IEM's AI Modeling: Short-term COVID-19 Projections
Date: 4/5/21

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 <u>not</u> 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 4/5/21 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
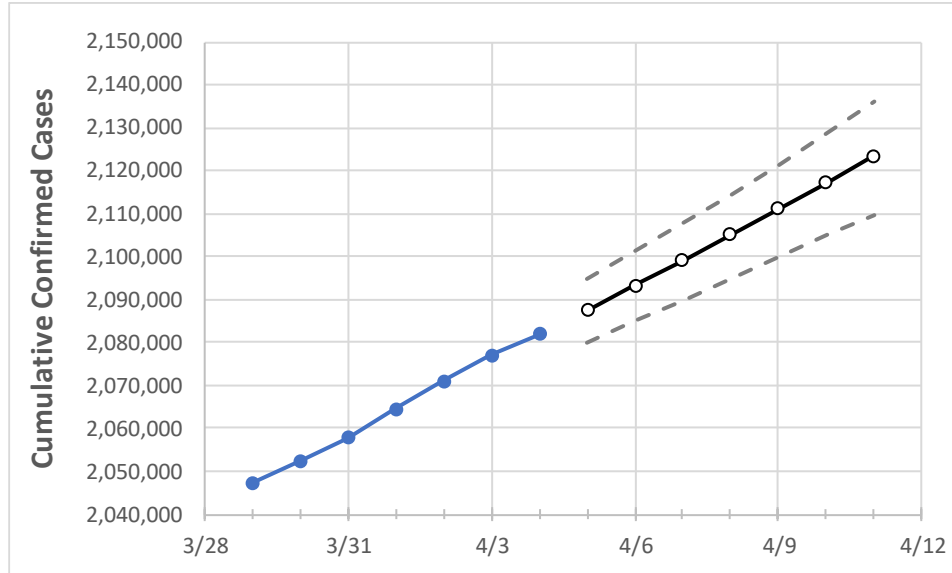
	Actual Confirmed Cases On:				Projected Cases For:						
	4/1	4/2	4/3	4/4	4/5	4/6	4/7	4/8	4/9	4/10	4/11
Florida	2,064,525	2,071,015	2,077,032	2,081,826	2,087,508	2,093,316	2,099,171	2,105,111	2,111,122	2,117,241	2,123,429

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:						
	4/1	4/2	4/3	4/4	4/5	4/6	4/7	4/8	4/9	4/10	4/11
Alachua	23,440	23,506	23,559	23,588	23,636	23,685	23,734	23,785	23,838	23,892	23,946
Broward	215,488	216,277	217,060	217,780	218,521	219,281	220,049	220,827	221,617	222,433	223,245
Charlotte	11,605	11,668	11,714	11,766	11,821	11,877	11,935	11,997	12,061	12,126	12,194
Collier	32,637	32,741	32,836	32,927	33,024	33,121	33,220	33,323	33,427	33,534	33,641
Duval	92,715	92,860	92,993	93,097	93,219	93,341	93,463	93,587	93,711	93,835	93,959
Hillsborough	122,188	122,713	123,169	123,479	123,896	124,326	124,767	125,215	125,672	126,124	126,570
Lake	26,776	26,862	26,924	26,983	27,058	27,131	27,206	27,282	27,358	27,436	27,514
Lee	62,902	63,130	63,334	63,512	63,718	63,927	64,139	64,354	64,574	64,795	65,021
Manatee	34,922	35,044	35,161	35,249	35,354	35,461	35,570	35,676	35,786	35,896	36,008
Miami-Dade	447,042	448,479	449,891	451,019	452,300	453,575	454,882	456,201	457,521	458,858	460,200
Okaloosa	19,771	19,786	19,799	19,809	19,820	19,831	19,842	19,852	19,862	19,871	19,881
Orange	124,227	124,687	125,108	125,414	125,846	126,279	126,723	127,173	127,640	128,116	128,595
Osceola	39,766	39,905	40,024	40,121	40,235	40,353	40,471	40,591	40,709	40,831	40,960
Palm Beach	132,098	132,528	132,961	133,286	133,671	134,058	134,454	134,855	135,250	135,661	136,077
Pasco	36,511	36,645	36,787	36,906	37,029	37,156	37,283	37,416	37,547	37,676	37,814
Pinellas	72,557	72,844	73,080	73,290	73,529	73,765	74,015	74,268	74,528	74,789	75,060
Polk	61,390	61,574	61,747	61,888	62,061	62,236	62,415	62,593	62,775	62,962	63,155
Sarasota	29,465	29,584	29,679	29,766	29,872	29,981	30,092	30,204	30,319	30,436	30,557
Seminole	30,154	30,303	30,410	30,495	30,612	30,733	30,856	30,981	31,102	31,226	31,354
St. Johns	21,217	21,245	21,294	21,337	21,400	21,467	21,538	21,610	21,684	21,762	21,842
Sumter	8,812	8,827	8,852	8,868	8,891	8,914	8,938	8,960	8,984	9,007	9,030
Volusia	38,413	38,634	38,819	38,939	39,126	39,318	39,512	39,713	39,917	40,125	40,334

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:		
	4/1	4/2	4/3	4/4	4/6	4/8	4/10
Alachua	23,440	23,506	23,559	23,588	23,685 (4,737) [1,137] {568}	23,785 (4,757) [1,142] {571}	23,892 (4,778) [1,147] {573}
Broward	215,488	216,277	217,060	217,780	219,281 (43,856) [10,525] {5,263}	220,827 (44,165) [10,600] {5,300}	222,433 (44,487) [10,677] {5,338}
Charlotte	11,605	11,668	11,714	11,766	11,877 (2,375) [570] {285}	11,997 (2,399) [576] {288}	12,126 (2,425) [582] {291}
Collier	32,637	32,741	32,836	32,927	33,121 (6,624) [1,590] {795}	33,323 (6,665) [1,599] {800}	33,534 (6,707) [1,610] {805}
Duval	92,715	92,860	92,993	93,097	93,341 (18,668) [4,480] {2,240}	93,587 (18,717) [4,492] {2,246}	93,835 (18,767) [4,504] {2,252}
Hillsborough	122,188	122,713	123,169	123,479	124,326 (24,865) [5,968] {2,984}	125,215 (25,043) [6,010] {3,005}	126,124 (25,225) [6,054] {3,027}
Lake	26,776	26,862	26,924	26,983	27,131 (5,426) [1,302] {651}	27,282 (5,456) [1,310] {655}	27,436 (5,487) [1,317] {658}
Lee	62,902	63,130	63,334	63,512	63,927 (12,785) [3,069] {1,534}	64,354 (12,871) [3,089] {1,545}	64,795 (12,959) [3,110] {1,555}
Manatee	34,922	35,044	35,161	35,249	35,461 (7,092) [1,702] {851}	35,676 (7,135) [1,712] {856}	35,896 (7,179) [1,723] {862}
Miami-Dade	447,042	448,479	449,891	451,019	453,575 (90,715) [21,772] {10,886}	456,201 (91,240) [21,898] {10,949}	458,858 (91,772) [22,025] {11,013}
Okaloosa	19,771	19,786	19,799	19,809	19,831 (3,966) [952] {476}	19,852 (3,970) [953] {476}	19,871 (3,974) [954] {477}
Orange	124,227	124,687	125,108	125,414	126,279 (25,256) [6,061] {3,031}	127,173 (25,435) [6,104] {3,052}	128,116 (25,623) [6,150] {3,075}
Osceola	39,766	39,905	40,024	40,121	40,353 (8,071) [1,937] {968}	40,591 (8,118) [1,948] {974}	40,831 (8,166) [1,960] {980}
Palm Beach	132,098	132,528	132,961	133,286	134,058 (26,812) [6,435] {3,217}	134,855 (26,971) [6,473] {3,237}	135,661 (27,132) [6,512] {3,256}
Pasco	36,511	36,645	36,787	36,906	37,156 (7,431) [1,784] {892}	37,416 (7,483) [1,796] {898}	37,676 (7,535) [1,808] {904}
Pinellas	72,557	72,844	73,080	73,290	73,765 (14,753) [3,541] {1,770}	74,268 (14,854) [3,565] {1,782}	74,789 (14,958) [3,590] {1,795}
Polk	61,390	61,574	61,747	61,888	62,236 (12,447) [2,987] {1,494}	62,593 (12,519) [3,004] {1,502}	62,962 (12,592) [3,022] {1,511}
Sarasota	29,465	29,584	29,679	29,766	29,981 (5,996) [1,439] {720}	30,204 (6,041) [1,450] {725}	30,436 (6,087) [1,461] {730}
Seminole	30,154	30,303	30,410	30,495	30,733 (6,147) [1,475] {738}	30,981 (6,196) [1,487] {744}	31,226 (6,245) [1,499] {749}
St. Johns	21,217	21,245	21,294	21,337	21,467 (4,293) [1,030] {515}	21,610 (4,322) [1,037] {519}	21,762 (4,352) [1,045] {522}
Sumter	8,812	8,827	8,852	8,868	8,914 (1,783) [428] {214}	8,960 (1,792) [430] {215}	9,007 (1,801) [432] {216}
Volusia	38,413	38,634	38,819	38,939	39,318 (7,864) [1,887] {944}	39,713 (7,943) [1,906] {953}	40,125 (8,025) [1,926] {963}

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.