IEM's AI Modeling: Short-term COVID-19 Projections
Date: 4/2/21

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 4/2/21 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
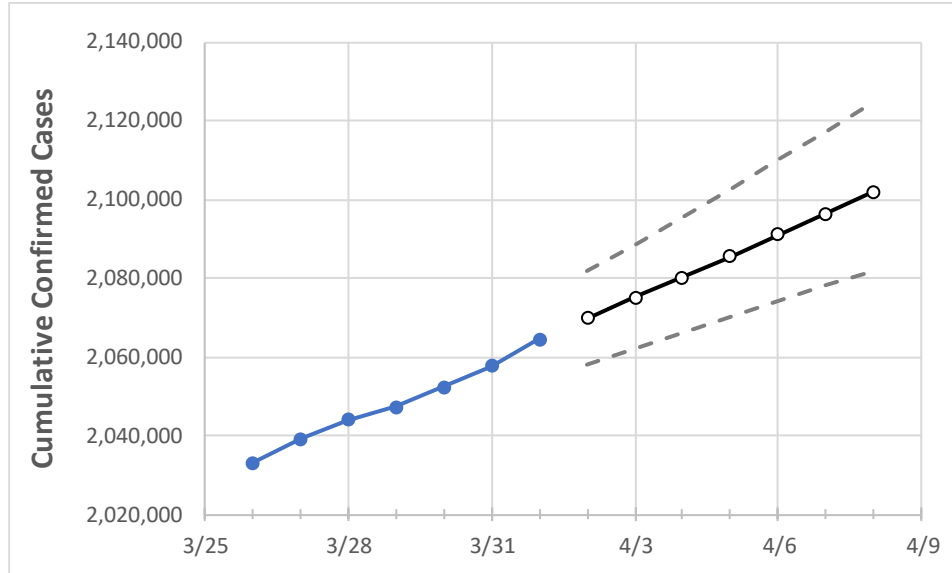
	Actual Confirmed Cases On:				Projected Cases For:						
	3/29	3/30	3/31	4/1	4/2	4/3	4/4	4/5	4/6	4/7	4/8
Florida	2,047,379	2,052,441	2,057,735	2,064,525	2,069,778	2,075,015	2,080,255	2,085,538	2,090,950	2,096,396	2,101,889

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:						
	3/29	3/30	3/31	4/1	4/2	4/3	4/4	4/5	4/6	4/7	4/8
Alachua	23,283	23,339	23,378	23,440	23,485	23,532	23,581	23,630	23,681	23,733	23,786
Broward	213,158	213,880	214,599	215,488	216,216	216,948	217,691	218,439	219,207	219,969	220,752
Charlotte	11,475	11,508	11,556	11,605	11,652	11,700	11,750	11,803	11,857	11,912	11,970
Collier	32,315	32,414	32,516	32,637	32,717	32,796	32,879	32,962	33,047	33,131	33,216
Duval	92,305	92,440	92,562	92,715	92,833	92,951	93,070	93,189	93,308	93,426	93,541
Hillsborough	120,893	121,150	121,553	122,188	122,589	122,992	123,402	123,822	124,250	124,675	125,093
Lake	26,507	26,604	26,679	26,776	26,847	26,919	26,993	27,065	27,139	27,215	27,289
Lee	62,300	62,483	62,713	62,902	63,099	63,298	63,501	63,707	63,915	64,126	64,345
Manatee	34,620	34,697	34,769	34,922	35,023	35,125	35,227	35,333	35,439	35,543	35,648
Miami-Dade	443,207	444,487	445,464	447,042	448,254	449,465	450,694	451,937	453,183	454,431	455,702
Okaloosa	19,722	19,734	19,749	19,771	19,782	19,794	19,805	19,816	19,826	19,836	19,846
Orange	123,018	123,352	123,683	124,227	124,641	125,062	125,490	125,914	126,360	126,827	127,296
Osceola	39,411	39,521	39,604	39,766	39,873	39,977	40,085	40,195	40,306	40,416	40,531
Palm Beach	130,904	131,235	131,581	132,098	132,450	132,807	133,164	133,533	133,893	134,262	134,633
Pasco	36,147	36,265	36,391	36,511	36,627	36,746	36,865	36,988	37,110	37,235	37,362
Pinellas	71,839	72,005	72,243	72,557	72,784	73,017	73,250	73,496	73,736	73,980	74,233
Polk	60,852	61,019	61,175	61,390	61,550	61,712	61,882	62,046	62,216	62,391	62,567
Sarasota	29,178	29,248	29,359	29,465	29,567	29,671	29,779	29,887	29,998	30,111	30,231
Seminole	29,816	29,955	30,052	30,154	30,272	30,390	30,509	30,631	30,754	30,880	31,010
St. Johns	21,080	21,127	21,337	21,217	21,293	21,373	21,456	21,543	21,636	21,734	21,835
Sumter	8,755	8,780	8,790	8,812	8,838	8,865	8,892	8,918	8,945	8,971	8,999
Volusia	37,895	38,069	38,265	38,413	38,595	38,783	38,977	39,178	39,385	39,597	39,812

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:		
	3/29	3/30	3/31	4/1	4/3	4/5	4/7
Alachua	23,283	23,339	23,378	23,440	23,532 (4,706) [1,130] {565}	23,630 (4,726) [1,134] {567}	23,733 (4,747) [1,139] {570}
Broward	213,158	213,880	214,599	215,488	216,948 (43,390) [10,414] {5,207}	218,439 (43,688) [10,485] {5,243}	219,969 (43,994) [10,559] {5,279}
Charlotte	11,475	11,508	11,556	11,605	11,700 (2,340) [562] {281}	11,803 (2,361) [567] {283}	11,912 (2,382) [572] {286}
Collier	32,315	32,414	32,516	32,637	32,796 (6,559) [1,574] {787}	32,962 (6,592) [1,582] {791}	33,131 (6,626) [1,590] {795}
Duval	92,305	92,440	92,562	92,715	92,951 (18,590) [4,462] {2,231}	93,189 (18,638) [4,473] {2,237}	93,426 (18,685) [4,484] {2,242}
Hillsborough	120,893	121,150	121,553	122,188	122,992 (24,598) [5,904] {2,952}	123,822 (24,764) [5,943] {2,972}	124,675 (24,935) [5,984] {2,992}
Lake	26,507	26,604	26,679	26,776	26,919 (5,384) [1,292] {646}	27,065 (5,413) [1,299] {650}	27,215 (5,443) [1,306] {653}
Lee	62,300	62,483	62,713	62,902	63,298 (12,660) [3,038] {1,519}	63,707 (12,741) [3,058] {1,529}	64,126 (12,825) [3,078] {1,539}
Manatee	34,620	34,697	34,769	34,922	35,125 (7,025) [1,686] {843}	35,333 (7,067) [1,696] {848}	35,543 (7,109) [1,706] {853}
Miami-Dade	443,207	444,487	445,464	447,042	449,465 (89,893) [21,574] {10,787}	451,937 (90,387) [21,693] {10,846}	454,431 (90,886) [21,813] {10,906}
Okaloosa	19,722	19,734	19,749	19,771	19,794 (3,959) [950] {475}	19,816 (3,963) [951] {476}	19,836 (3,967) [952] {476}
Orange	123,018	123,352	123,683	124,227	125,062 (25,012) [6,003] {3,001}	125,914 (25,183) [6,044] {3,022}	126,827 (25,365) [6,088] {3,044}
Osceola	39,411	39,521	39,604	39,766	39,977 (7,995) [1,919] {959}	40,195 (8,039) [1,929] {965}	40,416 (8,083) [1,940] {970}
Palm Beach	130,904	131,235	131,581	132,098	132,807 (26,561) [6,375] {3,187}	133,533 (26,707) [6,410] {3,205}	134,262 (26,852) [6,445] {3,222}
Pasco	36,147	36,265	36,391	36,511	36,746 (7,349) [1,764] {882}	36,988 (7,398) [1,775] {888}	37,235 (7,447) [1,787] {894}
Pinellas	71,839	72,005	72,243	72,557	73,017 (14,603) [3,505] {1,752}	73,496 (14,699) [3,528] {1,764}	73,980 (14,796) [3,551] {1,776}
Polk	60,852	61,019	61,175	61,390	61,712 (12,342) [2,962] {1,481}	62,046 (12,409) [2,978] {1,489}	62,391 (12,478) [2,995] {1,497}
Sarasota	29,178	29,248	29,359	29,465	29,671 (5,934) [1,424] {712}	29,887 (5,977) [1,435] {717}	30,111 (6,022) [1,445] {723}
Seminole	29,816	29,955	30,052	30,154	30,390 (6,078) [1,459] {729}	30,631 (6,126) [1,470] {735}	30,880 (6,176) [1,482] {741}
St. Johns	21,080	21,127	21,337	21,217	21,373 (4,275) [1,026] {513}	21,543 (4,309) [1,034] {517}	21,734 (4,347) [1,043] {522}
Sumter	8,755	8,780	8,790	8,812	8,865 (1,773) [426] {213}	8,918 (1,784) [428] {214}	8,971 (1,794) [431] {215}
Volusia	37,895	38,069	38,265	38,413	38,783 (7,757) [1,862] {931}	39,178 (7,836) [1,881] {940}	39,597 (7,919) [1,901] {950}

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.