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

Date: 10/6/21

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 10/6/21 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.

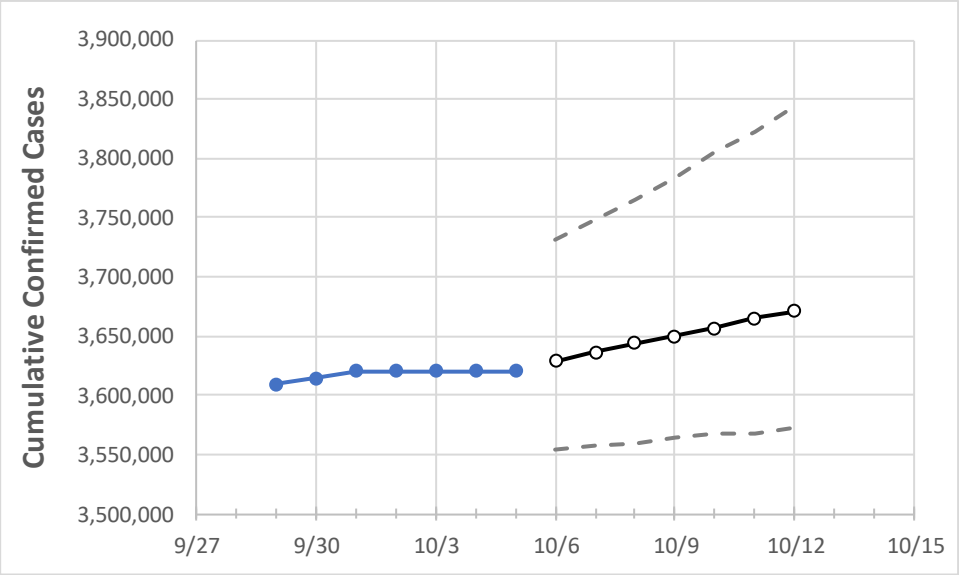
IEM's Modeling Lead

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:						
	10/2	10/3	10/4	10/5	10/6	10/7	10/8	10/9	10/10	10/11	10/12
Florida	3,620,106	3,620,106	3,620,106	3,620,106	3,629,231	3,636,132	3,643,843	3,650,286	3,656,900	3,664,988	3,671,383

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:						
	10/2	10/3	10/4	10/5	10/6	10/7	10/8	10/9	10/10	10/11	10/12
Alachua	38,898	38,898	38,898	38,898	38,947	38,995	39,041	39,087	39,131	39,174	39,216
Broward	352,795	352,795	352,795	352,795	353,222	353,638	354,045	354,450	354,847	355,233	355,613
Charlotte	22,724	22,724	22,724	22,724	22,779	22,835	22,891	22,947	23,003	23,059	23,113
Collier	57,183	57,183	57,183	57,183	57,269	57,352	57,432	57,511	57,586	57,662	57,734
Duval	163,630	163,630	163,630	163,630	163,816	163,998	164,178	164,355	164,530	164,703	164,871
Hillsborough	236,927	236,927	236,927	236,927	237,258	237,582	237,899	238,202	238,500	238,796	239,072
Lake	53,497	53,497	53,497	53,497	53,625	53,749	53,871	53,991	54,111	54,227	54,342
Lee	124,919	124,919	124,919	124,919	125,065	125,202	125,335	125,460	125,587	125,704	125,815
Manatee	64,427	64,427	64,427	64,427	64,516	64,602	64,685	64,764	64,843	64,921	64,991
Miami-Dade	668,562	668,562	668,562	668,562	669,174	669,770	670,350	670,919	671,481	672,024	672,571
Okaloosa	34,008	34,008	34,008	34,008	34,052	34,096	34,137	34,176	34,215	34,254	34,291
Orange	225,612	225,612	225,612	225,612	225,885	226,154	226,410	226,660	226,907	227,144	227,375
Osceola	70,886	70,886	70,886	70,886	70,965	71,039	71,111	71,180	71,250	71,317	71,380
Palm Beach	222,781	222,781	222,781	222,781	223,080	223,373	223,661	223,944	224,220	224,494	224,759
Pasco	78,006	78,006	78,006	78,006	78,125	78,239	78,353	78,459	78,563	78,665	78,762
Pinellas	133,599	133,599	133,599	133,599	133,780	133,957	134,127	134,293	134,454	134,613	134,766
Polk	126,378	126,378	126,378	126,378	126,542	126,697	126,847	126,994	127,138	127,276	127,402
Sarasota	55,837	55,837	55,837	55,837	55,901	55,962	56,018	56,074	56,130	56,181	56,232
Seminole	60,983	60,983	60,983	60,983	61,060	61,134	61,207	61,279	61,347	61,416	61,480
St. Johns	40,033	40,033	40,033	40,033	40,106	40,176	40,245	40,311	40,375	40,439	40,499
Sumter	14,273	14,273	14,273	14,273	14,293	14,312	14,330	14,348	14,366	14,383	14,399
Volusia	74,285	74,285	74,285	74,285	74,392	74,496	74,596	74,694	74,789	74,884	74,972

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:		
	10/2	10/3	10/4	10/5	10/7	10/9	10/11
Alachua	38,898	38,898	38,898	38,898	38,995 (7,799) [1,872] {936}	39,087 (7,817) [1,876] {938}	39,174 (7,835) [1,880] {940}
Broward	352,795	352,795	352,795	352,795	353,638 (70,728) [16,975] {8,487}	354,450 (70,890) [17,014] {8,507}	355,233 (71,047) [17,051] {8,526}
Charlotte	22,724	22,724	22,724	22,724	22,835 (4,567) [1,096] {548}	22,947 (4,589) [1,101] {551}	23,059 (4,612) [1,107] {553}
Collier	57,183	57,183	57,183	57,183	57,352 (11,470) [2,753] {1,376}	57,511 (11,502) [2,761] {1,380}	57,662 (11,532) [2,768] {1,384}
Duval	163,630	163,630	163,630	163,630	163,998 (32,800) [7,872] {3,936}	164,355 (32,871) [7,889] {3,945}	164,703 (32,941) [7,906] {3,953}
Hillsborough	236,927	236,927	236,927	236,927	237,582 (47,516) [11,404] {5,702}	238,202 (47,640) [11,434] {5,717}	238,796 (47,759) [11,462] {5,731}
Lake	53,497	53,497	53,497	53,497	53,749 (10,750) [2,580] {1,290}	53,991 (10,798) [2,592] {1,296}	54,227 (10,845) [2,603] {1,301}
Lee	124,919	124,919	124,919	124,919	125,202 (25,040) [6,010] {3,005}	125,460 (25,092) [6,022] {3,011}	125,704 (25,141) [6,034] {3,017}
Manatee	64,427	64,427	64,427	64,427	64,602 (12,920) [3,101] {1,550}	64,764 (12,953) [3,109] {1,554}	64,921 (12,984) [3,116] {1,558}
Miami-Dade	668,562	668,562	668,562	668,562	669,770 (133,954) [32,149] {16,074}	670,919 (134,184) [32,204] {16,102}	672,024 (134,405) [32,257] {16,129}
Okaloosa	34,008	34,008	34,008	34,008	34,096 (6,819) [1,637] {818}	34,176 (6,835) [1,640] {820}	34,254 (6,851) [1,644] {822}
Orange	225,612	225,612	225,612	225,612	226,154 (45,231) [10,855] {5,428}	226,660 (45,332) [10,880] {5,440}	227,144 (45,429) [10,903] {5,451}
Osceola	70,886	70,886	70,886	70,886	71,039 (14,208) [3,410] {1,705}	71,180 (14,236) [3,417] {1,708}	71,317 (14,263) [3,423] {1,712}
Palm Beach	222,781	222,781	222,781	222,781	223,373 (44,675) [10,722] {5,361}	223,944 (44,789) [10,749] {5,375}	224,494 (44,899) [10,776] {5,388}
Pasco	78,006	78,006	78,006	78,006	78,239 (15,648) [3,755] {1,878}	78,459 (15,692) [3,766] {1,883}	78,665 (15,733) [3,776] {1,888}
Pinellas	133,599	133,599	133,599	133,599	133,957 (26,791) [6,430] {3,215}	134,293 (26,859) [6,446] {3,223}	134,613 (26,923) [6,461] {3,231}
Polk	126,378	126,378	126,378	126,378	126,697 (25,339) [6,081] {3,041}	126,994 (25,399) [6,096] {3,048}	127,276 (25,455) [6,109] {3,055}
Sarasota	55,837	55,837	55,837	55,837	55,962 (11,192) [2,686] {1,343}	56,074 (11,215) [2,692] {1,346}	56,181 (11,236) [2,697] {1,348}
Seminole	60,983	60,983	60,983	60,983	61,134 (12,227) [2,934] {1,467}	61,279 (12,256) [2,941] {1,471}	61,416 (12,283) [2,948] {1,474}
St. Johns	40,033	40,033	40,033	40,033	40,176 (8,035) [1,928] {964}	40,311 (8,062) [1,935] {967}	40,439 (8,088) [1,941] {971}
Sumter	14,273	14,273	14,273	14,273	14,312 (2,862) [687] {343}	14,348 (2,870) [689] {344}	14,383 (2,877) [690] {345}
Volusia	74,285	74,285	74,285	74,285	74,496 (14,899) [3,576] {1,788}	74,694 (14,939) [3,585] {1,793}	74,884 (14,977) [3,594] {1,797}

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.