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

Date: 12/3/20

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 12/3/20 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.

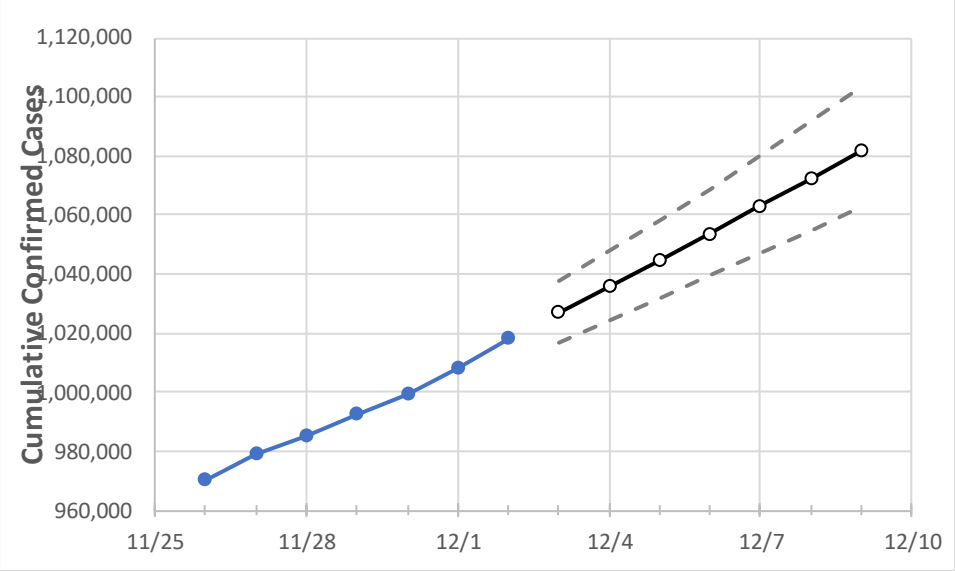
IEM's Modeling Lead

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:						
	11/29	11/30	12/1	12/2	12/3	12/4	12/5	12/6	12/7	12/8	12/9
Florida	992,660	999,319	1,008,166	1,018,160	1,026,904	1,035,761	1,044,734	1,053,824	1,063,031	1,072,359	1,081,805

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:						
	11/29	11/30	12/1	12/2	12/3	12/4	12/5	12/6	12/7	12/8	12/9
Alachua	12,813	12,864	12,911	13,017	13,083	13,149	13,215	13,280	13,345	13,409	13,474
Broward	106,698	107,524	108,325	109,360	110,283	111,217	112,164	113,124	114,096	115,081	116,079
Charlotte	5,052	5,087	5,150	5,220	5,280	5,341	5,402	5,464	5,528	5,592	5,657
Collier	17,693	17,757	17,911	18,132	18,261	18,391	18,524	18,657	18,793	18,931	19,070
Duval	43,599	43,978	44,450	44,969	45,494	46,042	46,612	47,206	47,826	48,471	49,143
Hillsborough	58,092	58,293	58,749	59,270	59,672	60,079	60,492	60,911	61,336	61,766	62,202
Lake	10,623	10,671	10,743	10,809	10,886	10,965	11,044	11,124	11,206	11,288	11,372
Lee	29,868	30,113	30,457	30,856	31,166	31,483	31,805	32,133	32,468	32,808	33,155
Manatee	16,703	16,860	17,006	17,164	17,329	17,499	17,673	17,850	18,033	18,220	18,411
Miami-Dade	227,656	229,618	231,761	234,054	236,250	238,490	240,775	243,106	245,482	247,905	250,376
Okaloosa	8,865	8,885	8,993	9,231	9,314	9,397	9,481	9,566	9,652	9,738	9,825
Orange	57,805	58,325	58,862	59,218	59,684	60,154	60,628	61,106	61,588	62,075	62,565
Osceola	18,248	18,354	18,598	18,817	18,996	19,178	19,364	19,553	19,746	19,943	20,144
Palm Beach	65,011	65,372	65,936	66,427	66,919	67,413	67,909	68,408	68,908	69,411	69,916
Pasco	14,783	14,899	15,041	15,248	15,421	15,597	15,774	15,954	16,136	16,320	16,507
Pinellas	32,808	33,058	33,246	33,493	33,759	34,025	34,291	34,558	34,825	35,092	35,359
Polk	27,481	27,611	27,822	28,101	28,285	28,473	28,663	28,857	29,054	29,254	29,458
Sarasota	13,647	13,763	13,917	14,093	14,290	14,492	14,701	14,915	15,136	15,362	15,596
Seminole	12,871	12,940	13,072	13,194	13,296	13,400	13,504	13,611	13,718	13,827	13,937
St. Johns	8,727	8,832	8,931	9,085	9,208	9,336	9,469	9,606	9,748	9,895	10,048
Sumter	3,442	3,467	3,503	3,535	3,564	3,595	3,627	3,660	3,695	3,731	3,770
Volusia	16,358	16,506	16,633	16,773	16,943	17,119	17,301	17,488	17,682	17,883	18,090

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:		
	11/29	11/30	12/1	12/2	12/4	12/6	12/8
Alachua	12,813	12,864	12,911	13,017	13,149 (2,630) [631] {316}	13,280 (2,656) [637] {319}	13,409 (2,682) [644] {322}
Broward	106,698	107,524	108,325	109,360	111,217 (22,243) [5,338] {2,669}	113,124 (22,625) [5,430] {2,715}	115,081 (23,016) [5,524] {2,762}
Charlotte	5,052	5,087	5,150	5,220	5,341 (1,068) [256] {128}	5,464 (1,093) [262] {131}	5,592 (1,118) [268] {134}
Collier	17,693	17,757	17,911	18,132	18,391 (3,678) [883] {441}	18,657 (3,731) [896] {448}	18,931 (3,786) [909] {454}
Duval	43,599	43,978	44,450	44,969	46,042 (9,208) [2,210] {1,105}	47,206 (9,441) [2,266] {1,133}	48,471 (9,694) [2,327] {1,163}
Hillsborough	58,092	58,293	58,749	59,270	60,079 (12,016) [2,884] {1,442}	60,911 (12,182) [2,924] {1,462}	61,766 (12,353) [2,965] {1,482}
Lake	10,623	10,671	10,743	10,809	10,965 (2,193) [526] {263}	11,124 (2,225) [534] {267}	11,288 (2,258) [542] {271}
Lee	29,868	30,113	30,457	30,856	31,483 (6,297) [1,511] {756}	32,133 (6,427) [1,542] {771}	32,808 (6,562) [1,575] {787}
Manatee	16,703	16,860	17,006	17,164	17,499 (3,500) [840] {420}	17,850 (3,570) [857] {428}	18,220 (3,644) [875] {437}
Miami-Dade	227,656	229,618	231,761	234,054	238,490 (47,698) [11,448] {5,724}	243,106 (48,621) [11,669] {5,835}	247,905 (49,581) [11,899] {5,950}
Okaloosa	8,865	8,885	8,993	9,231	9,397 (1,879) [451] {226}	9,566 (1,913) [459] {230}	9,738 (1,948) [467] {234}
Orange	57,805	58,325	58,862	59,218	60,154 (12,031) [2,887] {1,444}	61,106 (12,221) [2,933] {1,467}	62,075 (12,415) [2,980] {1,490}
Osceola	18,248	18,354	18,598	18,817	19,178 (3,836) [921] {460}	19,553 (3,911) [939] {469}	19,943 (3,989) [957] {479}
Palm Beach	65,011	65,372	65,936	66,427	67,413 (13,483) [3,236] {1,618}	68,408 (13,682) [3,284] {1,642}	69,411 (13,882) [3,332] {1,666}
Pasco	14,783	14,899	15,041	15,248	15,597 (3,119) [749] {374}	15,954 (3,191) [766] {383}	16,320 (3,264) [783] {392}
Pinellas	32,808	33,058	33,246	33,493	34,025 (6,805) [1,633] {817}	34,558 (6,912) [1,659] {829}	35,092 (7,018) [1,684] {842}
Polk	27,481	27,611	27,822	28,101	28,473 (5,695) [1,367] {683}	28,857 (5,771) [1,385] {693}	29,254 (5,851) [1,404] {702}
Sarasota	13,647	13,763	13,917	14,093	14,492 (2,898) [696] {348}	14,915 (2,983) [716] {358}	15,362 (3,072) [737] {369}
Seminole	12,871	12,940	13,072	13,194	13,400 (2,680) [643] {322}	13,611 (2,722) [653] {327}	13,827 (2,765) [664] {332}
St. Johns	8,727	8,832	8,931	9,085	9,336 (1,867) [448] {224}	9,606 (1,921) [461] {231}	9,895 (1,979) [475] {237}
Sumter	3,442	3,467	3,503	3,535	3,595 (719) [173] {86}	3,660 (732) [176] {88}	3,731 (746) [179] {90}
Volusia	16,358	16,506	16,633	16,773	17,119 (3,424) [822] {411}	17,488 (3,498) [839] {420}	17,883 (3,577) [858] {429}

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.