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

Date: 2/18/22

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 2/18/22 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.

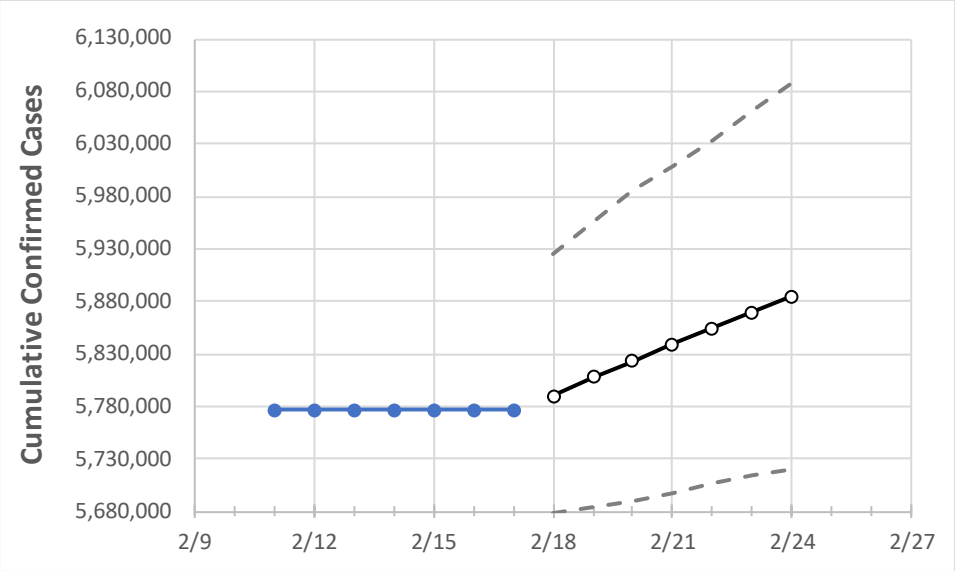
IEM's Modeling Lead

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:						
	2/14	2/15	2/16	2/17	2/18	2/19	2/20	2/21	2/22	2/23	2/24
Florida	5,776,333	5,776,333	5,776,333	5,776,333	5,790,193	5,808,019	5,823,309	5,838,942	5,853,986	5,869,472	5,884,420

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:						
	2/14	2/15	2/16	2/17	2/18	2/19	2/20	2/21	2/22	2/23	2/24
Alachua	66,308	66,308	66,308	66,308	66,464	66,618	66,766	66,908	67,044	67,177	67,307
Broward	594,384	594,384	594,384	594,384	595,716	597,027	598,346	599,660	600,958	602,251	603,536
Charlotte	34,540	34,540	34,540	34,540	34,676	34,811	34,944	35,077	35,206	35,336	35,463
Collier	83,015	83,015	83,015	83,015	83,152	83,284	83,415	83,538	83,661	83,782	83,895
Duval	249,406	249,406	249,406	249,406	249,920	250,441	250,933	251,418	251,889	252,347	252,774
Hillsborough	364,995	364,995	364,995	364,995	366,329	367,685	369,055	370,430	371,813	373,203	374,582
Lake	83,056	83,056	83,056	83,056	83,280	83,498	83,709	83,917	84,122	84,318	84,513
Lee	186,567	186,567	186,567	186,567	186,969	187,354	187,730	188,096	188,453	188,803	189,143
Manatee	93,958	93,958	93,958	93,958	94,216	94,467	94,716	94,953	95,191	95,421	95,645
Miami-Dade	1,168,806	1,168,806	1,168,806	1,168,806	1,171,722	1,174,683	1,177,528	1,180,391	1,183,220	1,185,972	1,188,718
Okaloosa	50,654	50,654	50,654	50,654	50,769	50,877	50,985	51,089	51,189	51,287	51,381
Orange	368,920	368,920	368,920	368,920	370,120	371,334	372,562	373,801	375,039	376,269	377,491
Osceola	111,522	111,522	111,522	111,522	111,701	111,876	112,046	112,212	112,373	112,527	112,678
Palm Beach	362,089	362,089	362,089	362,089	362,988	363,900	364,821	365,751	366,683	367,616	368,546
Pasco	119,371	119,371	119,371	119,371	119,711	120,042	120,365	120,686	120,997	121,301	121,597
Pinellas	204,763	204,763	204,763	204,763	205,388	206,000	206,608	207,210	207,804	208,382	208,956
Polk	196,363	196,363	196,363	196,363	196,814	197,258	197,683	198,106	198,517	198,913	199,296
Sarasota	87,976	87,976	87,976	87,976	88,236	88,493	88,740	88,984	89,213	89,446	89,668
Seminole	101,526	101,526	101,526	101,526	101,749	101,963	102,177	102,382	102,586	102,778	102,963
St. Johns	61,909	61,909	61,909	61,909	62,110	62,305	62,495	62,680	62,862	63,037	63,205
Sumter	20,907	20,907	20,907	20,907	20,975	21,040	21,105	21,169	21,232	21,294	21,353
Volusia	114,594	114,594	114,594	114,594	114,951	115,307	115,660	116,002	116,346	116,680	117,006

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:		
	2/14	2/15	2/16	2/17	2/19	2/21	2/23
Alachua	66,308	66,308	66,308	66,308	66,618 (13,324) [3,198] {1,599}	66,908 (13,382) [3,212] {1,606}	67,177 (13,435) [3,225] {1,612}
Broward	594,384	594,384	594,384	594,384	597,027 (119,405) [28,657] {14,329}	599,660 (119,932) [28,784] {14,392}	602,251 (120,450) [28,908] {14,454}
Charlotte	34,540	34,540	34,540	34,540	34,811 (6,962) [1,671] {835}	35,077 (7,015) [1,684] {842}	35,336 (7,067) [1,696] {848}
Collier	83,015	83,015	83,015	83,015	83,284 (16,657) [3,998] {1,999}	83,538 (16,708) [4,010] {2,005}	83,782 (16,756) [4,022] {2,011}
Duval	249,406	249,406	249,406	249,406	250,441 (50,088) [12,021] {6,011}	251,418 (50,284) [12,068] {6,034}	252,347 (50,469) [12,113] {6,056}
Hillsborough	364,995	364,995	364,995	364,995	367,685 (73,537) [17,649] {8,824}	370,430 (74,086) [17,781] {8,890}	373,203 (74,641) [17,914] {8,957}
Lake	83,056	83,056	83,056	83,056	83,498 (16,700) [4,008] {2,004}	83,917 (16,783) [4,028] {2,014}	84,318 (16,864) [4,047] {2,024}
Lee	186,567	186,567	186,567	186,567	187,354 (37,471) [8,993] {4,496}	188,096 (37,619) [9,029] {4,514}	188,803 (37,761) [9,063] {4,531}
Manatee	93,958	93,958	93,958	93,958	94,467 (18,893) [4,534] {2,267}	94,953 (18,991) [4,558] {2,279}	95,421 (19,084) [4,580] {2,290}
Miami-Dade	1,168,806	1,168,806	1,168,806	1,168,806	1,174,683 (234,937) [56,385] {28,192}	1,180,391 (236,078) [56,659] {28,329}	1,185,972 (237,194) [56,927] {28,463}
Okaloosa	50,654	50,654	50,654	50,654	50,877 (10,175) [2,442] {1,221}	51,089 (10,218) [2,452] {1,226}	51,287 (10,257) [2,462] {1,231}
Orange	368,920	368,920	368,920	368,920	371,334 (74,267) [17,824] {8,912}	373,801 (74,760) [17,942] {8,971}	376,269 (75,254) [18,061] {9,030}
Osceola	111,522	111,522	111,522	111,522	111,876 (22,375) [5,370] {2,685}	112,212 (22,442) [5,386] {2,693}	112,527 (22,505) [5,401] {2,701}
Palm Beach	362,089	362,089	362,089	362,089	363,900 (72,780) [17,467] {8,734}	365,751 (73,150) [17,556] {8,778}	367,616 (73,523) [17,646] {8,823}
Pasco	119,371	119,371	119,371	119,371	120,042 (24,008) [5,762] {2,881}	120,686 (24,137) [5,793] {2,896}	121,301 (24,260) [5,822] {2,911}
Pinellas	204,763	204,763	204,763	204,763	206,000 (41,200) [9,888] {4,944}	207,210 (41,442) [9,946] {4,973}	208,382 (41,676) [10,002] {5,001}
Polk	196,363	196,363	196,363	196,363	197,258 (39,452) [9,468] {4,734}	198,106 (39,621) [9,509] {4,755}	198,913 (39,783) [9,548] {4,774}
Sarasota	87,976	87,976	87,976	87,976	88,493 (17,699) [4,248] {2,124}	88,984 (17,797) [4,271] {2,136}	89,446 (17,889) [4,293] {2,147}
Seminole	101,526	101,526	101,526	101,526	101,963 (20,393) [4,894] {2,447}	102,382 (20,476) [4,914] {2,457}	102,778 (20,556) [4,933] {2,467}
St. Johns	61,909	61,909	61,909	61,909	62,305 (12,461) [2,991] {1,495}	62,680 (12,536) [3,009] {1,504}	63,037 (12,607) [3,026] {1,513}
Sumter	20,907	20,907	20,907	20,907	21,040 (4,208) [1,010] {505}	21,169 (4,234) [1,016] {508}	21,294 (4,259) [1,022] {511}
Volusia	114,594	114,594	114,594	114,594	115,307 (23,061) [5,535] {2,767}	116,002 (23,200) [5,568] {2,784}	116,680 (23,336) [5,601] {2,800}

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.