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

Date: 4/19/21

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 4/19/21 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.

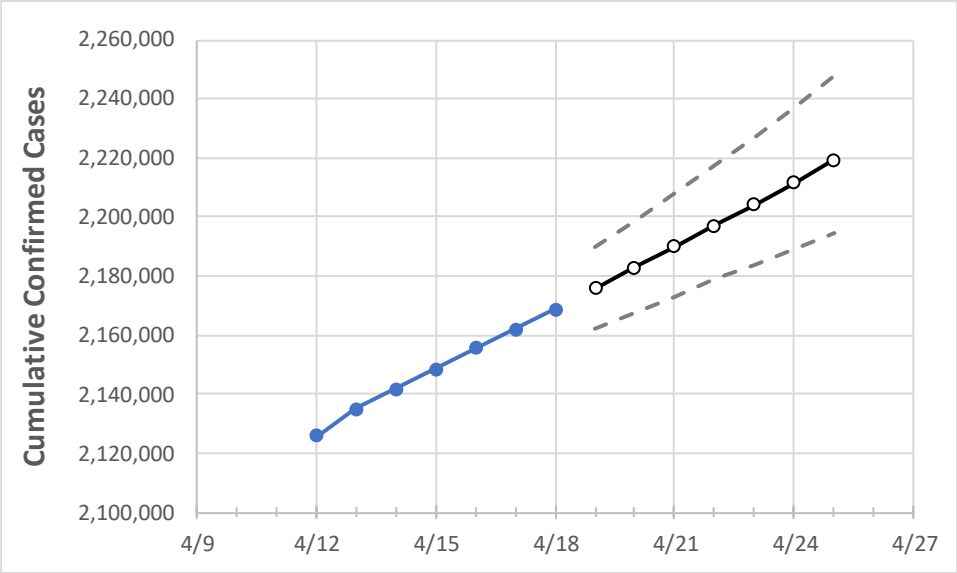
IEM's Modeling Lead

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:						
	4/15	4/16	4/17	4/18	4/19	4/20	4/21	4/22	4/23	4/24	4/25
Florida	2,148,448	2,155,744	2,162,067	2,168,901	2,175,813	2,182,831	2,189,980	2,197,068	2,204,298	2,211,747	2,219,324

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:						
	4/15	4/16	4/17	4/18	4/19	4/20	4/21	4/22	4/23	4/24	4/25
Alachua	24,021	24,072	24,110	24,151	24,195	24,237	24,280	24,322	24,367	24,412	24,457
Broward	226,054	226,990	227,738	228,502	229,309	230,132	230,958	231,800	232,620	233,472	234,303
Charlotte	12,227	12,272	12,297	12,331	12,369	12,406	12,443	12,479	12,515	12,551	12,586
Collier	34,006	34,138	34,223	34,321	34,429	34,540	34,652	34,765	34,877	34,992	35,107
Duval	94,802	94,984	95,143	95,314	95,505	95,701	95,900	96,105	96,313	96,531	96,753
Hillsborough	128,503	129,041	129,549	130,034	130,580	131,142	131,715	132,290	132,891	133,486	134,104
Lake	28,022	28,118	28,213	28,317	28,428	28,542	28,660	28,780	28,902	29,030	29,158
Lee	65,791	66,058	66,301	66,554	66,787	67,021	67,263	67,491	67,734	67,989	68,247
Manatee	36,505	36,646	36,768	36,883	37,014	37,150	37,287	37,432	37,576	37,723	37,874
Miami-Dade	466,000	467,464	468,908	470,668	472,206	473,754	475,318	476,896	478,554	480,184	481,839
Okaloosa	20,069	20,103	20,114	20,151	20,183	20,217	20,253	20,290	20,328	20,368	20,409
Orange	130,366	130,889	131,312	131,738	132,244	132,772	133,307	133,868	134,426	135,000	135,589
Osceola	41,829	41,984	42,145	42,317	42,506	42,698	42,896	43,100	43,309	43,522	43,745
Palm Beach	137,552	138,063	138,476	138,967	139,411	139,852	140,295	140,743	141,200	141,659	142,121
Pasco	38,522	38,721	38,883	39,036	39,214	39,391	39,579	39,766	39,951	40,142	40,338
Pinellas	75,873	76,172	76,425	76,637	76,891	77,150	77,410	77,666	77,929	78,200	78,462
Polk	64,189	64,447	64,706	64,922	65,196	65,476	65,767	66,065	66,371	66,689	67,011
Sarasota	30,986	31,104	31,236	31,387	31,512	31,639	31,765	31,894	32,028	32,158	32,289
Seminole	31,853	32,006	32,131	32,284	32,433	32,586	32,745	32,905	33,066	33,232	33,397
St. Johns	21,808	21,848	21,893	21,947	21,989	22,031	22,073	22,115	22,159	22,203	22,244
Sumter	9,048	9,070	9,084	9,093	9,106	9,120	9,133	9,146	9,160	9,172	9,185
Volusia	40,741	40,929	41,080	41,255	41,439	41,630	41,821	42,013	42,202	42,401	42,598

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:		
	4/15	4/16	4/17	4/18	4/20	4/22	4/24
Alachua	24,021	24,072	24,110	24,151	24,237 (4,847) [1,163] {582}	24,322 (4,864) [1,167] {584}	24,412 (4,882) [1,172] {586}
Broward	226,054	226,990	227,738	228,502	230,132 (46,026) [11,046] {5,523}	231,800 (46,360) [11,126] {5,563}	233,472 (46,694) [11,207] {5,603}
Charlotte	12,227	12,272	12,297	12,331	12,406 (2,481) [595] {298}	12,479 (2,496) [599] {299}	12,551 (2,510) [602] {301}
Collier	34,006	34,138	34,223	34,321	34,540 (6,908) [1,658] {829}	34,765 (6,953) [1,669] {834}	34,992 (6,998) [1,680] {840}
Duval	94,802	94,984	95,143	95,314	95,701 (19,140) [4,594] {2,297}	96,105 (19,221) [4,613] {2,307}	96,531 (19,306) [4,633] {2,317}
Hillsborough	128,503	129,041	129,549	130,034	131,142 (26,228) [6,295] {3,147}	132,290 (26,458) [6,350] {3,175}	133,486 (26,697) [6,407] {3,204}
Lake	28,022	28,118	28,213	28,317	28,542 (5,708) [1,370] {685}	28,780 (5,756) [1,381] {691}	29,030 (5,806) [1,393] {697}
Lee	65,791	66,058	66,301	66,554	67,021 (13,404) [3,217] {1,609}	67,491 (13,498) [3,240] {1,620}	67,989 (13,598) [3,263] {1,632}
Manatee	36,505	36,646	36,768	36,883	37,150 (7,430) [1,783] {892}	37,432 (7,486) [1,797] {898}	37,723 (7,545) [1,811] {905}
Miami-Dade	466,000	467,464	468,908	470,668	473,754 (94,751) [22,740] {11,370}	476,896 (95,379) [22,891] {11,446}	480,184 (96,037) [23,049] {11,524}
Okaloosa	20,069	20,103	20,114	20,151	20,217 (4,043) [970] {485}	20,290 (4,058) [974] {487}	20,368 (4,074) [978] {489}
Orange	130,366	130,889	131,312	131,738	132,772 (26,554) [6,373] {3,187}	133,868 (26,774) [6,426] {3,213}	135,000 (27,000) [6,480] {3,240}
Osceola	41,829	41,984	42,145	42,317	42,698 (8,540) [2,049] {1,025}	43,100 (8,620) [2,069] {1,034}	43,522 (8,704) [2,089] {1,045}
Palm Beach	137,552	138,063	138,476	138,967	139,852 (27,970) [6,713] {3,356}	140,743 (28,149) [6,756] {3,378}	141,659 (28,332) [6,800] {3,400}
Pasco	38,522	38,721	38,883	39,036	39,391 (7,878) [1,891] {945}	39,766 (7,953) [1,909] {954}	40,142 (8,028) [1,927] {963}
Pinellas	75,873	76,172	76,425	76,637	77,150 (15,430) [3,703] {1,852}	77,666 (15,533) [3,728] {1,864}	78,200 (15,640) [3,754] {1,877}
Polk	64,189	64,447	64,706	64,922	65,476 (13,095) [3,143] {1,571}	66,065 (13,213) [3,171] {1,586}	66,689 (13,338) [3,201] {1,601}
Sarasota	30,986	31,104	31,236	31,387	31,639 (6,328) [1,519] {759}	31,894 (6,379) [1,531] {765}	32,158 (6,432) [1,544] {772}
Seminole	31,853	32,006	32,131	32,284	32,586 (6,517) [1,564] {782}	32,905 (6,581) [1,579] {790}	33,232 (6,646) [1,595] {798}
St. Johns	21,808	21,848	21,893	21,947	22,031 (4,406) [1,057] {529}	22,115 (4,423) [1,062] {531}	22,203 (4,441) [1,066] {533}
Sumter	9,048	9,070	9,084	9,093	9,120 (1,824) [438] {219}	9,146 (1,829) [439] {220}	9,172 (1,834) [440] {220}
Volusia	40,741	40,929	41,080	41,255	41,630 (8,326) [1,998] {999}	42,013 (8,403) [2,017] {1,008}	42,401 (8,480) [2,035] {1,018}

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.