IEM's AI Modeling: Short-term COVID-19 Projections
Date: 8/14/20

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 20%, and are often within 10%, of actual confirmed cases.

The projections shown in this document are based on data pulled in as of 8/14/20 1 p.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
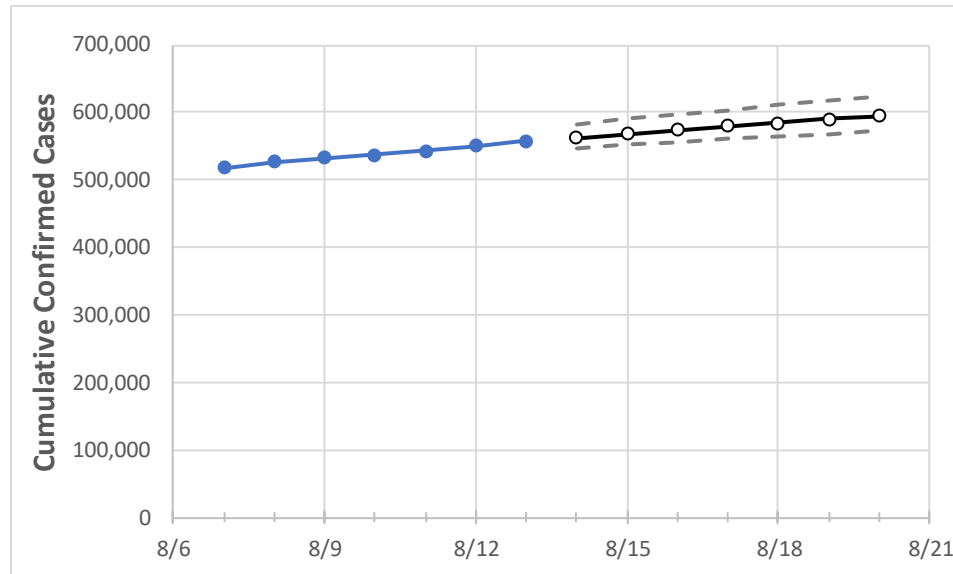
	Actual Confirmed Cases On:				Projected Cases For:						
	8/10	8/11	8/12	8/13	8/14	8/15	8/16	8/17	8/18	8/19	8/20
Florida	536,961	542,774	550,901	557,137	562,877	568,507	574,031	579,449	584,763	589,976	595,089

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 20%, and are often within 10%, of actual confirmed cases.

Florida Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	8/10	8/11	8/12	8/13	8/14	8/15	8/16	8/17	8/18	8/19	8/20
Alachua	4,171	4,246	4,309	4,391	4,452	4,513	4,575	4,637	4,698	4,760	4,823
Broward	62,898	63,605	64,080	64,741	65,288	65,820	66,338	66,841	67,330	67,806	68,268
Charlotte	2,257	2,281	2,297	2,321	2,345	2,369	2,393	2,417	2,440	2,463	2,486
Collier	10,448	10,487	10,530	10,640	10,697	10,753	10,806	10,858	10,908	10,956	11,003
Duval	23,530	23,741	23,972	24,162	24,329	24,492	24,651	24,805	24,955	25,100	25,242
Hillsborough	32,731	32,996	33,198	33,428	33,654	33,873	34,086	34,292	34,491	34,685	34,873
Lake	5,177	5,229	5,291	5,391	5,440	5,489	5,537	5,584	5,630	5,676	5,721
Lee	16,632	16,718	16,872	17,039	17,135	17,227	17,317	17,405	17,489	17,571	17,651
Manatee	9,340	9,395	9,468	9,554	9,611	9,666	9,718	9,770	9,819	9,866	9,912
Miami-Dade	133,623	135,130	139,271	140,984	142,416	143,829	145,221	146,594	147,947	149,281	150,595
Okaloosa	3,541	3,587	3,608	3,632	3,682	3,732	3,782	3,831	3,880	3,929	3,977
Orange	31,851	32,042	32,341	32,575	32,764	32,947	33,124	33,296	33,461	33,622	33,777
Osceola	9,769	9,858	9,936	10,037	10,126	10,212	10,296	10,379	10,459	10,537	10,614
Palm Beach	37,297	37,641	37,934	38,208	38,516	38,819	39,116	39,408	39,694	39,976	40,252
Pasco	7,114	7,172	7,213	7,283	7,338	7,391	7,443	7,494	7,543	7,591	7,637
Pinellas	17,941	18,103	18,217	18,329	18,439	18,546	18,650	18,751	18,850	18,945	19,038
Polk	14,475	14,645	14,812	14,992	15,147	15,301	15,452	15,602	15,750	15,896	16,041
Sarasota	6,256	6,314	6,394	6,479	6,531	6,581	6,630	6,678	6,725	6,771	6,815
Seminole	7,152	7,219	7,264	7,323	7,371	7,418	7,464	7,509	7,553	7,595	7,637
St. Johns	3,660	3,738	3,774	3,817	3,853	3,888	3,923	3,958	3,991	4,025	4,058
Sumter	1,307	1,344	1,383	1,410	1,431	1,452	1,474	1,496	1,519	1,541	1,564
Volusia	7,960	8,040	8,129	8,206	8,289	8,371	8,451	8,530	8,608	8,685	8,761

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:		
	8/10	8/11	8/12	8/13	8/15	8/17	8/19
Alachua	4,171	4,246	4,309	4,391	4,513 (903) [217] {108}	4,637 (927) [223] {111}	4,760 (952) [229] {114}
Broward	62,898	63,605	64,080	64,741	65,820 (13,164) [3,159] {1,580}	66,841 (13,368) [3,208] {1,604}	67,806 (13,561) [3,255] {1,627}
Charlotte	2,257	2,281	2,297	2,321	2,369 (474) [114] {57}	2,417 (483) [116] {58}	2,463 (493) [118] {59}
Collier	10,448	10,487	10,530	10,640	10,753 (2,151) [516] {258}	10,858 (2,172) [521] {261}	10,956 (2,191) [526] {263}
Duval	23,530	23,741	23,972	24,162	24,492 (4,898) [1,176] {588}	24,805 (4,961) [1,191] {595}	25,100 (5,020) [1,205] {602}
Hillsborough	32,731	32,996	33,198	33,428	33,873 (6,775) [1,626] {813}	34,292 (6,858) [1,646] {823}	34,685 (6,937) [1,665] {832}
Lake	5,177	5,229	5,291	5,391	5,489 (1,098) [263] {132}	5,584 (1,117) [268] {134}	5,676 (1,135) [272] {136}
Lee	16,632	16,718	16,872	17,039	17,227 (3,445) [827] {413}	17,405 (3,481) [835] {418}	17,571 (3,514) [843] {422}
Manatee	9,340	9,395	9,468	9,554	9,666 (1,933) [464] {232}	9,770 (1,954) [469] {234}	9,866 (1,973) [474] {237}
Miami-Dade	133,623	135,130	139,271	140,984	143,829 (28,766) [6,904] {3,452}	146,594 (29,319) [7,037] {3,518}	149,281 (29,856) [7,165] {3,583}
Okaloosa	3,541	3,587	3,608	3,632	3,732 (746) [179] {90}	3,831 (766) [184] {92}	3,929 (786) [189] {94}
Orange	31,851	32,042	32,341	32,575	32,947 (6,589) [1,581] {791}	33,296 (6,659) [1,598] {799}	33,622 (6,724) [1,614] {807}
Osceola	9,769	9,858	9,936	10,037	10,212 (2,042) [490] {245}	10,379 (2,076) [498] {249}	10,537 (2,107) [506] {253}
Palm Beach	37,297	37,641	37,934	38,208	38,819 (7,764) [1,863] {932}	39,408 (7,882) [1,892] {946}	39,976 (7,995) [1,919] {959}
Pasco	7,114	7,172	7,213	7,283	7,391 (1,478) [355] {177}	7,494 (1,499) [360] {180}	7,591 (1,518) [364] {182}
Pinellas	17,941	18,103	18,217	18,329	18,546 (3,709) [890] {445}	18,751 (3,750) [900] {450}	18,945 (3,789) [909] {455}
Polk	14,475	14,645	14,812	14,992	15,301 (3,060) [734] {367}	15,602 (3,120) [749] {374}	15,896 (3,179) [763] {382}
Sarasota	6,256	6,314	6,394	6,479	6,581 (1,316) [316] {158}	6,678 (1,336) [321] {160}	6,771 (1,354) [325] {162}
Seminole	7,152	7,219	7,264	7,323	7,418 (1,484) [356] {178}	7,509 (1,502) [360] {180}	7,595 (1,519) [365] {182}
St. Johns	3,660	3,738	3,774	3,817	3,888 (778) [187] {93}	3,958 (792) [190] {95}	4,025 (805) [193] {97}
Sumter	1,307	1,344	1,383	1,410	1,452 (290) [70] {35}	1,496 (299) [72] {36}	1,541 (308) [74] {37}
Volusia	7,960	8,040	8,129	8,206	8,371 (1,674) [402] {201}	8,530 (1,706) [409] {205}	8,685 (1,737) [417] {208}

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.