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

Date: 6/1/21

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 6/1/21 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.

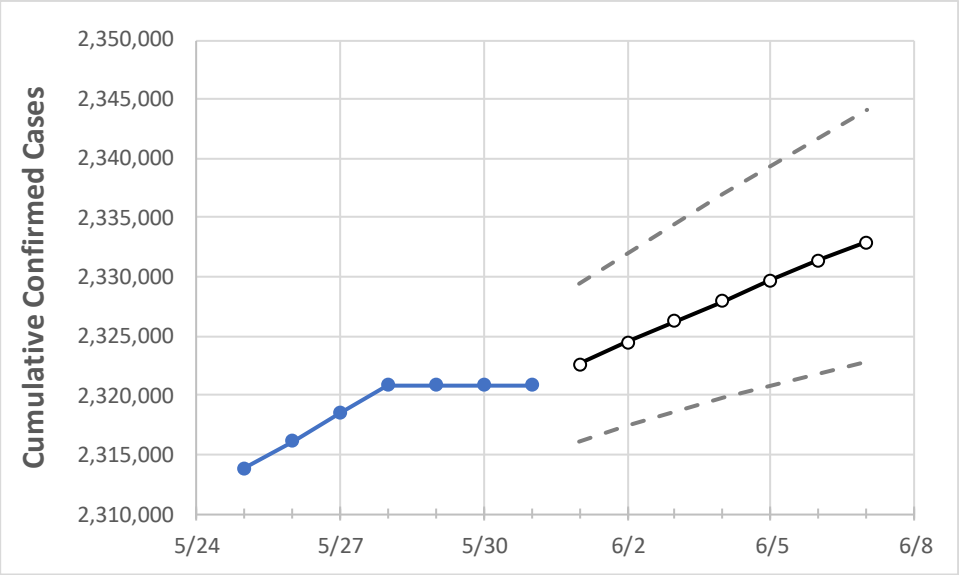
IEM's Modeling Lead

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:						
	5/28	5/29	5/30	5/31	6/1	6/2	6/3	6/4	6/5	6/6	6/7
Florida	2,320,818	2,320,818	2,320,818	2,320,818	2,322,666	2,324,487	2,326,247	2,327,985	2,329,680	2,331,400	2,332,961

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:						
	5/28	5/29	5/30	5/31	6/1	6/2	6/3	6/4	6/5	6/6	6/7
Alachua	25,439	25,439	25,439	25,439	25,466	25,494	25,520	25,548	25,575	25,603	25,631
Broward	244,552	244,552	244,552	244,552	244,701	244,845	244,983	245,111	245,240	245,365	245,489
Charlotte	13,361	13,361	13,361	13,361	13,377	13,393	13,408	13,423	13,438	13,453	13,467
Collier	37,009	37,009	37,009	37,009	37,046	37,082	37,117	37,151	37,185	37,217	37,250
Duval	100,502	100,502	100,502	100,502	100,584	100,664	100,743	100,821	100,896	100,968	101,041
Hillsborough	142,735	142,735	142,735	142,735	142,911	143,089	143,257	143,418	143,581	143,744	143,901
Lake	30,960	30,960	30,960	30,960	31,006	31,052	31,097	31,141	31,184	31,227	31,270
Lee	73,462	73,462	73,462	73,462	73,535	73,605	73,673	73,738	73,798	73,856	73,913
Manatee	39,793	39,793	39,793	39,793	39,823	39,852	39,881	39,908	39,934	39,958	39,983
Miami-Dade	500,323	500,323	500,323	500,323	500,645	500,962	501,273	501,560	501,841	502,118	502,378
Okaloosa	20,864	20,864	20,864	20,864	20,876	20,887	20,899	20,910	20,922	20,933	20,945
Orange	142,541	142,541	142,541	142,541	142,661	142,775	142,888	142,997	143,105	143,213	143,317
Osceola	46,052	46,052	46,052	46,052	46,096	46,139	46,182	46,225	46,267	46,306	46,347
Palm Beach	148,277	148,277	148,277	148,277	148,369	148,456	148,540	148,619	148,695	148,771	148,844
Pasco	42,754	42,754	42,754	42,754	42,794	42,831	42,868	42,904	42,940	42,974	43,008
Pinellas	81,289	81,289	81,289	81,289	81,331	81,371	81,410	81,446	81,479	81,513	81,545
Polk	70,908	70,908	70,908	70,908	70,976	71,043	71,108	71,170	71,233	71,293	71,352
Sarasota	33,627	33,627	33,627	33,627	33,655	33,682	33,709	33,736	33,762	33,787	33,812
Seminole	35,243	35,243	35,243	35,243	35,284	35,324	35,364	35,403	35,442	35,480	35,518
St. Johns	23,228	23,228	23,228	23,228	23,250	23,271	23,292	23,312	23,333	23,354	23,373
Sumter	9,487	9,487	9,487	9,487	9,496	9,504	9,513	9,521	9,530	9,539	9,548
Volusia	44,745	44,745	44,745	44,745	44,794	44,843	44,891	44,938	44,982	45,026	45,069

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:		
	5/28	5/29	5/30	5/31	6/2	6/4	6/6
Alachua	25,439	25,439	25,439	25,439	25,494 (5,099) [1,224] {612}	25,548 (5,110) [1,226] {613}	25,603 (5,121) [1,229] {614}
Broward	244,552	244,552	244,552	244,552	244,845 (48,969) [11,753] {5,876}	245,111 (49,022) [11,765] {5,883}	245,365 (49,073) [11,778] {5,889}
Charlotte	13,361	13,361	13,361	13,361	13,393 (2,679) [643] {321}	13,423 (2,685) [644] {322}	13,453 (2,691) [646] {323}
Collier	37,009	37,009	37,009	37,009	37,082 (7,416) [1,780] {890}	37,151 (7,430) [1,783] {892}	37,217 (7,443) [1,786] {893}
Duval	100,502	100,502	100,502	100,502	100,664 (20,133) [4,832] {2,416}	100,821 (20,164) [4,839] {2,420}	100,968 (20,194) [4,846] {2,423}
Hillsborough	142,735	142,735	142,735	142,735	143,089 (28,618) [6,868] {3,434}	143,418 (28,684) [6,884] {3,442}	143,744 (28,749) [6,900] {3,450}
Lake	30,960	30,960	30,960	30,960	31,052 (6,210) [1,490] {745}	31,141 (6,228) [1,495] {747}	31,227 (6,245) [1,499] {749}
Lee	73,462	73,462	73,462	73,462	73,605 (14,721) [3,533] {1,767}	73,738 (14,748) [3,539] {1,770}	73,856 (14,771) [3,545] {1,773}
Manatee	39,793	39,793	39,793	39,793	39,852 (7,970) [1,913] {956}	39,908 (7,982) [1,916] {958}	39,958 (7,992) [1,918] {959}
Miami-Dade	500,323	500,323	500,323	500,323	500,962 (100,192) [24,046] {12,023}	501,560 (100,312) [24,075] {12,037}	502,118 (100,424) [24,102] {12,051}
Okaloosa	20,864	20,864	20,864	20,864	20,887 (4,177) [1,003] {501}	20,910 (4,182) [1,004] {502}	20,933 (4,187) [1,005] {502}
Orange	142,541	142,541	142,541	142,541	142,775 (28,555) [6,853] {3,427}	142,997 (28,599) [6,864] {3,432}	143,213 (28,643) [6,874] {3,437}
Osceola	46,052	46,052	46,052	46,052	46,139 (9,228) [2,215] {1,107}	46,225 (9,245) [2,219] {1,109}	46,306 (9,261) [2,223] {1,111}
Palm Beach	148,277	148,277	148,277	148,277	148,456 (29,691) [7,126] {3,563}	148,619 (29,724) [7,134] {3,567}	148,771 (29,754) [7,141] {3,570}
Pasco	42,754	42,754	42,754	42,754	42,831 (8,566) [2,056] {1,028}	42,904 (8,581) [2,059] {1,030}	42,974 (8,595) [2,063] {1,031}
Pinellas	81,289	81,289	81,289	81,289	81,371 (16,274) [3,906] {1,953}	81,446 (16,289) [3,909] {1,955}	81,513 (16,303) [3,913] {1,956}
Polk	70,908	70,908	70,908	70,908	71,043 (14,209) [3,410] {1,705}	71,170 (14,234) [3,416] {1,708}	71,293 (14,259) [3,422] {1,711}
Sarasota	33,627	33,627	33,627	33,627	33,682 (6,736) [1,617] {808}	33,736 (6,747) [1,619] {810}	33,787 (6,757) [1,622] {811}
Seminole	35,243	35,243	35,243	35,243	35,324 (7,065) [1,696] {848}	35,403 (7,081) [1,699] {850}	35,480 (7,096) [1,703] {852}
St. Johns	23,228	23,228	23,228	23,228	23,271 (4,654) [1,117] {558}	23,312 (4,662) [1,119] {559}	23,354 (4,671) [1,121] {560}
Sumter	9,487	9,487	9,487	9,487	9,504 (1,901) [456] {228}	9,521 (1,904) [457] {229}	9,539 (1,908) [458] {229}
Volusia	44,745	44,745	44,745	44,745	44,843 (8,969) [2,152] {1,076}	44,938 (8,988) [2,157] {1,079}	45,026 (9,005) [2,161] {1,081}

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.