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

Date: 4/7/21

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 4/7/21 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.

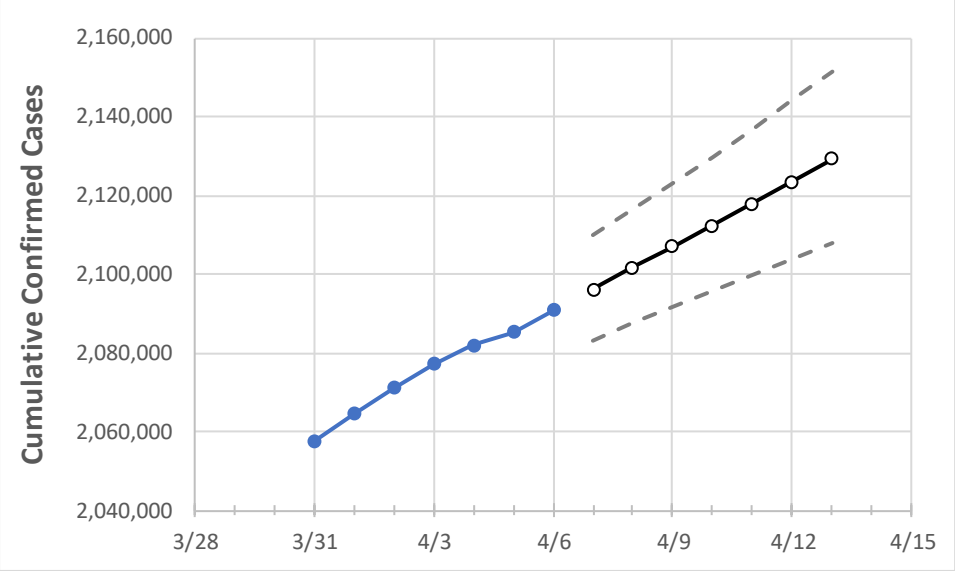
IEM's Modeling Lead

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:						
	4/3	4/4	4/5	4/6	4/7	4/8	4/9	4/10	4/11	4/12	4/13
Florida	2,077,032	2,081,826	2,085,306	2,090,862	2,096,231	2,101,635	2,107,010	2,112,438	2,117,854	2,123,548	2,129,241

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:						
	4/3	4/4	4/5	4/6	4/7	4/8	4/9	4/10	4/11	4/12	4/13
Alachua	23,559	23,588	23,611	23,645	23,688	23,734	23,780	23,827	23,874	23,923	23,971
Broward	217,060	217,780	218,184	218,973	219,704	220,446	221,157	221,889	222,625	223,372	224,142
Charlotte	11,714	11,766	11,796	11,842	11,895	11,948	12,004	12,061	12,122	12,184	12,247
Collier	32,836	32,927	32,967	33,074	33,166	33,261	33,355	33,452	33,548	33,645	33,746
Duval	92,993	93,097	93,200	93,290	93,402	93,516	93,630	93,743	93,856	93,969	94,081
Hillsborough	123,169	123,479	123,770	124,167	124,585	125,003	125,437	125,861	126,299	126,742	127,173
Lake	26,924	26,983	27,028	27,081	27,149	27,219	27,288	27,357	27,426	27,494	27,562
Lee	63,334	63,512	63,572	63,774	63,958	64,144	64,334	64,521	64,710	64,898	65,083
Manatee	35,161	35,249	35,280	35,411	35,511	35,609	35,707	35,807	35,909	36,008	36,108
Miami-Dade	449,891	451,019	451,829	453,345	454,608	455,885	457,181	458,475	459,781	461,106	462,421
Okaloosa	19,799	19,809	19,816	19,834	19,845	19,857	19,867	19,878	19,888	19,898	19,908
Orange	125,108	125,414	125,661	126,044	126,447	126,856	127,272	127,689	128,115	128,554	128,992
Osceola	40,024	40,121	40,214	40,362	40,481	40,603	40,725	40,850	40,977	41,104	41,233
Palm Beach	132,961	133,286	133,571	133,836	134,195	134,553	134,908	135,266	135,623	135,990	136,350
Pasco	36,787	36,906	37,013	37,136	37,264	37,396	37,527	37,661	37,798	37,934	38,067
Pinellas	73,080	73,290	73,429	73,591	73,818	74,044	74,273	74,506	74,736	74,964	75,203
Polk	61,747	61,888	61,995	62,197	62,365	62,538	62,707	62,881	63,059	63,237	63,420
Sarasota	29,679	29,766	29,846	29,929	30,030	30,135	30,239	30,344	30,452	30,559	30,668
Seminole	30,410	30,495	30,570	30,642	30,753	30,862	30,974	31,090	31,200	31,312	31,427
St. Johns	21,294	21,337	21,362	21,394	21,452	21,510	21,571	21,632	21,695	21,760	21,825
Sumter	8,852	8,868	8,880	8,886	8,906	8,924	8,943	8,961	8,979	8,996	9,014
Volusia	38,819	38,939	39,045	39,120	39,290	39,461	39,634	39,806	39,978	40,152	40,323

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:		
	4/3	4/4	4/5	4/6	4/8	4/10	4/12
Alachua	23,559	23,588	23,611	23,645	23,734 (4,747) [1,139] {570}	23,827 (4,765) [1,144] {572}	23,923 (4,785) [1,148] {574}
Broward	217,060	217,780	218,184	218,973	220,446 (44,089) [10,581] {5,291}	221,889 (44,378) [10,651] {5,325}	223,372 (44,674) [10,722] {5,361}
Charlotte	11,714	11,766	11,796	11,842	11,948 (2,390) [574] {287}	12,061 (2,412) [579] {289}	12,184 (2,437) [585] {292}
Collier	32,836	32,927	32,967	33,074	33,261 (6,652) [1,597] {798}	33,452 (6,690) [1,606] {803}	33,645 (6,729) [1,615] {807}
Duval	92,993	93,097	93,200	93,290	93,516 (18,703) [4,489] {2,244}	93,743 (18,749) [4,500] {2,250}	93,969 (18,794) [4,510] {2,255}
Hillsborough	123,169	123,479	123,770	124,167	125,003 (25,001) [6,000] {3,000}	125,861 (25,172) [6,041] {3,021}	126,742 (25,348) [6,084] {3,042}
Lake	26,924	26,983	27,028	27,081	27,219 (5,444) [1,306] {653}	27,357 (5,471) [1,313] {657}	27,494 (5,499) [1,320] {660}
Lee	63,334	63,512	63,572	63,774	64,144 (12,829) [3,079] {1,539}	64,521 (12,904) [3,097] {1,549}	64,898 (12,980) [3,115] {1,558}
Manatee	35,161	35,249	35,280	35,411	35,609 (7,122) [1,709] {855}	35,807 (7,161) [1,719] {859}	36,008 (7,202) [1,728] {864}
Miami-Dade	449,891	451,019	451,829	453,345	455,885 (91,177) [21,882] {10,941}	458,475 (91,695) [22,007] {11,003}	461,106 (92,221) [22,133] {11,067}
Okaloosa	19,799	19,809	19,816	19,834	19,857 (3,971) [953] {477}	19,878 (3,976) [954] {477}	19,898 (3,980) [955] {478}
Orange	125,108	125,414	125,661	126,044	126,856 (25,371) [6,089] {3,045}	127,689 (25,538) [6,129] {3,065}	128,554 (25,711) [6,171] {3,085}
Osceola	40,024	40,121	40,214	40,362	40,603 (8,121) [1,949] {974}	40,850 (8,170) [1,961] {980}	41,104 (8,221) [1,973] {986}
Palm Beach	132,961	133,286	133,571	133,836	134,553 (26,911) [6,459] {3,229}	135,266 (27,053) [6,493] {3,246}	135,990 (27,198) [6,528] {3,264}
Pasco	36,787	36,906	37,013	37,136	37,396 (7,479) [1,795] {897}	37,661 (7,532) [1,808] {904}	37,934 (7,587) [1,821] {910}
Pinellas	73,080	73,290	73,429	73,591	74,044 (14,809) [3,554] {1,777}	74,506 (14,901) [3,576] {1,788}	74,964 (14,993) [3,598] {1,799}
Polk	61,747	61,888	61,995	62,197	62,538 (12,508) [3,002] {1,501}	62,881 (12,576) [3,018] {1,509}	63,237 (12,647) [3,035] {1,518}
Sarasota	29,679	29,766	29,846	29,929	30,135 (6,027) [1,446] {723}	30,344 (6,069) [1,457] {728}	30,559 (6,112) [1,467] {733}
Seminole	30,410	30,495	30,570	30,642	30,862 (6,172) [1,481] {741}	31,090 (6,218) [1,492] {746}	31,312 (6,262) [1,503] {751}
St. Johns	21,294	21,337	21,362	21,394	21,510 (4,302) [1,032] {516}	21,632 (4,326) [1,038] {519}	21,760 (4,352) [1,044] {522}
Sumter	8,852	8,868	8,880	8,886	8,924 (1,785) [428] {214}	8,961 (1,792) [430] {215}	8,996 (1,799) [432] {216}
Volusia	38,819	38,939	39,045	39,120	39,461 (7,892) [1,894] {947}	39,806 (7,961) [1,911] {955}	40,152 (8,030) [1,927] {964}

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.