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

Date: 1/7/21

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 1/7/21 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.

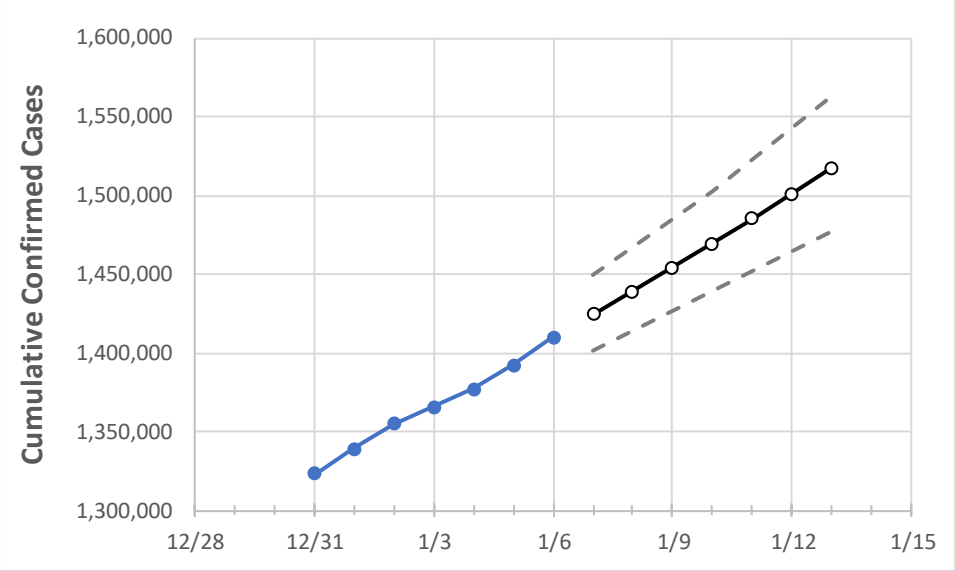
IEM's Modeling Lead

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:						
	1/3	1/4	1/5	1/6	1/7	1/8	1/9	1/10	1/11	1/12	1/13
Florida	1,365,436	1,376,692	1,392,123	1,409,906	1,424,543	1,439,172	1,454,217	1,469,394	1,485,039	1,501,108	1,517,596

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:						
	1/3	1/4	1/5	1/6	1/7	1/8	1/9	1/10	1/11	1/12	1/13
Alachua	16,335	16,437	16,585	16,804	16,945	17,089	17,236	17,382	17,532	17,689	17,851
Broward	141,010	141,993	143,186	144,590	145,737	146,923	148,133	149,367	150,597	151,853	153,124
Charlotte	7,727	7,807	7,880	8,029	8,128	8,232	8,334	8,437	8,544	8,653	8,760
Collier	23,070	23,197	23,323	23,502	23,673	23,847	24,021	24,194	24,377	24,556	24,738
Duval	63,743	64,225	65,556	66,647	67,485	68,349	69,250	70,149	71,082	72,032	72,996
Hillsborough	80,035	80,586	81,105	82,257	83,055	83,882	84,712	85,547	86,425	87,295	88,176
Lake	16,261	16,483	16,697	16,897	17,123	17,356	17,586	17,824	18,061	18,304	18,547
Lee	41,916	42,368	42,845	43,327	43,757	44,191	44,637	45,095	45,570	46,051	46,530
Manatee	22,920	23,044	23,338	23,690	23,915	24,146	24,368	24,607	24,844	25,092	25,349
Miami-Dade	305,734	308,259	311,606	314,742	317,385	320,102	322,839	325,627	328,472	331,341	334,251
Okaloosa	13,212	13,268	13,371	13,571	13,685	13,801	13,917	14,035	14,153	14,269	14,387
Orange	79,165	80,053	81,162	82,155	83,065	83,982	84,915	85,872	86,856	87,857	88,878
Osceola	26,223	26,550	26,727	27,113	27,354	27,603	27,858	28,113	28,367	28,636	28,901
Palm Beach	85,479	86,275	86,839	87,683	88,427	89,174	89,926	90,701	91,506	92,303	93,116
Pasco	22,879	23,082	23,258	23,606	23,854	24,105	24,354	24,602	24,853	25,109	25,360
Pinellas	46,860	47,207	47,739	48,273	48,756	49,253	49,750	50,255	50,753	51,268	51,794
Polk	38,843	39,268	39,739	40,361	40,879	41,413	41,972	42,536	43,107	43,711	44,334
Sarasota	19,271	19,409	19,787	20,190	20,444	20,707	20,985	21,266	21,553	21,852	22,168
Seminole	18,726	18,886	19,213	19,539	19,746	19,958	20,168	20,388	20,611	20,843	21,077
St. Johns	13,756	13,858	14,165	14,407	14,629	14,854	15,086	15,323	15,571	15,823	16,079
Sumter	5,350	5,403	5,508	5,634	5,732	5,833	5,936	6,042	6,153	6,270	6,388
Volusia	23,078	23,229	23,791	24,205	24,502	24,805	25,119	25,443	25,768	26,112	26,473

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:		
	1/3	1/4	1/5	1/6	1/8	1/10	1/12
Alachua	16,335	16,437	16,585	16,804	17,089 (3,418) [820] {410}	17,382 (3,476) [834] {417}	17,689 (3,538) [849] {425}
Broward	141,010	141,993	143,186	144,590	146,923 (29,385) [7,052] {3,526}	149,367 (29,873) [7,170] {3,585}	151,853 (30,371) [7,289] {3,644}
Charlotte	7,727	7,807	7,880	8,029	8,232 (1,646) [395] {198}	8,437 (1,687) [405] {202}	8,653 (1,731) [415] {208}
Collier	23,070	23,197	23,323	23,502	23,847 (4,769) [1,145] {572}	24,194 (4,839) [1,161] {581}	24,556 (4,911) [1,179] {589}
Duval	63,743	64,225	65,556	66,647	68,349 (13,670) [3,281] {1,640}	70,149 (14,030) [3,367] {1,684}	72,032 (14,406) [3,458] {1,729}
Hillsborough	80,035	80,586	81,105	82,257	83,882 (16,776) [4,026] {2,013}	85,547 (17,109) [4,106] {2,053}	87,295 (17,459) [4,190] {2,095}
Lake	16,261	16,483	16,697	16,897	17,356 (3,471) [833] {417}	17,824 (3,565) [856] {428}	18,304 (3,661) [879] {439}
Lee	41,916	42,368	42,845	43,327	44,191 (8,838) [2,121] {1,061}	45,095 (9,019) [2,165] {1,082}	46,051 (9,210) [2,210] {1,105}
Manatee	22,920	23,044	23,338	23,690	24,146 (4,829) [1,159] {580}	24,607 (4,921) [1,181] {591}	25,092 (5,018) [1,204] {602}
Miami-Dade	305,734	308,259	311,606	314,742	320,102 (64,020) [15,365] {7,682}	325,627 (65,125) [15,630] {7,815}	331,341 (66,268) [15,904] {7,952}
Okaloosa	13,212	13,268	13,371	13,571	13,801 (2,760) [662] {331}	14,035 (2,807) [674] {337}	14,269 (2,854) [685] {342}
Orange	79,165	80,053	81,162	82,155	83,982 (16,796) [4,031] {2,016}	85,872 (17,174) [4,122] {2,061}	87,857 (17,571) [4,217] {2,109}
Osceola	26,223	26,550	26,727	27,113	27,603 (5,521) [1,325] {662}	28,113 (5,623) [1,349] {675}	28,636 (5,727) [1,375] {687}
Palm Beach	85,479	86,275	86,839	87,683	89,174 (17,835) [4,280] {2,140}	90,701 (18,140) [4,354] {2,177}	92,303 (18,461) [4,431] {2,215}
Pasco	22,879	23,082	23,258	23,606	24,105 (4,821) [1,157] {579}	24,602 (4,920) [1,181] {590}	25,109 (5,022) [1,205] {603}
Pinellas	46,860	47,207	47,739	48,273	49,253 (9,851) [2,364] {1,182}	50,255 (10,051) [2,412] {1,206}	51,268 (10,254) [2,461] {1,230}
Polk	38,843	39,268	39,739	40,361	41,413 (8,283) [1,988] {994}	42,536 (8,507) [2,042] {1,021}	43,711 (8,742) [2,098] {1,049}
Sarasota	19,271	19,409	19,787	20,190	20,707 (4,141) [994] {497}	21,266 (4,253) [1,021] {510}	21,852 (4,370) [1,049] {524}
Seminole	18,726	18,886	19,213	19,539	19,958 (3,992) [958] {479}	20,388 (4,078) [979] {489}	20,843 (4,169) [1,000] {500}
St. Johns	13,756	13,858	14,165	14,407	14,854 (2,971) [713] {356}	15,323 (3,065) [736] {368}	15,823 (3,165) [760] {380}
Sumter	5,350	5,403	5,508	5,634	5,833 (1,167) [280] {140}	6,042 (1,208) [290] {145}	6,270 (1,254) [301] {150}
Volusia	23,078	23,229	23,791	24,205	24,805 (4,961) [1,191] {595}	25,443 (5,089) [1,221] {611}	26,112 (5,222) [1,253] {627}

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.