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

Date: 214/22

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 2/14/22 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.

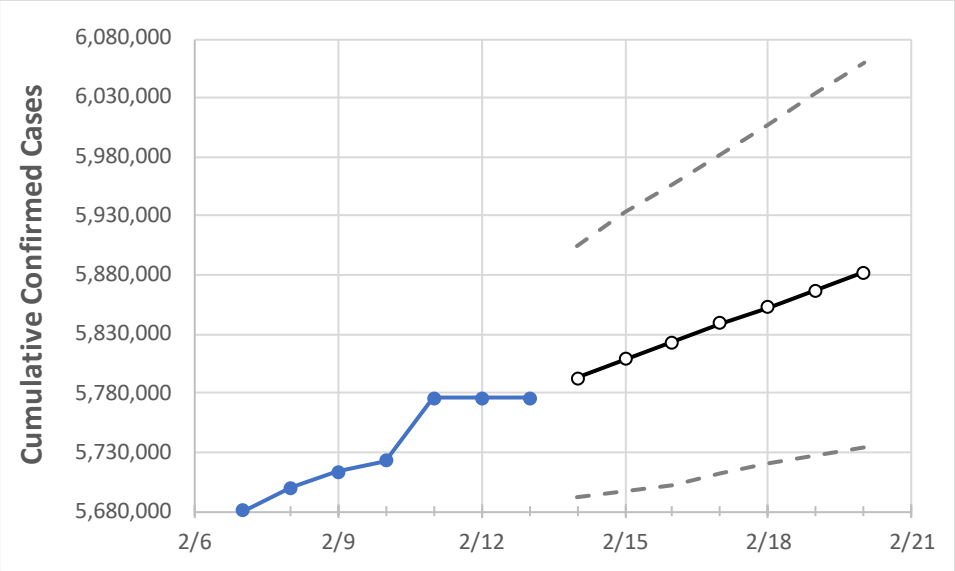
IEM's Modeling Lead

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:						
	2/10	2/11	2/12	2/13	2/14	2/15	2/16	2/17	2/18	2/19	2/20
Florida	5,723,066	5,776,333	5,776,333	5,776,333	5,792,898	5,808,727	5,823,469	5,838,871	5,853,077	5,867,124	5,882,580

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:						
	2/10	2/11	2/12	2/13	2/14	2/15	2/16	2/17	2/18	2/19	2/20
Alachua	66,087	66,308	66,308	66,308	66,490	66,664	66,834	66,994	67,153	67,301	67,446
Broward	592,916	594,384	594,384	594,384	596,240	598,184	600,198	602,291	604,445	606,661	608,923
Charlotte	34,391	34,540	34,540	34,540	34,683	34,825	34,966	35,106	35,243	35,378	35,510
Collier	82,834	83,015	83,015	83,015	83,168	83,318	83,460	83,599	83,735	83,865	83,990
Duval	248,695	249,406	249,406	249,406	250,002	250,578	251,138	251,682	252,200	252,704	253,189
Hillsborough	363,792	364,995	364,995	364,995	366,312	367,657	369,018	370,384	371,752	373,131	374,492
Lake	82,776	83,056	83,056	83,056	83,303	83,544	83,781	84,012	84,234	84,453	84,667
Lee	186,050	186,567	186,567	186,567	187,013	187,445	187,860	188,265	188,667	189,048	189,413
Manatee	93,639	93,958	93,958	93,958	94,238	94,511	94,780	95,039	95,294	95,539	95,781
Miami-Dade	1,165,351	1,168,806	1,168,806	1,168,806	1,172,843	1,177,027	1,181,407	1,185,855	1,190,426	1,195,124	1,199,712
Okaloosa	50,494	50,654	50,654	50,654	50,786	50,914	51,033	51,152	51,262	51,373	51,475
Orange	367,828	368,920	368,920	368,920	370,088	371,278	372,476	373,673	374,880	376,081	377,267
Osceola	111,290	111,522	111,522	111,522	111,729	111,931	112,129	112,322	112,509	112,691	112,865
Palm Beach	361,287	362,089	362,089	362,089	362,962	363,850	364,743	365,644	366,546	367,446	368,336
Pasco	118,951	119,371	119,371	119,371	119,747	120,118	120,478	120,831	121,177	121,514	121,838
Pinellas	204,061	204,763	204,763	204,763	205,444	206,125	206,797	207,461	208,117	208,765	209,395
Polk	195,773	196,363	196,363	196,363	196,874	197,382	197,866	198,343	198,800	199,241	199,679
Sarasota	87,645	87,976	87,976	87,976	88,267	88,549	88,821	89,087	89,348	89,602	89,846
Seminole	101,231	101,526	101,526	101,526	101,777	102,021	102,255	102,483	102,706	102,920	103,124
St. Johns	61,654	61,909	61,909	61,909	62,132	62,346	62,556	62,759	62,953	63,147	63,330
Sumter	20,825	20,907	20,907	20,907	20,979	21,050	21,120	21,188	21,255	21,319	21,384
Volusia	114,184	114,594	114,594	114,594	114,982	115,367	115,744	116,119	116,486	116,846	117,200

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:		
	2/10	2/11	2/12	2/13	2/15	2/17	2/19
Alachua	66,087	66,308	66,308	66,308	66,664 (13,333) [3,200] {1,600}	66,994 (13,399) [3,216] {1,608}	67,301 (13,460) [3,230] {1,615}
Broward	592,916	594,384	594,384	594,384	598,184 (119,637) [28,713] {14,356}	602,291 (120,458) [28,910] {14,455}	606,661 (121,332) [29,120] {14,560}
Charlotte	34,391	34,540	34,540	34,540	34,825 (6,965) [1,672] {836}	35,106 (7,021) [1,685] {843}	35,378 (7,076) [1,698] {849}
Collier	82,834	83,015	83,015	83,015	83,318 (16,664) [3,999] {2,000}	83,599 (16,720) [4,013] {2,006}	83,865 (16,773) [4,026] {2,013}
Duval	248,695	249,406	249,406	249,406	250,578 (50,116) [12,028] {6,014}	251,682 (50,336) [12,081] {6,040}	252,704 (50,541) [12,130] {6,065}
Hillsborough	363,792	364,995	364,995	364,995	367,657 (73,531) [17,648] {8,824}	370,384 (74,077) [17,778] {8,889}	373,131 (74,626) [17,910] {8,955}
Lake	82,776	83,056	83,056	83,056	83,544 (16,709) [4,010] {2,005}	84,012 (16,802) [4,033] {2,016}	84,453 (16,891) [4,054] {2,027}
Lee	186,050	186,567	186,567	186,567	187,445 (37,489) [8,997] {4,499}	188,265 (37,653) [9,037] {4,518}	189,048 (37,810) [9,074] {4,537}
Manatee	93,639	93,958	93,958	93,958	94,511 (18,902) [4,537] {2,268}	95,039 (19,008) [4,562] {2,281}	95,539 (19,108) [4,586] {2,293}
Miami-Dade	1,165,351	1,168,806	1,168,806	1,168,806	1,177,027 (235,405) [56,497] {28,249}	1,185,855 (237,171) [56,921] {28,461}	1,195,124 (239,025) [57,366] {28,683}
Okaloosa	50,494	50,654	50,654	50,654	50,914 (10,183) [2,444] {1,222}	51,152 (10,230) [2,455] {1,228}	51,373 (10,275) [2,466] {1,233}
Orange	367,828	368,920	368,920	368,920	371,278 (74,256) [17,821] {8,911}	373,673 (74,735) [17,936] {8,968}	376,081 (75,216) [18,052] {9,026}
Osceola	111,290	111,522	111,522	111,522	111,931 (22,386) [5,373] {2,686}	112,322 (22,464) [5,391] {2,696}	112,691 (22,538) [5,409] {2,705}
Palm Beach	361,287	362,089	362,089	362,089	363,850 (72,770) [17,465] {8,732}	365,644 (73,129) [17,551] {8,775}	367,446 (73,489) [17,637] {8,819}
Pasco	118,951	119,371	119,371	119,371	120,118 (24,024) [5,766] {2,883}	120,831 (24,166) [5,800] {2,900}	121,514 (24,303) [5,833] {2,916}
Pinellas	204,061	204,763	204,763	204,763	206,125 (41,225) [9,894] {4,947}	207,461 (41,492) [9,958] {4,979}	208,765 (41,753) [10,021] {5,010}
Polk	195,773	196,363	196,363	196,363	197,382 (39,476) [9,474] {4,737}	198,343 (39,669) [9,520] {4,760}	199,241 (39,848) [9,564] {4,782}
Sarasota	87,645	87,976	87,976	87,976	88,549 (17,710) [4,250] {2,125}	89,087 (17,817) [4,276] {2,138}	89,602 (17,920) [4,301] {2,150}
Seminole	101,231	101,526	101,526	101,526	102,021 (20,404) [4,897] {2,448}	102,483 (20,497) [4,919] {2,460}	102,920 (20,584) [4,940] {2,470}
St. Johns	61,654	61,909	61,909	61,909	62,346 (12,469) [2,993] {1,496}	62,759 (12,552) [3,012] {1,506}	63,147 (12,629) [3,031] {1,516}
Sumter	20,825	20,907	20,907	20,907	21,050 (4,210) [1,010] {505}	21,188 (4,238) [1,017] {509}	21,319 (4,264) [1,023] {512}
Volusia	114,184	114,594	114,594	114,594	115,367 (23,073) [5,538] {2,769}	116,119 (23,224) [5,574] {2,787}	116,846 (23,369) [5,609] {2,804}

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.