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

Date: 12/4/20

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 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 12/4/20 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.

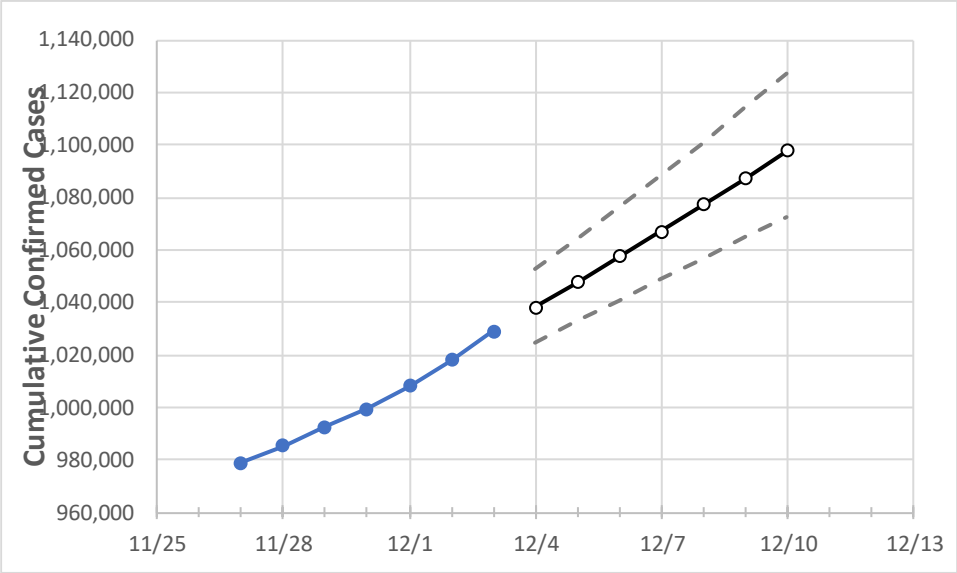
IEM's Modeling Lead

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:						
	11/30	12/1	12/2	12/3	12/4	12/5	12/6	12/7	12/8	12/9	12/10
Florida	999,319	1,008,166	1,018,160	1,029,030	1,038,282	1,047,712	1,057,322	1,067,115	1,077,094	1,087,264	1,097,627

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:						
	11/30	12/1	12/2	12/3	12/4	12/5	12/6	12/7	12/8	12/9	12/10
Alachua	12,864	12,911	13,017	13,118	13,190	13,262	13,334	13,407	13,480	13,554	13,628
Broward	107,524	108,325	109,360	110,517	111,494	112,490	113,504	114,537	115,589	116,661	117,753
Charlotte	5,087	5,150	5,220	5,293	5,355	5,419	5,483	5,549	5,616	5,684	5,753
Collier	17,757	17,911	18,132	18,334	18,469	18,607	18,746	18,889	19,033	19,180	19,330
Duval	43,978	44,450	44,969	45,575	46,142	46,736	47,359	48,012	48,696	49,414	50,165
Hillsborough	58,293	58,749	59,270	59,809	60,224	60,644	61,072	61,505	61,945	62,392	62,845
Lake	10,671	10,743	10,809	10,899	10,977	11,057	11,137	11,218	11,300	11,383	11,468
Lee	30,113	30,457	30,856	31,243	31,570	31,905	32,248	32,600	32,959	33,326	33,703
Manatee	16,860	17,006	17,164	17,324	17,492	17,664	17,842	18,024	18,211	18,404	18,601
Miami-Dade	229,618	231,761	234,054	236,308	238,579	240,902	243,276	245,702	248,183	250,717	253,307
Okaloosa	8,885	8,993	9,231	9,431	9,525	9,620	9,717	9,815	9,915	10,017	10,120
Orange	58,325	58,862	59,218	59,791	60,279	60,773	61,275	61,783	62,299	62,821	63,351
Osceola	18,354	18,598	18,817	19,066	19,251	19,440	19,633	19,830	20,032	20,238	20,448
Palm Beach	65,372	65,936	66,427	67,106	67,622	68,144	68,671	69,202	69,740	70,282	70,830
Pasco	14,899	15,041	15,248	15,480	15,666	15,855	16,048	16,245	16,445	16,649	16,857
Pinellas	33,058	33,246	33,493	33,857	34,144	34,435	34,729	35,026	35,328	35,632	35,941
Polk	27,611	27,822	28,101	28,399	28,595	28,795	28,998	29,206	29,419	29,635	29,856
Sarasota	13,763	13,917	14,093	14,257	14,453	14,656	14,864	15,079	15,300	15,528	15,762
Seminole	12,940	13,072	13,194	13,323	13,430	13,539	13,649	13,761	13,874	13,989	14,106
St. Johns	8,832	8,931	9,085	9,217	9,346	9,479	9,617	9,761	9,910	10,065	10,225
Sumter	3,467	3,503	3,535	3,602	3,636	3,672	3,709	3,749	3,791	3,836	3,882
Volusia	16,506	16,633	16,773	16,921	17,093	17,270	17,453	17,642	17,837	18,039	18,247

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:		
	11/30	12/1	12/2	12/3	12/5	12/7	12/9
Alachua	12,864	12,911	13,017	13,118	13,262 (2,652) [637] {318}	13,407 (2,681) [644] {322}	13,554 (2,711) [651] {325}
Broward	107,524	108,325	109,360	110,517	112,490 (22,498) [5,400] {2,700}	114,537 (22,907) [5,498] {2,749}	116,661 (23,332) [5,600] {2,800}
Charlotte	5,087	5,150	5,220	5,293	5,419 (1,084) [260] {130}	5,549 (1,110) [266] {133}	5,684 (1,137) [273] {136}
Collier	17,757	17,911	18,132	18,334	18,607 (3,721) [893] {447}	18,889 (3,778) [907] {453}	19,180 (3,836) [921] {460}
Duval	43,978	44,450	44,969	45,575	46,736 (9,347) [2,243] {1,122}	48,012 (9,602) [2,305] {1,152}	49,414 (9,883) [2,372] {1,186}
Hillsborough	58,293	58,749	59,270	59,809	60,644 (12,129) [2,911] {1,455}	61,505 (12,301) [2,952] {1,476}	62,392 (12,478) [2,995] {1,497}
Lake	10,671	10,743	10,809	10,899	11,057 (2,211) [531] {265}	11,218 (2,244) [538] {269}	11,383 (2,277) [546] {273}
Lee	30,113	30,457	30,856	31,243	31,905 (6,381) [1,531] {766}	32,600 (6,520) [1,565] {782}	33,326 (6,665) [1,600] {800}
Manatee	16,860	17,006	17,164	17,324	17,664 (3,533) [848] {424}	18,024 (3,605) [865] {433}	18,404 (3,681) [883] {442}
Miami-Dade	229,618	231,761	234,054	236,308	240,902 (48,180) [11,563] {5,782}	245,702 (49,140) [11,794] {5,897}	250,717 (50,143) [12,034] {6,017}
Okaloosa	8,885	8,993	9,231	9,431	9,620 (1,924) [462] {231}	9,815 (1,963) [471] {236}	10,017 (2,003) [481] {240}
Orange	58,325	58,862	59,218	59,791	60,773 (12,155) [2,917] {1,459}	61,783 (12,357) [2,966] {1,483}	62,821 (12,564) [3,015] {1,508}
Osceola	18,354	18,598	18,817	19,066	19,440 (3,888) [933] {467}	19,830 (3,966) [952] {476}	20,238 (4,048) [971] {486}
Palm Beach	65,372	65,936	66,427	67,106	68,144 (13,629) [3,271] {1,635}	69,202 (13,840) [3,322] {1,661}	70,282 (14,056) [3,374] {1,687}
Pasco	14,899	15,041	15,248	15,480	15,855 (3,171) [761] {381}	16,245 (3,249) [780] {390}	16,649 (3,330) [799] {400}
Pinellas	33,058	33,246	33,493	33,857	34,435 (6,887) [1,653] {826}	35,026 (7,005) [1,681] {841}	35,632 (7,126) [1,710] {855}
Polk	27,611	27,822	28,101	28,399	28,795 (5,759) [1,382] {691}	29,206 (5,841) [1,402] {701}	29,635 (5,927) [1,422] {711}
Sarasota	13,763	13,917	14,093	14,257	14,656 (2,931) [703] {352}	15,079 (3,016) [724] {362}	15,528 (3,106) [745] {373}
Seminole	12,940	13,072	13,194	13,323	13,539 (2,708) [650] {325}	13,761 (2,752) [661] {330}	13,989 (2,798) [671] {336}
St. Johns	8,832	8,931	9,085	9,217	9,479 (1,896) [455] {227}	9,761 (1,952) [469] {234}	10,065 (2,013) [483] {242}
Sumter	3,467	3,503	3,535	3,602	3,672 (734) [176] {88}	3,749 (750) [180] {90}	3,836 (767) [184] {92}
Volusia	16,506	16,633	16,773	16,921	17,270 (3,454) [829] {414}	17,642 (3,528) [847] {423}	18,039 (3,608) [866] {433}

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.