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

Date: 3/5/21

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 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 3/5/21 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.

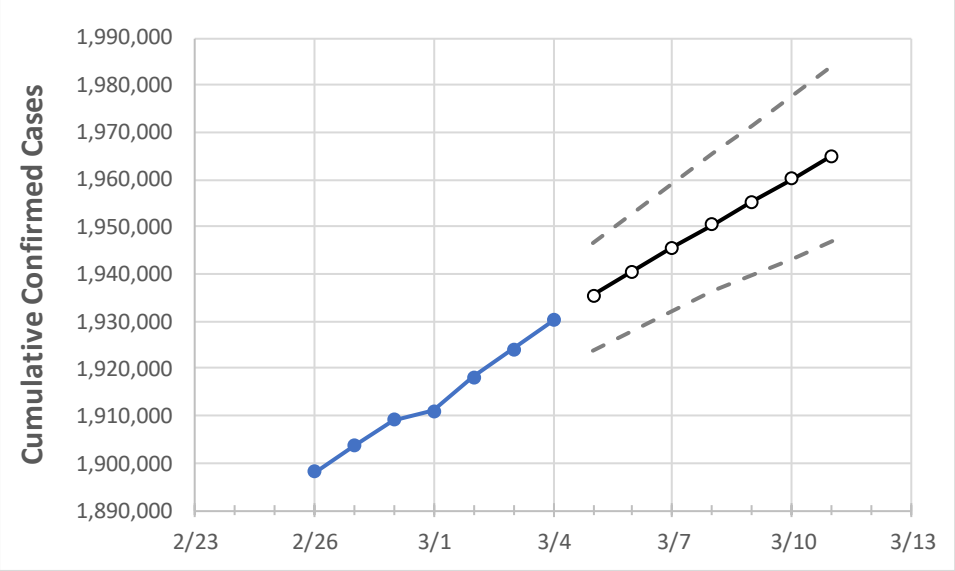
IEM's Modeling Lead

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:						
	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	3/10	3/11
Florida	1,910,921	1,918,100	1,924,114	1,930,232	1,935,433	1,940,520	1,945,611	1,950,521	1,955,420	1,960,276	1,965,108

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:						
	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	3/10	3/11
Alachua	22,371	22,412	22,458	22,512	22,540	22,566	22,592	22,617	22,641	22,664	22,688
Broward	195,217	196,114	196,771	197,542	198,206	198,872	199,524	200,171	200,824	201,488	202,111
Charlotte	10,698	10,725	10,751	10,781	10,802	10,822	10,842	10,861	10,880	10,898	10,915
Collier	30,300	30,429	30,505	30,572	30,642	30,714	30,782	30,850	30,915	30,981	31,048
Duval	88,825	88,998	89,177	89,337	89,466	89,591	89,716	89,841	89,955	90,066	90,175
Hillsborough	111,550	111,990	112,267	112,672	112,994	113,310	113,614	113,929	114,230	114,535	114,824
Lake	24,635	24,744	24,841	24,928	25,006	25,083	25,161	25,236	25,311	25,385	25,458
Lee	57,763	58,004	58,193	58,360	58,502	58,642	58,782	58,918	59,057	59,192	59,328
Manatee	31,962	32,089	32,176	32,309	32,410	32,512	32,613	32,713	32,814	32,917	33,017
Miami-Dade	410,952	412,908	414,776	416,021	417,252	418,481	419,715	420,931	422,143	423,381	424,573
Okaloosa	18,900	19,008	19,090	19,125	19,189	19,251	19,312	19,372	19,431	19,492	19,554
Orange	114,434	114,841	115,085	115,475	115,766	116,056	116,336	116,615	116,887	117,157	117,431
Osceola	36,839	36,981	37,045	37,188	37,278	37,368	37,460	37,550	37,637	37,722	37,809
Palm Beach	120,868	121,226	121,652	122,226	122,608	122,997	123,364	123,736	124,095	124,454	124,809
Pasco	33,426	33,551	33,658	33,778	33,881	33,983	34,081	34,181	34,280	34,375	34,468
Pinellas	66,646	66,894	67,061	67,359	67,563	67,775	67,981	68,183	68,385	68,582	68,783
Polk	57,150	57,339	57,496	57,655	57,793	57,927	58,056	58,188	58,309	58,425	58,536
Sarasota	27,065	27,122	27,220	27,301	27,371	27,441	27,509	27,578	27,646	27,714	27,782
Seminole	27,262	27,384	27,464	27,554	27,629	27,703	27,776	27,851	27,923	27,994	28,065
St. Johns	20,105	20,154	20,188	20,242	20,270	20,296	20,321	20,346	20,370	20,394	20,418
Sumter	8,021	8,071	8,095	8,125	8,152	8,178	8,204	8,233	8,260	8,287	8,314
Volusia	34,565	34,680	34,791	34,891	34,979	35,066	35,149	35,232	35,316	35,396	35,476

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:		
	3/1	3/2	3/3	3/4	3/6	3/8	3/10
Alachua	22,371	22,412	22,458	22,512	22,566 (4,513) [1,083] {542}	22,617 (4,523) [1,086] {543}	22,664 (4,533) [1,088] {544}
Broward	195,217	196,114	196,771	197,542	198,872 (39,774) [9,546] {4,773}	200,171 (40,034) [9,608] {4,804}	201,488 (40,298) [9,671] {4,836}
Charlotte	10,698	10,725	10,751	10,781	10,822 (2,164) [519] {260}	10,861 (2,172) [521] {261}	10,898 (2,180) [523] {262}
Collier	30,300	30,429	30,505	30,572	30,714 (6,143) [1,474] {737}	30,850 (6,170) [1,481] {740}	30,981 (6,196) [1,487] {744}
Duval	88,825	88,998	89,177	89,337	89,591 (17,918) [4,300] {2,150}	89,841 (17,968) [4,312] {2,156}	90,066 (18,013) [4,323] {2,162}
Hillsborough	111,550	111,990	112,267	112,672	113,310 (22,662) [5,439] {2,719}	113,929 (22,786) [5,469] {2,734}	114,535 (22,907) [5,498] {2,749}
Lake	24,635	24,744	24,841	24,928	25,083 (5,017) [1,204] {602}	25,236 (5,047) [1,211] {606}	25,385 (5,077) [1,218] {609}
Lee	57,763	58,004	58,193	58,360	58,642 (11,728) [2,815] {1,407}	58,918 (11,784) [2,828] {1,414}	59,192 (11,838) [2,841] {1,421}
Manatee	31,962	32,089	32,176	32,309	32,512 (6,502) [1,561] {780}	32,713 (6,543) [1,570] {785}	32,917 (6,583) [1,580] {790}
Miami-Dade	410,952	412,908	414,776	416,021	418,481 (83,696) [20,087] {10,044}	420,931 (84,186) [20,205] {10,102}	423,381 (84,676) [20,322] {10,161}
Okaloosa	18,900	19,008	19,090	19,125	19,251 (3,850) [924] {462}	19,372 (3,874) [930] {465}	19,492 (3,898) [936] {468}
Orange	114,434	114,841	115,085	115,475	116,056 (23,211) [5,571] {2,785}	116,615 (23,323) [5,598] {2,799}	117,157 (23,431) [5,624] {2,812}
Osceola	36,839	36,981	37,045	37,188	37,368 (7,474) [1,794] {897}	37,550 (7,510) [1,802] {901}	37,722 (7,544) [1,811] {905}
Palm Beach	120,868	121,226	121,652	122,226	122,997 (24,599) [5,904] {2,952}	123,736 (24,747) [5,939] {2,970}	124,454 (24,891) [5,974] {2,987}
Pasco	33,426	33,551	33,658	33,778	33,983 (6,797) [1,631] {816}	34,181 (6,836) [1,641] {820}	34,375 (6,875) [1,650] {825}
Pinellas	66,646	66,894	67,061	67,359	67,775 (13,555) [3,253] {1,627}	68,183 (13,637) [3,273] {1,636}	68,582 (13,716) [3,292] {1,646}
Polk	57,150	57,339	57,496	57,655	57,927 (11,585) [2,781] {1,390}	58,188 (11,638) [2,793] {1,397}	58,425 (11,685) [2,804] {1,402}
Sarasota	27,065	27,122	27,220	27,301	27,441 (5,488) [1,317] {659}	27,578 (5,516) [1,324] {662}	27,714 (5,543) [1,330] {665}
Seminole	27,262	27,384	27,464	27,554	27,703 (5,541) [1,330] {665}	27,851 (5,570) [1,337] {668}	27,994 (5,599) [1,344] {672}
St. Johns	20,105	20,154	20,188	20,242	20,296 (4,059) [974] {487}	20,346 (4,069) [977] {488}	20,394 (4,079) [979] {489}
Sumter	8,021	8,071	8,095	8,125	8,178 (1,636) [393] {196}	8,233 (1,647) [395] {198}	8,287 (1,657) [398] {199}
Volusia	34,565	34,680	34,791	34,891	35,066 (7,013) [1,683] {842}	35,232 (7,046) [1,691] {846}	35,396 (7,079) [1,699] {849}

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.