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

Date: 4/13/21

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 4/13/21 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.

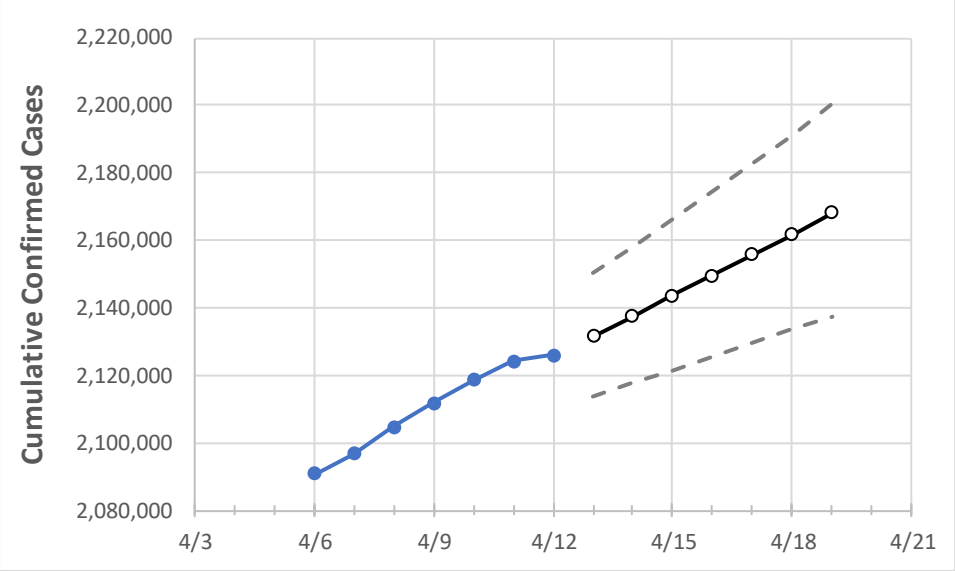
IEM's Modeling Lead

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:						
	4/9	4/10	4/11	4/12	4/13	4/14	4/15	4/16	4/17	4/18	4/19
Florida	2,111,807	2,118,713	2,124,233	2,125,846	2,131,702	2,137,603	2,143,656	2,149,707	2,155,808	2,161,869	2,168,088

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:						
	4/9	4/10	4/11	4/12	4/13	4/14	4/15	4/16	4/17	4/18	4/19
Alachua	23,788	23,844	23,879	23,887	23,933	23,978	24,024	24,072	24,119	24,166	24,214
Broward	221,623	222,445	223,152	223,356	224,102	224,839	225,587	226,326	227,069	227,819	228,561
Charlotte	11,982	12,034	12,075	12,085	12,133	12,182	12,232	12,281	12,332	12,384	12,435
Collier	33,404	33,548	33,644	33,654	33,757	33,862	33,970	34,079	34,187	34,296	34,407
Duval	93,818	93,966	94,128	94,183	94,323	94,462	94,603	94,747	94,896	95,042	95,189
Hillsborough	125,684	126,165	126,600	126,721	127,156	127,604	128,055	128,511	128,965	129,430	129,891
Lake	27,447	27,557	27,632	27,654	27,741	27,828	27,917	28,006	28,098	28,191	28,283
Lee	64,424	64,693	64,915	64,922	65,116	65,314	65,512	65,709	65,906	66,104	66,306
Manatee	35,788	35,917	36,024	36,038	36,140	36,243	36,346	36,450	36,555	36,658	36,762
Miami-Dade	457,918	459,493	460,653	461,041	462,423	463,790	465,143	466,530	467,894	469,293	470,700
Okaloosa	19,904	19,942	19,954	19,961	19,977	19,992	20,008	20,024	20,040	20,056	20,072
Orange	127,691	128,195	128,564	128,700	129,133	129,567	130,004	130,447	130,909	131,370	131,836
Osceola	40,844	41,004	41,144	41,191	41,333	41,480	41,631	41,782	41,935	42,091	42,252
Palm Beach	135,324	135,758	136,108	136,206	136,592	136,972	137,353	137,745	138,128	138,517	138,908
Pasco	37,618	37,783	37,924	37,975	38,120	38,265	38,413	38,562	38,717	38,874	39,032
Pinellas	74,455	74,799	75,056	75,108	75,367	75,627	75,895	76,166	76,438	76,711	76,988
Polk	62,807	63,044	63,240	63,319	63,515	63,714	63,914	64,117	64,326	64,532	64,746
Sarasota	30,385	30,505	30,608	30,637	30,753	30,869	30,986	31,107	31,231	31,352	31,479
Seminole	31,066	31,220	31,317	31,342	31,451	31,562	31,673	31,785	31,899	32,008	32,121
St. Johns	21,550	21,610	21,643	21,652	21,701	21,749	21,798	21,846	21,896	21,947	21,998
Sumter	8,956	8,971	8,988	8,990	9,003	9,016	9,028	9,040	9,052	9,063	9,074
Volusia	39,709	39,893	40,065	40,094	40,250	40,410	40,566	40,726	40,885	41,042	41,200

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:		
	4/9	4/10	4/11	4/12	4/14	4/16	4/18
Alachua	23,788	23,844	23,879	23,887	23,978 (4,796) [1,151] {575}	24,072 (4,814) [1,155] {578}	24,166 (4,833) [1,160] {580}
Broward	221,623	222,445	223,152	223,356	224,839 (44,968) [10,792] {5,396}	226,326 (45,265) [10,864] {5,432}	227,819 (45,564) [10,935] {5,468}
Charlotte	11,982	12,034	12,075	12,085	12,182 (2,436) [585] {292}	12,281 (2,456) [589] {295}	12,384 (2,477) [594] {297}
Collier	33,404	33,548	33,644	33,654	33,862 (6,772) [1,625] {813}	34,079 (6,816) [1,636] {818}	34,296 (6,859) [1,646] {823}
Duval	93,818	93,966	94,128	94,183	94,462 (18,892) [4,534] {2,267}	94,747 (18,949) [4,548] {2,274}	95,042 (19,008) [4,562] {2,281}
Hillsborough	125,684	126,165	126,600	126,721	127,604 (25,521) [6,125] {3,063}	128,511 (25,702) [6,169] {3,084}	129,430 (25,886) [6,213] {3,106}
Lake	27,447	27,557	27,632	27,654	27,828 (5,566) [1,336] {668}	28,006 (5,601) [1,344] {672}	28,191 (5,638) [1,353] {677}
Lee	64,424	64,693	64,915	64,922	65,314 (13,063) [3,135] {1,568}	65,709 (13,142) [3,154] {1,577}	66,104 (13,221) [3,173] {1,586}
Manatee	35,788	35,917	36,024	36,038	36,243 (7,249) [1,740] {870}	36,450 (7,290) [1,750] {875}	36,658 (7,332) [1,760] {880}
Miami-Dade	457,918	459,493	460,653	461,041	463,790 (92,758) [22,262] {11,131}	466,530 (93,306) [22,393] {11,197}	469,293 (93,859) [22,526] {11,263}
Okaloosa	19,904	19,942	19,954	19,961	19,992 (3,998) [960] {480}	20,024 (4,005) [961] {481}	20,056 (4,011) [963] {481}
Orange	127,691	128,195	128,564	128,700	129,567 (25,913) [6,219] {3,110}	130,447 (26,089) [6,261] {3,131}	131,370 (26,274) [6,306] {3,153}
Osceola	40,844	41,004	41,144	41,191	41,480 (8,296) [1,991] {996}	41,782 (8,356) [2,006] {1,003}	42,091 (8,418) [2,020] {1,010}
Palm Beach	135,324	135,758	136,108	136,206	136,972 (27,394) [6,575] {3,287}	137,745 (27,549) [6,612] {3,306}	138,517 (27,703) [6,649] {3,324}
Pasco	37,618	37,783	37,924	37,975	38,265 (7,653) [1,837] {918}	38,562 (7,712) [1,851] {925}	38,874 (7,775) [1,866] {933}
Pinellas	74,455	74,799	75,056	75,108	75,627 (15,125) [3,630] {1,815}	76,166 (15,233) [3,656] {1,828}	76,711 (15,342) [3,682] {1,841}
Polk	62,807	63,044	63,240	63,319	63,714 (12,743) [3,058] {1,529}	64,117 (12,823) [3,078] {1,539}	64,532 (12,906) [3,098] {1,549}
Sarasota	30,385	30,505	30,608	30,637	30,869 (6,174) [1,482] {741}	31,107 (6,221) [1,493] {747}	31,352 (6,270) [1,505] {752}
Seminole	31,066	31,220	31,317	31,342	31,562 (6,312) [1,515] {757}	31,785 (6,357) [1,526] {763}	32,008 (6,402) [1,536] {768}
St. Johns	21,550	21,610	21,643	21,652	21,749 (4,350) [1,044] {522}	21,846 (4,369) [1,049] {524}	21,947 (4,389) [1,053] {527}
Sumter	8,956	8,971	8,988	8,990	9,016 (1,803) [433] {216}	9,040 (1,808) [434] {217}	9,063 (1,813) [435] {218}
Volusia	39,709	39,893	40,065	40,094	40,410 (8,082) [1,940] {970}	40,726 (8,145) [1,955] {977}	41,042 (8,208) [1,970] {985}

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.