,889	77,911	77,932	77,953	77,973	77,993

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:		
	11/29	11/30	12/1	12/2	12/4	12/6	12/8
Alachua	40,371	40,383	40,383	40,383	40,404 (8,081) [1,939] {970}	40,423 (8,085) [1,940] {970}	40,443 (8,089) [1,941] {971}
Broward	363,439	363,511	363,511	363,511	363,638 (72,728) [17,455] {8,727}	363,760 (72,752) [17,460] {8,730}	363,873 (72,775) [17,466] {8,733}
Charlotte	23,768	23,775	23,775	23,775	23,789 (4,758) [1,142] {571}	23,802 (4,760) [1,143] {571}	23,815 (4,763) [1,143] {572}
Collier	58,802	58,819	58,819	58,819	58,850 (11,770) [2,825] {1,412}	58,879 (11,776) [2,826] {1,413}	58,908 (11,782) [2,828] {1,414}
Duval	167,125	167,148	167,148	167,148	167,188 (33,438) [8,025] {4,013}	167,227 (33,445) [8,027] {4,013}	167,264 (33,453) [8,029] {4,014}
Hillsborough	246,365	246,433	246,433	246,433	246,570 (49,314) [11,835] {5,918}	246,698 (49,340) [11,842] {5,921}	246,823 (49,365) [11,847] {5,924}
Lake	55,882	55,896	55,896	55,896	55,924 (11,185) [2,684] {1,342}	55,949 (11,190) [2,686] {1,343}	55,974 (11,195) [2,687] {1,343}
Lee	128,478	128,502	128,502	128,502	128,542 (25,708) [6,170] {3,085}	128,579 (25,716) [6,172] {3,086}	128,615 (25,723) [6,174] {3,087}
Manatee	66,323	66,337	66,337	66,337	66,362 (13,272) [3,185] {1,593}	66,385 (13,277) [3,186] {1,593}	66,408 (13,282) [3,188] {1,594}
Miami-Dade	685,976	686,124	686,124	686,124	686,384 (137,277) [32,946] {16,473}	686,631 (137,326) [32,958] {16,479}	686,869 (137,374) [32,970] {16,485}
Okaloosa	35,002	35,007	35,007	35,007	35,016 (7,003) [1,681] {840}	35,024 (7,005) [1,681] {841}	35,032 (7,006) [1,682] {841}
Orange	232,462	232,511	232,511	232,511	232,613 (46,523) [11,165] {5,583}	232,716 (46,543) [11,170] {5,585}	232,819 (46,564) [11,175] {5,588}
Osceola	73,363	73,384	73,384	73,384	73,424 (14,685) [3,524] {1,762}	73,462 (14,692) [3,526] {1,763}	73,499 (14,700) [3,528] {1,764}
Palm Beach	230,278	230,329	230,329	230,329	230,422 (46,084) [11,060] {5,530}	230,511 (46,102) [11,065] {5,532}	230,597 (46,119) [11,069] {5,534}
Pasco	80,287	80,303	80,303	80,303	80,332 (16,066) [3,856] {1,928}	80,360 (16,072) [3,857] {1,929}	80,387 (16,077) [3,859] {1,929}
Pinellas	137,712	137,742	137,742	137,742	137,796 (27,559) [6,614] {3,307}	137,847 (27,569) [6,617] {3,308}	137,897 (27,579) [6,619] {3,310}
Polk	130,294	130,322	130,322	130,322	130,372 (26,074) [6,258] {3,129}	130,419 (26,084) [6,260] {3,130}	130,466 (26,093) [6,262] {3,131}
Sarasota	57,519	57,539	57,539	57,539	57,577 (11,515) [2,764] {1,382}	57,615 (11,523) [2,766] {1,383}	57,652 (11,530) [2,767] {1,384}
Seminole	63,412	63,435	63,435	63,435	63,476 (12,695) [3,047] {1,523}	63,515 (12,703) [3,049] {1,524}	63,553 (12,711) [3,051] {1,525}
St. Johns	41,556	41,569	41,569	41,569	41,594 (8,319) [1,997] {998}	41,618 (8,324) [1,998] {999}	41,642 (8,328) [1,999] {999}
Sumter	14,866	14,871	14,871	14,871	14,880 (2,976) [714] {357}	14,889 (2,978) [715] {357}	14,898 (2,980) [715] {358}
Volusia	77,819	77,844	77,844	77,844	77,889 (15,578) [3,739] {1,869}	77,932 (15,586) [3,741] {1,870}	77,973 (15,595) [3,743] {1,871}

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.