IEM's AI Modeling: Short-term COVID-19 Projections
Date: 3/4/21

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 3/4/21 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
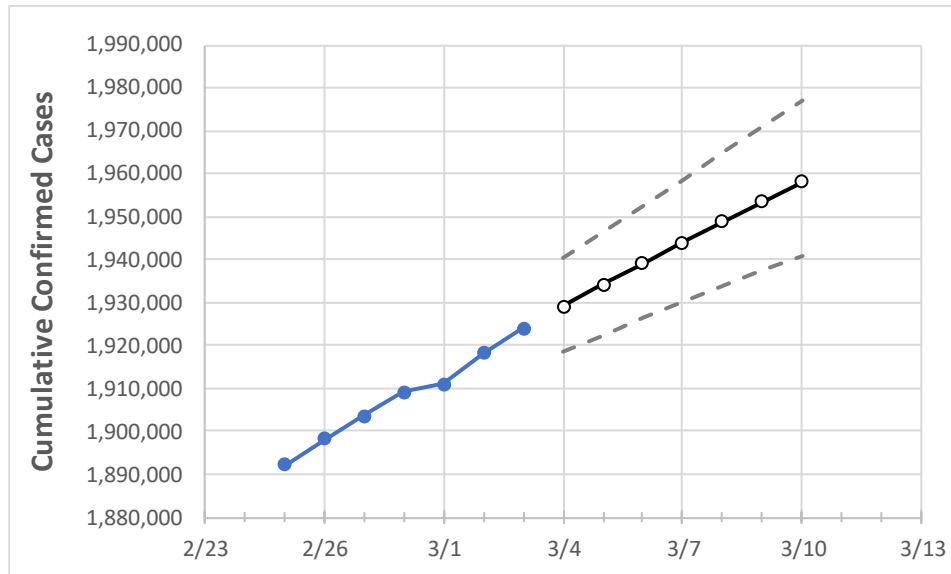
	Actual Confirmed Cases On:				Projected Cases For:						
	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	3/10
Florida	1,909,221	1,910,921	1,918,100	1,924,114	1,929,157	1,934,201	1,939,119	1,944,012	1,948,885	1,953,566	1,958,181

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:						
	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	3/10
Alachua	22,354	22,371	22,412	22,458	22,484	22,509	22,532	22,555	22,577	22,598	22,619
Broward	194,992	195,217	196,114	196,771	197,428	198,081	198,726	199,362	199,995	200,619	201,236
Charlotte	10,684	10,698	10,725	10,751	10,771	10,791	10,811	10,830	10,848	10,866	10,884
Collier	30,283	30,300	30,429	30,505	30,579	30,651	30,725	30,799	30,871	30,941	31,012
Duval	88,774	88,825	88,998	89,177	89,303	89,426	89,546	89,661	89,773	89,882	89,986
Hillsborough	111,441	111,550	111,990	112,267	112,576	112,880	113,169	113,461	113,765	114,048	114,330
Lake	24,611	24,635	24,744	24,841	24,916	24,994	25,071	25,146	25,219	25,289	25,361
Lee	57,737	57,763	58,004	58,193	58,334	58,473	58,612	58,750	58,890	59,025	59,160
Manatee	31,909	31,962	32,089	32,176	32,271	32,366	32,458	32,548	32,641	32,732	32,825
Miami-Dade	410,717	410,952	412,908	414,776	415,976	417,175	418,365	419,581	420,749	421,945	423,127
Okaloosa	18,871	18,900	19,008	19,090	19,156	19,223	19,289	19,355	19,421	19,488	19,553
Orange	114,322	114,434	114,841	115,085	115,366	115,632	115,904	116,173	116,433	116,687	116,934
Osceola	36,802	36,839	36,981	37,045	37,128	37,210	37,291	37,371	37,451	37,527	37,606
Palm Beach	120,735	120,868	121,226	121,652	122,022	122,393	122,759	123,122	123,481	123,820	124,176
Pasco	33,377	33,426	33,551	33,658	33,760	33,860	33,957	34,057	34,152	34,244	34,338
Pinellas	66,571	66,646	66,894	67,061	67,263	67,467	67,662	67,853	68,043	68,231	68,409
Polk	57,096	57,150	57,339	57,496	57,628	57,768	57,900	58,028	58,149	58,268	58,383
Sarasota	27,038	27,065	27,122	27,220	27,286	27,352	27,417	27,482	27,545	27,607	27,669
Seminole	27,237	27,262	27,384	27,464	27,544	27,619	27,694	27,766	27,839	27,911	27,978
St. Johns	20,095	20,105	20,154	20,188	20,214	20,239	20,263	20,286	20,309	20,329	20,350
Sumter	8,017	8,021	8,071	8,095	8,124	8,152	8,181	8,209	8,238	8,266	8,294
Volusia	34,546	34,565	34,680	34,791	34,876	34,961	35,043	35,125	35,205	35,283	35,359

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:		
	2/28	3/1	3/2	3/3	3/5	3/7	3/9
Alachua	22,354	22,371	22,412	22,458	22,509 (4,502) [1,080] {540}	22,555 (4,511) [1,083] {541}	22,598 (4,520) [1,085] {542}
Broward	194,992	195,217	196,114	196,771	198,081 (39,616) [9,508] {4,754}	199,362 (39,872) [9,569] {4,785}	200,619 (40,124) [9,630] {4,815}
Charlotte	10,684	10,698	10,725	10,751	10,791 (2,158) [518] {259}	10,830 (2,166) [520] {260}	10,866 (2,173) [522] {261}
Collier	30,283	30,300	30,429	30,505	30,651 (6,130) [1,471] {736}	30,799 (6,160) [1,478] {739}	30,941 (6,188) [1,485] {743}
Duval	88,774	88,825	88,998	89,177	89,426 (17,885) [4,292] {2,146}	89,661 (17,932) [4,304] {2,152}	89,882 (17,976) [4,314] {2,157}
Hillsborough	111,441	111,550	111,990	112,267	112,880 (22,576) [5,418] {2,709}	113,461 (22,692) [5,446] {2,723}	114,048 (22,810) [5,474] {2,737}
Lake	24,611	24,635	24,744	24,841	24,994 (4,999) [1,200] {600}	25,146 (5,029) [1,207] {603}	25,289 (5,058) [1,214] {607}
Lee	57,737	57,763	58,004	58,193	58,473 (11,695) [2,807] {1,403}	58,750 (11,750) [2,820] {1,410}	59,025 (11,805) [2,833] {1,417}
Manatee	31,909	31,962	32,089	32,176	32,366 (6,473) [1,554] {777}	32,548 (6,510) [1,562] {781}	32,732 (6,546) [1,571] {786}
Miami-Dade	410,717	410,952	412,908	414,776	417,175 (83,435) [20,024] {10,012}	419,581 (83,916) [20,140] {10,070}	421,945 (84,389) [20,253] {10,127}
Okaloosa	18,871	18,900	19,008	19,090	19,223 (3,845) [923] {461}	19,355 (3,871) [929] {465}	19,488 (3,898) [935] {468}
Orange	114,322	114,434	114,841	115,085	115,632 (23,126) [5,550] {2,775}	116,173 (23,235) [5,576] {2,788}	116,687 (23,337) [5,601] {2,800}
Osceola	36,802	36,839	36,981	37,045	37,210 (7,442) [1,786] {893}	37,371 (7,474) [1,794] {897}	37,527 (7,505) [1,801] {901}
Palm Beach	120,735	120,868	121,226	121,652	122,393 (24,479) [5,875] {2,937}	123,122 (24,624) [5,910] {2,955}	123,820 (24,764) [5,943] {2,972}
Pasco	33,377	33,426	33,551	33,658	33,860 (6,772) [1,625] {813}	34,057 (6,811) [1,635] {817}	34,244 (6,849) [1,644] {822}
Pinellas	66,571	66,646	66,894	67,061	67,467 (13,493) [3,238] {1,619}	67,853 (13,571) [3,257] {1,628}	68,231 (13,646) [3,275] {1,638}
Polk	57,096	57,150	57,339	57,496	57,768 (11,554) [2,773] {1,386}	58,028 (11,606) [2,785] {1,393}	58,268 (11,654) [2,797] {1,398}
Sarasota	27,038	27,065	27,122	27,220	27,352 (5,470) [1,313] {656}	27,482 (5,496) [1,319] {660}	27,607 (5,521) [1,325] {663}
Seminole	27,237	27,262	27,384	27,464	27,619 (5,524) [1,326] {663}	27,766 (5,553) [1,333] {666}	27,911 (5,582) [1,340] {670}
St. Johns	20,095	20,105	20,154	20,188	20,239 (4,048) [971] {486}	20,286 (4,057) [974] {487}	20,329 (4,066) [976] {488}
Sumter	8,017	8,021	8,071	8,095	8,152 (1,630) [391] {196}	8,209 (1,642) [394] {197}	8,266 (1,653) [397] {198}
Volusia	34,546	34,565	34,680	34,791	34,961 (6,992) [1,678] {839}	35,125 (7,025) [1,686] {843}	35,283 (7,057) [1,694] {847}

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.