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

Date: 3/24/21

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 3/24/21 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.

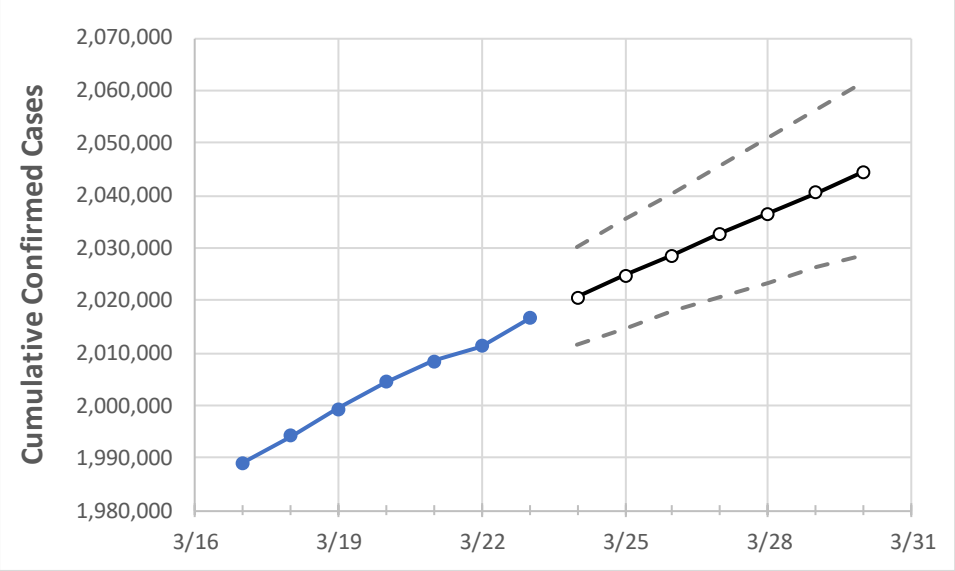
IEM's Modeling Lead

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:						
	3/20	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28	3/29	3/30
Florida	2,004,362	2,008,349	2,011,211	2,016,513	2,020,583	2,024,668	2,028,640	2,032,705	2,036,586	2,040,546	2,044,495

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:						
	3/20	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28	3/29	3/30
Alachua	22,994	23,015	23,039	23,068	23,095	23,122	23,147	23,172	23,198	23,223	23,248
Broward	207,580	208,096	208,462	209,170	209,744	210,303	210,856	211,408	211,958	212,501	213,046
Charlotte	11,155	11,187	11,209	11,241	11,268	11,295	11,322	11,350	11,377	11,405	11,433
Collier	31,697	31,736	31,763	31,857	31,922	31,985	32,049	32,113	32,176	32,241	32,302
Duval	91,342	91,450	91,536	91,651	91,757	91,861	91,963	92,065	92,166	92,265	92,359
Hillsborough	117,769	118,061	118,190	118,558	118,872	119,181	119,489	119,796	120,105	120,421	120,738
Lake	25,943	25,978	26,009	26,092	26,141	26,192	26,241	26,287	26,335	26,382	26,429
Lee	60,772	60,914	61,015	61,202	61,355	61,508	61,660	61,813	61,966	62,119	62,273
Manatee	33,763	33,832	33,905	34,036	34,118	34,197	34,274	34,351	34,428	34,504	34,583
Miami-Dade	433,452	434,352	435,135	436,394	437,405	438,381	439,388	440,368	441,346	442,301	443,251
Okaloosa	19,588	19,599	19,601	19,623	19,637	19,651	19,663	19,676	19,688	19,699	19,710
Orange	119,871	120,183	120,412	120,795	121,082	121,366	121,651	121,940	122,221	122,510	122,802
Osceola	38,577	38,661	38,723	38,843	38,924	39,007	39,088	39,172	39,256	39,337	39,416
Palm Beach	127,830	128,154	128,321	128,620	128,913	129,209	129,494	129,772	130,048	130,323	130,591
Pasco	35,248	35,336	35,373	35,492	35,578	35,661	35,745	35,827	35,910	35,991	36,074
Pinellas	70,089	70,251	70,382	70,580	70,748	70,911	71,076	71,237	71,391	71,553	71,714
Polk	59,654	59,767	59,834	59,991	60,095	60,197	60,299	60,400	60,499	60,599	60,697
Sarasota	28,399	28,455	28,515	28,592	28,657	28,724	28,790	28,857	28,924	28,990	29,055
Seminole	28,892	28,997	29,062	29,165	29,257	29,350	29,443	29,537	29,632	29,727	29,822
St. Johns	20,752	20,774	20,788	20,829	20,857	20,885	20,913	20,941	20,968	20,995	21,022
Sumter	8,489	8,501	8,518	8,562	8,583	8,605	8,626	8,647	8,668	8,690	8,710
Volusia	36,590	36,709	36,785	36,887	37,002	37,117	37,232	37,347	37,464	37,582	37,700

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:		
	3/20	3/21	3/22	3/23	3/25	3/27	3/29
Alachua	22,994	23,015	23,039	23,068	23,122 (4,624) [1,110] {555}	23,172 (4,634) [1,112] {556}	23,223 (4,645) [1,115] {557}
Broward	207,580	208,096	208,462	209,170	210,303 (42,061) [10,095] {5,047}	211,408 (42,282) [10,148] {5,074}	212,501 (42,500) [10,200] {5,100}
Charlotte	11,155	11,187	11,209	11,241	11,295 (2,259) [542] {271}	11,350 (2,270) [545] {272}	11,405 (2,281) [547] {274}
Collier	31,697	31,736	31,763	31,857	31,985 (6,397) [1,535] {768}	32,113 (6,423) [1,541] {771}	32,241 (6,448) [1,548] {774}
Duval	91,342	91,450	91,536	91,651	91,861 (18,372) [4,409] {2,205}	92,065 (18,413) [4,419] {2,210}	92,265 (18,453) [4,429] {2,214}
Hillsborough	117,769	118,061	118,190	118,558	119,181 (23,836) [5,721] {2,860}	119,796 (23,959) [5,750] {2,875}	120,421 (24,084) [5,780] {2,890}
Lake	25,943	25,978	26,009	26,092	26,192 (5,238) [1,257] {629}	26,287 (5,257) [1,262] {631}	26,382 (5,276) [1,266] {633}
Lee	60,772	60,914	61,015	61,202	61,508 (12,302) [2,952] {1,476}	61,813 (12,363) [2,967] {1,484}	62,119 (12,424) [2,982] {1,491}
Manatee	33,763	33,832	33,905	34,036	34,197 (6,839) [1,641] {821}	34,351 (6,870) [1,649] {824}	34,504 (6,901) [1,656] {828}
Miami-Dade	433,452	434,352	435,135	436,394	438,381 (87,676) [21,042] {10,521}	440,368 (88,074) [21,138] {10,569}	442,301 (88,460) [21,230] {10,615}
Okaloosa	19,588	19,599	19,601	19,623	19,651 (3,930) [943] {472}	19,676 (3,935) [944] {472}	19,699 (3,940) [946] {473}
Orange	119,871	120,183	120,412	120,795	121,366 (24,273) [5,826] {2,913}	121,940 (24,388) [5,853] {2,927}	122,510 (24,502) [5,881] {2,940}
Osceola	38,577	38,661	38,723	38,843	39,007 (7,801) [1,872] {936}	39,172 (7,834) [1,880] {940}	39,337 (7,867) [1,888] {944}
Palm Beach	127,830	128,154	128,321	128,620	129,209 (25,842) [6,202] {3,101}	129,772 (25,954) [6,229] {3,115}	130,323 (26,065) [6,256] {3,128}
Pasco	35,248	35,336	35,373	35,492	35,661 (7,132) [1,712] {856}	35,827 (7,165) [1,720] {860}	35,991 (7,198) [1,728] {864}
Pinellas	70,089	70,251	70,382	70,580	70,911 (14,182) [3,404] {1,702}	71,237 (14,247) [3,419] {1,710}	71,553 (14,311) [3,435] {1,717}
Polk	59,654	59,767	59,834	59,991	60,197 (12,039) [2,889] {1,445}	60,400 (12,080) [2,899] {1,450}	60,599 (12,120) [2,909] {1,454}
Sarasota	28,399	28,455	28,515	28,592	28,724 (5,745) [1,379] {689}	28,857 (5,771) [1,385] {693}	28,990 (5,798) [1,392] {696}
Seminole	28,892	28,997	29,062	29,165	29,350 (5,870) [1,409] {704}	29,537 (5,907) [1,418] {709}	29,727 (5,945) [1,427] {713}
St. Johns	20,752	20,774	20,788	20,829	20,885 (4,177) [1,002] {501}	20,941 (4,188) [1,005] {503}	20,995 (4,199) [1,008] {504}
Sumter	8,489	8,501	8,518	8,562	8,605 (1,721) [413] {207}	8,647 (1,729) [415] {208}	8,690 (1,738) [417] {209}
Volusia	36,590	36,709	36,785	36,887	37,117 (7,423) [1,782] {891}	37,347 (7,469) [1,793] {896}	37,582 (7,516) [1,804] {902}

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.