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

Date: 12/18/20

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 12/18/20 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.

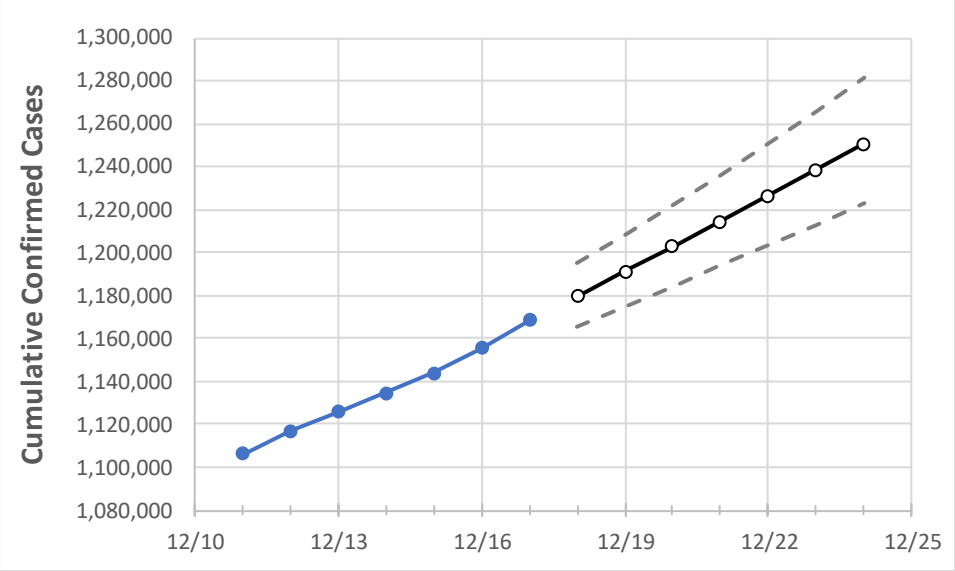
IEM's Modeling Lead

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:						
	12/14	12/15	12/16	12/17	12/18	12/19	12/20	12/21	12/22	12/23	12/24
Florida	1,134,383	1,143,794	1,155,335	1,168,483	1,179,672	1,191,052	1,202,623	1,214,388	1,226,346	1,238,503	1,250,856

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:						
	12/14	12/15	12/16	12/17	12/18	12/19	12/20	12/21	12/22	12/23	12/24
Alachua	14,128	14,225	14,323	14,468	14,576	14,686	14,798	14,912	15,028	15,146	15,267
Broward	120,840	121,512	122,883	123,991	125,015	126,048	127,088	128,136	129,193	130,257	131,329
Charlotte	6,111	6,104	6,207	6,313	6,404	6,496	6,590	6,687	6,785	6,886	6,989
Collier	20,021	20,151	20,294	20,482	20,638	20,795	20,952	21,110	21,269	21,429	21,590
Duval	50,646	51,112	51,936	52,674	53,266	53,870	54,488	55,118	55,761	56,418	57,088
Hillsborough	66,041	66,548	67,060	67,801	68,455	69,125	69,810	70,511	71,229	71,963	72,714
Lake	12,435	12,571	12,727	12,966	13,160	13,363	13,575	13,795	14,025	14,264	14,514
Lee	34,717	35,031	35,353	35,759	36,107	36,459	36,814	37,172	37,534	37,900	38,269
Manatee	19,020	19,212	19,389	19,612	19,798	19,988	20,181	20,377	20,578	20,782	20,990
Miami-Dade	260,138	262,298	264,673	267,255	269,658	272,088	274,544	277,027	279,536	282,071	284,634
Okaloosa	10,781	10,853	11,023	11,146	11,275	11,406	11,539	11,673	11,809	11,947	12,086
Orange	64,593	65,251	65,975	66,786	67,564	68,359	69,173	70,004	70,855	71,724	72,613
Osceola	21,644	21,833	22,057	22,353	22,616	22,883	23,155	23,431	23,711	23,996	24,285
Palm Beach	73,079	73,542	73,998	74,789	75,355	75,925	76,498	77,075	77,656	78,240	78,829
Pasco	17,975	18,190	18,385	18,733	18,998	19,269	19,546	19,828	20,117	20,412	20,713
Pinellas	38,118	38,457	38,783	39,337	39,777	40,225	40,683	41,149	41,626	42,111	42,607
Polk	31,383	31,668	31,996	32,432	32,784	33,146	33,520	33,905	34,302	34,711	35,132
Sarasota	15,915	16,031	16,189	16,389	16,536	16,683	16,830	16,976	17,122	17,268	17,413
Seminole	15,400	15,588	15,757	15,938	16,155	16,377	16,604	16,837	17,075	17,319	17,569
St. Johns	10,422	10,542	10,697	10,868	10,999	11,132	11,266	11,401	11,537	11,675	11,813
Sumter	4,037	4,067	4,154	4,221	4,279	4,339	4,402	4,467	4,536	4,607	4,681
Volusia	18,710	18,861	19,072	19,334	19,527	19,723	19,922	20,125	20,332	20,541	20,754

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:		
	12/14	12/15	12/16	12/17	12/19	12/21	12/23
Alachua	14,128	14,225	14,323	14,468	14,686 (2,937) [705] {352}	14,912 (2,982) [716] {358}	15,146 (3,029) [727] {364}
Broward	120,840	121,512	122,883	123,991	126,048 (25,210) [6,050] {3,025}	128,136 (25,627) [6,151] {3,075}	130,257 (26,051) [6,252] {3,126}
Charlotte	6,111	6,104	6,207	6,313	6,496 (1,299) [312] {156}	6,687 (1,337) [321] {160}	6,886 (1,377) [331] {165}
Collier	20,021	20,151	20,294	20,482	20,795 (4,159) [998] {499}	21,110 (4,222) [1,013] {507}	21,429 (4,286) [1,029] {514}
Duval	50,646	51,112	51,936	52,674	53,870 (10,774) [2,586] {1,293}	55,118 (11,024) [2,646] {1,323}	56,418 (11,284) [2,708] {1,354}
Hillsborough	66,041	66,548	67,060	67,801	69,125 (13,825) [3,318] {1,659}	70,511 (14,102) [3,385] {1,692}	71,963 (14,393) [3,454] {1,727}
Lake	12,435	12,571	12,727	12,966	13,363 (2,673) [641] {321}	13,795 (2,759) [662] {331}	14,264 (2,853) [685] {342}
Lee	34,717	35,031	35,353	35,759	36,459 (7,292) [1,750] {875}	37,172 (7,434) [1,784] {892}	37,900 (7,580) [1,819] {910}
Manatee	19,020	19,212	19,389	19,612	19,988 (3,998) [959] {480}	20,377 (4,075) [978] {489}	20,782 (4,156) [998] {499}
Miami-Dade	260,138	262,298	264,673	267,255	272,088 (54,418) [13,060] {6,530}	277,027 (55,405) [13,297] {6,649}	282,071 (56,414) [13,539] {6,770}
Okaloosa	10,781	10,853	11,023	11,146	11,406 (2,281) [548] {274}	11,673 (2,335) [560] {280}	11,947 (2,389) [573] {287}
Orange	64,593	65,251	65,975	66,786	68,359 (13,672) [3,281] {1,641}	70,004 (14,001) [3,360] {1,680}	71,724 (14,345) [3,443] {1,721}
Osceola	21,644	21,833	22,057	22,353	22,883 (4,577) [1,098] {549}	23,431 (4,686) [1,125] {562}	23,996 (4,799) [1,152] {576}
Palm Beach	73,079	73,542	73,998	74,789	75,925 (15,185) [3,644] {1,822}	77,075 (15,415) [3,700] {1,850}	78,240 (15,648) [3,756] {1,878}
Pasco	17,975	18,190	18,385	18,733	19,269 (3,854) [925] {462}	19,828 (3,966) [952] {476}	20,412 (4,082) [980] {490}
Pinellas	38,118	38,457	38,783	39,337	40,225 (8,045) [1,931] {965}	41,149 (8,230) [1,975] {988}	42,111 (8,422) [2,021] {1,011}
Polk	31,383	31,668	31,996	32,432	33,146 (6,629) [1,591] {796}	33,905 (6,781) [1,627] {814}	34,711 (6,942) [1,666] {833}
Sarasota	15,915	16,031	16,189	16,389	16,683 (3,337) [801] {400}	16,976 (3,395) [815] {407}	17,268 (3,454) [829] {414}
Seminole	15,400	15,588	15,757	15,938	16,377 (3,275) [786] {393}	16,837 (3,367) [808] {404}	17,319 (3,464) [831] {416}
St. Johns	10,422	10,542	10,697	10,868	11,132 (2,226) [534] {267}	11,401 (2,280) [547] {274}	11,675 (2,335) [560] {280}
Sumter	4,037	4,067	4,154	4,221	4,339 (868) [208] {104}	4,467 (893) [214] {107}	4,607 (921) [221] {111}
Volusia	18,710	18,861	19,072	19,334	19,723 (3,945) [947] {473}	20,125 (4,025) [966] {483}	20,541 (4,108) [986] {493}

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.