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

Date: 11/24/21

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 11/24/21 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.

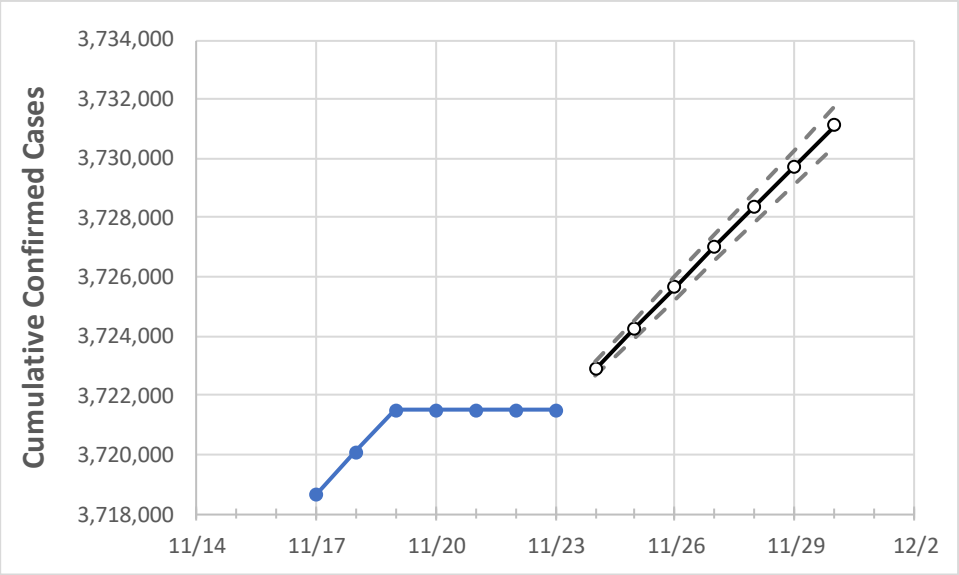
IEM's Modeling Lead

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:						
	11/20	11/21	11/22	11/23	11/24	11/25	11/26	11/27	11/28	11/29	11/30
Florida	3,721,503	3,721,503	3,721,503	3,721,503	3,722,889	3,724,272	3,725,649	3,727,024	3,728,391	3,729,754	3,731,111

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:						
	11/20	11/21	11/22	11/23	11/24	11/25	11/26	11/27	11/28	11/29	11/30
Alachua	40,253	40,253	40,253	40,253	40,270	40,288	40,304	40,321	40,338	40,355	40,371
Broward	362,721	362,721	362,721	362,721	362,854	362,986	363,118	363,250	363,382	363,513	363,643
Charlotte	23,696	23,696	23,696	23,696	23,710	23,724	23,738	23,752	23,767	23,781	23,796
Collier	58,636	58,636	58,636	58,636	58,658	58,680	58,703	58,725	58,747	58,769	58,792
Duval	166,899	166,899	166,899	166,899	166,933	166,966	167,000	167,033	167,066	167,099	167,132
Hillsborough	245,680	245,680	245,680	245,680	245,862	246,047	246,235	246,426	246,620	246,817	247,017
Lake	55,740	55,740	55,740	55,740	55,776	55,812	55,849	55,885	55,922	55,959	55,995
Lee	128,243	128,243	128,243	128,243	128,276	128,309	128,340	128,372	128,403	128,434	128,463
Manatee	66,185	66,185	66,185	66,185	66,206	66,226	66,246	66,266	66,286	66,306	66,326
Miami-Dade	684,494	684,494	684,494	684,494	684,725	684,954	685,181	685,405	685,629	685,853	686,074
Okaloosa	34,948	34,948	34,948	34,948	34,957	34,966	34,975	34,983	34,991	35,000	35,007
Orange	231,968	231,968	231,968	231,968	232,013	232,057	232,101	232,143	232,183	232,224	232,263
Osceola	73,149	73,149	73,149	73,149	73,187	73,225	73,263	73,301	73,339	73,378	73,416
Palm Beach	229,772	229,772	229,772	229,772	229,877	229,983	230,090	230,197	230,304	230,412	230,521
Pasco	80,128	80,128	80,128	80,128	80,160	80,193	80,225	80,258	80,291	80,325	80,359
Pinellas	137,413	137,413	137,413	137,413	137,460	137,508	137,555	137,603	137,650	137,698	137,745
Polk	130,013	130,013	130,013	130,013	130,062	130,111	130,159	130,206	130,254	130,302	130,350
Sarasota	57,318	57,318	57,318	57,318	57,345	57,373	57,401	57,429	57,458	57,487	57,517
Seminole	63,187	63,187	63,187	63,187	63,229	63,270	63,312	63,353	63,395	63,437	63,479
St. Johns	41,421	41,421	41,421	41,421	41,442	41,463	41,485	41,506	41,527	41,549	41,570
Sumter	14,814	14,814	14,814	14,814	14,822	14,829	14,837	14,844	14,852	14,860	14,867
Volusia	77,571	77,571	77,571	77,571	77,622	77,673	77,724	77,775	77,826	77,877	77,927

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:		
	11/20	11/21	11/22	11/23	11/25	11/27	11/29
Alachua	40,253	40,253	40,253	40,253	40,288 (8,058) [1,934] {967}	40,321 (8,064) [1,935] {968}	40,355 (8,071) [1,937] {969}
Broward	362,721	362,721	362,721	362,721	362,986 (72,597) [17,423] {8,712}	363,250 (72,650) [17,436] {8,718}	363,513 (72,703) [17,449] {8,724}
Charlotte	23,696	23,696	23,696	23,696	23,724 (4,745) [1,139] {569}	23,752 (4,750) [1,140] {570}	23,781 (4,756) [1,142] {571}
Collier	58,636	58,636	58,636	58,636	58,680 (11,736) [2,817] {1,408}	58,725 (11,745) [2,819] {1,409}	58,769 (11,754) [2,821] {1,410}
Duval	166,899	166,899	166,899	166,899	166,966 (33,393) [8,014] {4,007}	167,033 (33,407) [8,018] {4,009}	167,099 (33,420) [8,021] {4,010}
Hillsborough	245,680	245,680	245,680	245,680	246,047 (49,209) [11,810] {5,905}	246,426 (49,285) [11,828] {5,914}	246,817 (49,363) [11,847] {5,924}
Lake	55,740	55,740	55,740	55,740	55,812 (11,162) [2,679] {1,339}	55,885 (11,177) [2,682] {1,341}	55,959 (11,192) [2,686] {1,343}
Lee	128,243	128,243	128,243	128,243	128,309 (25,662) [6,159] {3,079}	128,372 (25,674) [6,162] {3,081}	128,434 (25,687) [6,165] {3,082}
Manatee	66,185	66,185	66,185	66,185	66,226 (13,245) [3,179] {1,589}	66,266 (13,253) [3,181] {1,590}	66,306 (13,261) [3,183] {1,591}
Miami-Dade	684,494	684,494	684,494	684,494	684,954 (136,991) [32,878] {16,439}	685,405 (137,081) [32,899] {16,450}	685,853 (137,171) [32,921] {16,460}
Okaloosa	34,948	34,948	34,948	34,948	34,966 (6,993) [1,678] {839}	34,983 (6,997) [1,679] {840}	35,000 (7,000) [1,680] {840}
Orange	231,968	231,968	231,968	231,968	232,057 (46,411) [11,139] {5,569}	232,143 (46,429) [11,143] {5,571}	232,224 (46,445) [11,147] {5,573}
Osceola	73,149	73,149	73,149	73,149	73,225 (14,645) [3,515] {1,757}	73,301 (14,660) [3,518] {1,759}	73,378 (14,676) [3,522] {1,761}
Palm Beach	229,772	229,772	229,772	229,772	229,983 (45,997) [11,039] {5,520}	230,197 (46,039) [11,049] {5,525}	230,412 (46,082) [11,060] {5,530}
Pasco	80,128	80,128	80,128	80,128	80,193 (16,039) [3,849] {1,925}	80,258 (16,052) [3,852] {1,926}	80,325 (16,065) [3,856] {1,928}
Pinellas	137,413	137,413	137,413	137,413	137,508 (27,502) [6,600] {3,300}	137,603 (27,521) [6,605] {3,302}	137,698 (27,540) [6,609] {3,305}
Polk	130,013	130,013	130,013	130,013	130,111 (26,022) [6,245] {3,123}	130,206 (26,041) [6,250] {3,125}	130,302 (26,060) [6,255] {3,127}
Sarasota	57,318	57,318	57,318	57,318	57,373 (11,475) [2,754] {1,377}	57,429 (11,486) [2,757] {1,378}	57,487 (11,497) [2,759] {1,380}
Seminole	63,187	63,187	63,187	63,187	63,270 (12,654) [3,037] {1,518}	63,353 (12,671) [3,041] {1,520}	63,437 (12,687) [3,045] {1,522}
St. Johns	41,421	41,421	41,421	41,421	41,463 (8,293) [1,990] {995}	41,506 (8,301) [1,992] {996}	41,549 (8,310) [1,994] {997}
Sumter	14,814	14,814	14,814	14,814	14,829 (2,966) [712] {356}	14,844 (2,969) [713] {356}	14,860 (2,972) [713] {357}
Volusia	77,571	77,571	77,571	77,571	77,673 (15,535) [3,728] {1,864}	77,775 (15,555) [3,733] {1,867}	77,877 (15,575) [3,738] {1,869}

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.