IEM's AI Modeling: Short-term COVID-19 Projections
Date: 3/16/21

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 3/16/21 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
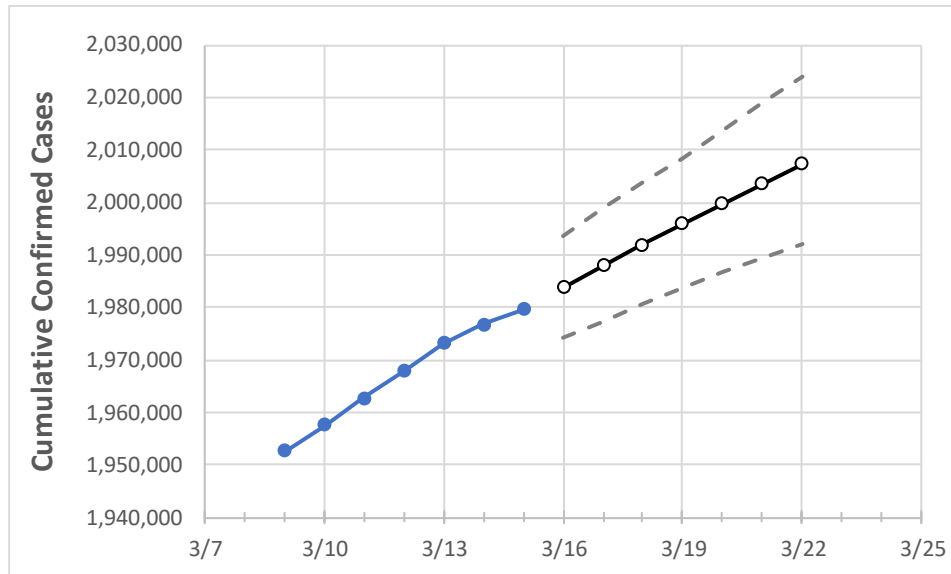
	Actual Confirmed Cases On:				Projected Cases For:						
	3/12	3/13	3/14	3/15	3/16	3/17	3/18	3/19	3/20	3/21	3/22
Florida	1,967,865	1,973,109	1,976,808	1,979,634	1,983,828	1,987,942	1,991,938	1,995,863	1,999,751	2,003,615	2,007,408

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:						
	3/12	3/13	3/14	3/15	3/16	3/17	3/18	3/19	3/20	3/21	3/22
Alachua	22,763	22,798	22,816	22,828	22,855	22,880	22,906	22,930	22,956	22,980	23,004
Broward	202,622	203,336	203,832	204,247	204,819	205,386	205,952	206,499	207,037	207,565	208,085
Charlotte	10,959	10,978	11,001	11,015	11,035	11,054	11,073	11,092	11,111	11,129	11,147
Collier	31,126	31,195	31,245	31,290	31,351	31,411	31,470	31,528	31,585	31,641	31,695
Duval	90,389	90,540	90,633	90,716	90,827	90,939	91,049	91,156	91,263	91,368	91,470
Hillsborough	115,087	115,482	115,722	115,912	116,189	116,460	116,728	117,003	117,270	117,536	117,800
Lake	25,444	25,529	25,591	25,627	25,687	25,748	25,805	25,861	25,918	25,973	26,025
Lee	59,518	59,685	59,834	59,951	60,092	60,233	60,373	60,510	60,645	60,784	60,921
Manatee	33,076	33,180	33,231	33,267	33,345	33,419	33,493	33,565	33,634	33,704	33,772
Miami-Dade	424,903	426,149	426,900	427,600	428,722	429,812	430,896	431,981	433,028	434,082	435,134
Okaloosa	19,399	19,427	19,452	19,468	19,499	19,529	19,560	19,588	19,616	19,645	19,672
Orange	117,597	117,906	118,154	118,321	118,563	118,801	119,042	119,275	119,497	119,716	119,935
Osceola	37,892	38,007	38,078	38,116	38,200	38,281	38,361	38,439	38,517	38,595	38,672
Palm Beach	125,085	125,506	125,866	126,062	126,398	126,733	127,060	127,381	127,699	128,007	128,318
Pasco	34,495	34,631	34,720	34,778	34,859	34,941	35,023	35,102	35,178	35,256	35,330
Pinellas	68,744	68,912	69,063	69,192	69,346	69,495	69,640	69,784	69,926	70,067	70,205
Polk	58,691	58,820	58,920	58,991	59,096	59,198	59,299	59,396	59,487	59,581	59,669
Sarasota	27,863	27,928	27,973	28,025	28,090	28,154	28,217	28,281	28,345	28,407	28,471
Seminole	28,195	28,275	28,368	28,431	28,504	28,578	28,649	28,722	28,793	28,865	28,938
St. Johns	20,490	20,531	20,557	20,574	20,602	20,629	20,654	20,680	20,704	20,729	20,753
Sumter	8,297	8,339	8,349	8,369	8,391	8,411	8,431	8,451	8,471	8,491	8,510
Volusia	35,696	35,791	35,881	35,955	36,045	36,134	36,221	36,307	36,395	36,483	36,564

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:		
	3/12	3/13	3/14	3/15	3/17	3/19	3/21
Alachua	22,763	22,798	22,816	22,828	22,880 (4,576) [1,098] {549}	22,930 (4,586) [1,101] {550}	22,980 (4,596) [1,103] {552}
Broward	202,622	203,336	203,832	204,247	205,386 (41,077) [9,859] {4,929}	206,499 (41,300) [9,912] {4,956}	207,565 (41,513) [9,963] {4,982}
Charlotte	10,959	10,978	11,001	11,015	11,054 (2,211) [531] {265}	11,092 (2,218) [532] {266}	11,129 (2,226) [534] {267}
Collier	31,126	31,195	31,245	31,290	31,411 (6,282) [1,508] {754}	31,528 (6,306) [1,513] {757}	31,641 (6,328) [1,519] {759}
Duval	90,389	90,540	90,633	90,716	90,939 (18,188) [4,365] {2,183}	91,156 (18,231) [4,376] {2,188}	91,368 (18,274) [4,386] {2,193}
Hillsborough	115,087	115,482	115,722	115,912	116,460 (23,292) [5,590] {2,795}	117,003 (23,401) [5,616] {2,808}	117,536 (23,507) [5,642] {2,821}
Lake	25,444	25,529	25,591	25,627	25,748 (5,150) [1,236] {618}	25,861 (5,172) [1,241] {621}	25,973 (5,195) [1,247] {623}
Lee	59,518	59,685	59,834	59,951	60,233 (12,047) [2,891] {1,446}	60,510 (12,102) [2,904] {1,452}	60,784 (12,157) [2,918] {1,459}
Manatee	33,076	33,180	33,231	33,267	33,419 (6,684) [1,604] {802}	33,565 (6,713) [1,611] {806}	33,704 (6,741) [1,618] {809}
Miami-Dade	424,903	426,149	426,900	427,600	429,812 (85,962) [20,631] {10,315}	431,981 (86,396) [20,735] {10,368}	434,082 (86,816) [20,836] {10,418}
Okaloosa	19,399	19,427	19,452	19,468	19,529 (3,906) [937] {469}	19,588 (3,918) [940] {470}	19,645 (3,929) [943] {471}
Orange	117,597	117,906	118,154	118,321	118,801 (23,760) [5,702] {2,851}	119,275 (23,855) [5,725] {2,863}	119,716 (23,943) [5,746] {2,873}
Osceola	37,892	38,007	38,078	38,116	38,281 (7,656) [1,837] {919}	38,439 (7,688) [1,845] {923}	38,595 (7,719) [1,853] {926}
Palm Beach	125,085	125,506	125,866	126,062	126,733 (25,347) [6,083] {3,042}	127,381 (25,476) [6,114] {3,057}	128,007 (25,601) [6,144] {3,072}
Pasco	34,495	34,631	34,720	34,778	34,941 (6,988) [1,677] {839}	35,102 (7,020) [1,685] {842}	35,256 (7,051) [1,692] {846}
Pinellas	68,744	68,912	69,063	69,192	69,495 (13,899) [3,336] {1,668}	69,784 (13,957) [3,350] {1,675}	70,067 (14,013) [3,363] {1,682}
Polk	58,691	58,820	58,920	58,991	59,198 (11,840) [2,841] {1,421}	59,396 (11,879) [2,851] {1,426}	59,581 (11,916) [2,860] {1,430}
Sarasota	27,863	27,928	27,973	28,025	28,154 (5,631) [1,351] {676}	28,281 (5,656) [1,357] {679}	28,407 (5,681) [1,364] {682}
Seminole	28,195	28,275	28,368	28,431	28,578 (5,716) [1,372] {686}	28,722 (5,744) [1,379] {689}	28,865 (5,773) [1,386] {693}
St. Johns	20,490	20,531	20,557	20,574	20,629 (4,126) [990] {495}	20,680 (4,136) [993] {496}	20,729 (4,146) [995] {497}
Sumter	8,297	8,339	8,349	8,369	8,411 (1,682) [404] {202}	8,451 (1,690) [406] {203}	8,491 (1,698) [408] {204}
Volusia	35,696	35,791	35,881	35,955	36,134 (7,227) [1,734] {867}	36,307 (7,261) [1,743] {871}	36,483 (7,297) [1,751] {876}

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.