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

Date: 4/9/21

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 4/9/21 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.

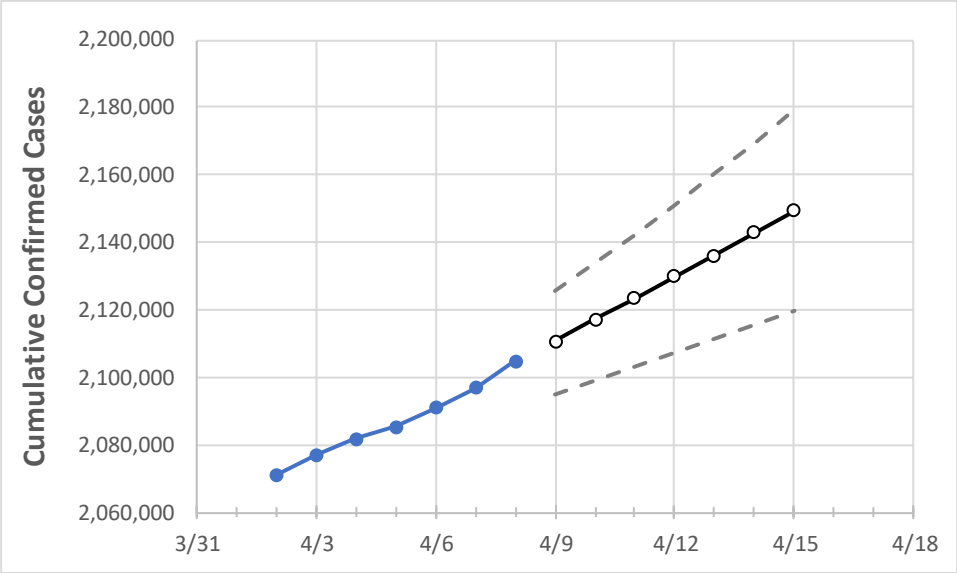
IEM's Modeling Lead

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:						
	4/5	4/6	4/7	4/8	4/9	4/10	4/11	4/12	4/13	4/14	4/15
Florida	2,085,306	2,090,862	2,096,747	2,104,686	2,110,770	2,117,113	2,123,370	2,129,768	2,136,247	2,142,888	2,149,439

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:						
	4/5	4/6	4/7	4/8	4/9	4/10	4/11	4/12	4/13	4/14	4/15
Alachua	23,611	23,645	23,674	23,734	23,780	23,828	23,876	23,925	23,975	24,027	24,079
Broward	218,184	218,973	219,792	220,739	221,542	222,351	223,170	224,001	224,841	225,682	226,539
Charlotte	11,796	11,842	11,882	11,933	11,986	12,039	12,093	12,149	12,207	12,266	12,326
Collier	32,967	33,074	33,179	33,310	33,419	33,531	33,646	33,762	33,878	33,998	34,122
Duval	93,200	93,290	93,426	93,616	93,746	93,878	94,010	94,144	94,281	94,419	94,564
Hillsborough	123,770	124,167	124,636	125,180	125,645	126,120	126,600	127,094	127,594	128,091	128,605
Lake	27,028	27,081	27,173	27,321	27,401	27,482	27,566	27,648	27,731	27,817	27,905
Lee	63,572	63,774	63,957	64,206	64,404	64,601	64,801	65,004	65,205	65,408	65,613
Manatee	35,280	35,411	35,534	35,665	35,770	35,876	35,984	36,095	36,206	36,316	36,428
Miami-Dade	451,829	453,345	454,405	456,317	457,683	459,079	460,477	461,920	463,382	464,881	466,339
Okaloosa	19,816	19,834	19,847	19,879	19,891	19,904	19,916	19,928	19,940	19,952	19,964
Orange	125,661	126,044	126,468	127,153	127,589	128,041	128,512	128,976	129,450	129,938	130,447
Osceola	40,214	40,362	40,496	40,666	40,809	40,956	41,110	41,265	41,426	41,594	41,766
Palm Beach	133,571	133,836	134,337	134,854	135,240	135,633	136,031	136,429	136,832	137,239	137,652
Pasco	37,013	37,136	37,272	37,424	37,561	37,701	37,847	37,995	38,145	38,302	38,460
Pinellas	73,429	73,591	73,828	74,155	74,401	74,654	74,904	75,162	75,425	75,696	75,964
Polk	61,995	62,197	62,402	62,606	62,799	62,999	63,195	63,394	63,599	63,814	64,034
Sarasota	29,846	29,929	30,044	30,231	30,353	30,479	30,607	30,739	30,872	31,008	31,151
Seminole	30,570	30,642	30,759	30,915	31,028	31,141	31,252	31,364	31,478	31,586	31,700
St. Johns	21,362	21,394	21,431	21,507	21,565	21,624	21,685	21,744	21,807	21,870	21,934
Sumter	8,880	8,886	8,909	8,923	8,935	8,946	8,956	8,966	8,976	8,985	8,995
Volusia	39,045	39,120	39,322	39,538	39,712	39,890	40,067	40,247	40,427	40,610	40,797

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:		
	4/5	4/6	4/7	4/8	4/10	4/12	4/14
Alachua	23,611	23,645	23,674	23,734	23,828 (4,766) [1,144] {572}	23,925 (4,785) [1,148] {574}	24,027 (4,805) [1,153] {577}
Broward	218,184	218,973	219,792	220,739	222,351 (44,470) [10,673] {5,336}	224,001 (44,800) [10,752] {5,376}	225,682 (45,136) [10,833] {5,416}
Charlotte	11,796	11,842	11,882	11,933	12,039 (2,408) [578] {289}	12,149 (2,430) [583] {292}	12,266 (2,453) [589] {294}
Collier	32,967	33,074	33,179	33,310	33,531 (6,706) [1,609] {805}	33,762 (6,752) [1,621] {810}	33,998 (6,800) [1,632] {816}
Duval	93,200	93,290	93,426	93,616	93,878 (18,776) [4,506] {2,253}	94,144 (18,829) [4,519] {2,259}	94,419 (18,884) [4,532] {2,266}
Hillsborough	123,770	124,167	124,636	125,180	126,120 (25,224) [6,054] {3,027}	127,094 (25,419) [6,101] {3,050}	128,091 (25,618) [6,148] {3,074}
Lake	27,028	27,081	27,173	27,321	27,482 (5,496) [1,319] {660}	27,648 (5,530) [1,327] {664}	27,817 (5,563) [1,335] {668}
Lee	63,572	63,774	63,957	64,206	64,601 (12,920) [3,101] {1,550}	65,004 (13,001) [3,120] {1,560}	65,408 (13,082) [3,140] {1,570}
Manatee	35,280	35,411	35,534	35,665	35,876 (7,175) [1,722] {861}	36,095 (7,219) [1,733] {866}	36,316 (7,263) [1,743] {872}
Miami-Dade	451,829	453,345	454,405	456,317	459,079 (91,816) [22,036] {11,018}	461,920 (92,384) [22,172] {11,086}	464,881 (92,976) [22,314] {11,157}
Okaloosa	19,816	19,834	19,847	19,879	19,904 (3,981) [955] {478}	19,928 (3,986) [957] {478}	19,952 (3,990) [958] {479}
Orange	125,661	126,044	126,468	127,153	128,041 (25,608) [6,146] {3,073}	128,976 (25,795) [6,191] {3,095}	129,938 (25,988) [6,237] {3,119}
Osceola	40,214	40,362	40,496	40,666	40,956 (8,191) [1,966] {983}	41,265 (8,253) [1,981] {990}	41,594 (8,319) [1,996] {998}
Palm Beach	133,571	133,836	134,337	134,854	135,633 (27,127) [6,510] {3,255}	136,429 (27,286) [6,549] {3,274}	137,239 (27,448) [6,587] {3,294}
Pasco	37,013	37,136	37,272	37,424	37,701 (7,540) [1,810] {905}	37,995 (7,599) [1,824] {912}	38,302 (7,660) [1,838] {919}
Pinellas	73,429	73,591	73,828	74,155	74,654 (14,931) [3,583] {1,792}	75,162 (15,032) [3,608] {1,804}	75,696 (15,139) [3,633] {1,817}
Polk	61,995	62,197	62,402	62,606	62,999 (12,600) [3,024] {1,512}	63,394 (12,679) [3,043] {1,521}	63,814 (12,763) [3,063] {1,532}
Sarasota	29,846	29,929	30,044	30,231	30,479 (6,096) [1,463] {731}	30,739 (6,148) [1,475] {738}	31,008 (6,202) [1,488] {744}
Seminole	30,570	30,642	30,759	30,915	31,141 (6,228) [1,495] {747}	31,364 (6,273) [1,505] {753}	31,586 (6,317) [1,516] {758}
St. Johns	21,362	21,394	21,431	21,507	21,624 (4,325) [1,038] {519}	21,744 (4,349) [1,044] {522}	21,870 (4,374) [1,050] {525}
Sumter	8,880	8,886	8,909	8,923	8,946 (1,789) [429] {215}	8,966 (1,793) [430] {215}	8,985 (1,797) [431] {216}
Volusia	39,045	39,120	39,322	39,538	39,890 (7,978) [1,915] {957}	40,247 (8,049) [1,932] {966}	40,610 (8,122) [1,949] {975}

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.