IEM's AI Modeling: Short-term COVID-19 Projections
Date: 12/16/20

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 10%, and are often within 5%, of actual confirmed cases.

The projections shown in this document are based on data pulled in as of 12/16/20 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
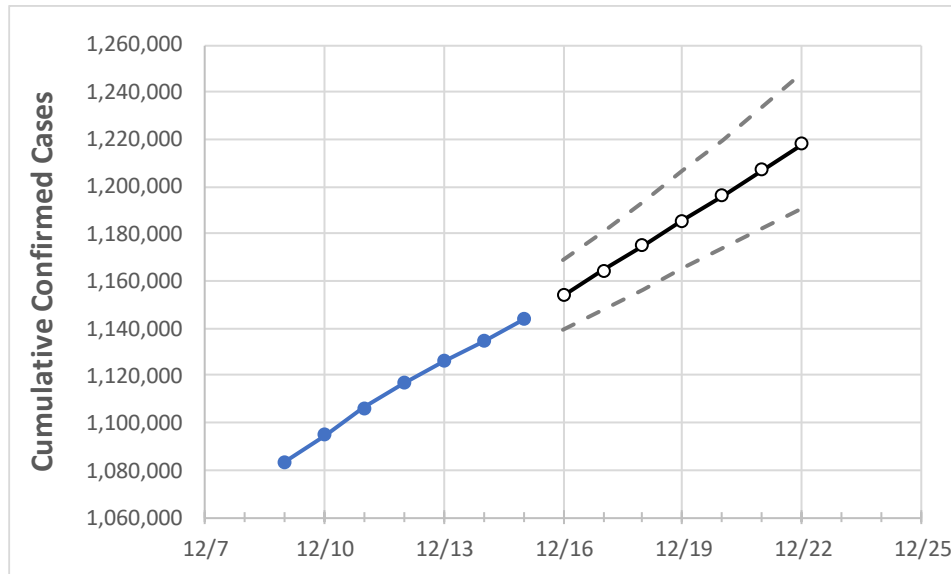
	Actual Confirmed Cases On:				Projected Cases For:						
	12/12	12/13	12/14	12/15	12/16	12/17	12/18	12/19	12/20	12/21	12/22
Florida	1,116,973	1,125,931	1,134,383	1,143,794	1,154,115	1,164,529	1,175,035	1,185,635	1,196,329	1,207,116	1,218,000

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:						
	12/12	12/13	12/14	12/15	12/16	12/17	12/18	12/19	12/20	12/21	12/22
Alachua	13,971	14,039	14,128	14,225	14,323	14,423	14,523	14,625	14,728	14,833	14,938
Broward	119,429	120,166	120,840	121,512	122,383	123,244	124,095	124,937	125,770	126,594	127,409
Charlotte	6,004	6,066	6,111	6,104	6,186	6,268	6,353	6,438	6,525	6,613	6,703
Collier	19,854	19,935	20,021	20,151	20,304	20,456	20,608	20,760	20,912	21,063	21,214
Duval	49,697	50,230	50,646	51,112	51,599	52,087	52,577	53,069	53,563	54,058	54,554
Hillsborough	64,999	65,502	66,041	66,548	67,177	67,821	68,481	69,158	69,851	70,561	71,289
Lake	12,136	12,291	12,435	12,571	12,745	12,925	13,113	13,309	13,512	13,724	13,944
Lee	34,177	34,478	34,717	35,031	35,362	35,693	36,026	36,358	36,691	37,025	37,359
Manatee	18,720	18,812	19,020	19,212	19,378	19,547	19,718	19,890	20,065	20,242	20,421
Miami-Dade	255,462	257,857	260,138	262,298	264,536	266,782	269,034	271,294	273,560	275,832	278,111
Okaloosa	10,647	10,728	10,781	10,853	10,984	11,116	11,250	11,385	11,521	11,659	11,799
Orange	63,281	63,814	64,593	65,251	65,995	66,757	67,539	68,338	69,158	69,997	70,856
Osceola	21,268	21,416	21,644	21,833	22,090	22,351	22,617	22,886	23,160	23,438	23,720
Palm Beach	72,247	72,708	73,079	73,542	74,073	74,603	75,132	75,661	76,190	76,718	77,245
Pasco	17,578	17,810	17,975	18,190	18,439	18,693	18,950	19,211	19,477	19,746	20,020
Pinellas	37,387	37,753	38,118	38,457	38,877	39,307	39,745	40,192	40,649	41,115	41,591
Polk	30,967	31,173	31,383	31,668	31,988	32,316	32,652	32,996	33,348	33,709	34,079
Sarasota	15,659	15,793	15,915	16,031	16,171	16,309	16,446	16,582	16,717	16,851	16,983
Seminole	15,175	15,297	15,400	15,588	15,810	16,039	16,276	16,520	16,771	17,030	17,298
St. Johns	10,215	10,331	10,422	10,542	10,662	10,783	10,904	11,026	11,148	11,271	11,394
Sumter	3,987	4,015	4,037	4,067	4,114	4,162	4,212	4,263	4,316	4,370	4,426
Volusia	18,419	18,585	18,710	18,861	19,024	19,188	19,354	19,521	19,689	19,858	20,029

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:		
	12/12	12/13	12/14	12/15	12/17	12/19	12/21
Alachua	13,971	14,039	14,128	14,225	14,423 (2,885) [692] {346}	14,625 (2,925) [702] {351}	14,833 (2,967) [712] {356}
Broward	119,429	120,166	120,840	121,512	123,244 (24,649) [5,916] {2,958}	124,937 (24,987) [5,997] {2,998}	126,594 (25,319) [6,077] {3,038}
Charlotte	6,004	6,066	6,111	6,104	6,268 (1,254) [301] {150}	6,438 (1,288) [309] {155}	6,613 (1,323) [317] {159}
Collier	19,854	19,935	20,021	20,151	20,456 (4,091) [982] {491}	20,760 (4,152) [996] {498}	21,063 (4,213) [1,011] {506}
Duval	49,697	50,230	50,646	51,112	52,087 (10,417) [2,500] {1,250}	53,069 (10,614) [2,547] {1,274}	54,058 (10,812) [2,595] {1,297}
Hillsborough	64,999	65,502	66,041	66,548	67,821 (13,564) [3,255] {1,628}	69,158 (13,832) [3,320] {1,660}	70,561 (14,112) [3,387] {1,693}
Lake	12,136	12,291	12,435	12,571	12,925 (2,585) [620] {310}	13,309 (2,662) [639] {319}	13,724 (2,745) [659] {329}
Lee	34,177	34,478	34,717	35,031	35,693 (7,139) [1,713] {857}	36,358 (7,272) [1,745] {873}	37,025 (7,405) [1,777] {889}
Manatee	18,720	18,812	19,020	19,212	19,547 (3,909) [938] {469}	19,890 (3,978) [955] {477}	20,242 (4,048) [972] {486}
Miami-Dade	255,462	257,857	260,138	262,298	266,782 (53,356) [12,806] {6,403}	271,294 (54,259) [13,022] {6,511}	275,832 (55,166) [13,240] {6,620}
Okaloosa	10,647	10,728	10,781	10,853	11,116 (2,223) [534] {267}	11,385 (2,277) [546] {273}	11,659 (2,332) [560] {280}
Orange	63,281	63,814	64,593	65,251	66,757 (13,351) [3,204] {1,602}	68,338 (13,668) [3,280] {1,640}	69,997 (13,999) [3,360] {1,680}
Osceola	21,268	21,416	21,644	21,833	22,351 (4,470) [1,073] {536}	22,886 (4,577) [1,099] {549}	23,438 (4,688) [1,125] {563}
Palm Beach	72,247	72,708	73,079	73,542	74,603 (14,921) [3,581] {1,790}	75,661 (15,132) [3,632] {1,816}	76,718 (15,344) [3,682] {1,841}
Pasco	17,578	17,810	17,975	18,190	18,693 (3,739) [897] {449}	19,211 (3,842) [922] {461}	19,746 (3,949) [948] {474}
Pinellas	37,387	37,753	38,118	38,457	39,307 (7,861) [1,887] {943}	40,192 (8,038) [1,929] {965}	41,115 (8,223) [1,974] {987}
Polk	30,967	31,173	31,383	31,668	32,316 (6,463) [1,551] {776}	32,996 (6,599) [1,584] {792}	33,709 (6,742) [1,618] {809}
Sarasota	15,659	15,793	15,915	16,031	16,309 (3,262) [783] {391}	16,582 (3,316) [796] {398}	16,851 (3,370) [809] {404}
Seminole	15,175	15,297	15,400	15,588	16,039 (3,208) [770] {385}	16,520 (3,304) [793] {396}	17,030 (3,406) [817] {409}
St. Johns	10,215	10,331	10,422	10,542	10,783 (2,157) [518] {259}	11,026 (2,205) [529] {265}	11,271 (2,254) [541] {270}
Sumter	3,987	4,015	4,037	4,067	4,162 (832) [200] {100}	4,263 (853) [205] {102}	4,370 (874) [210] {105}
Volusia	18,419	18,585	18,710	18,861	19,188 (3,838) [921] {461}	19,521 (3,904) [937] {468}	19,858 (3,972) [953] {477}

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.