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

Date: 2/16/21

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 2/16/21 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.

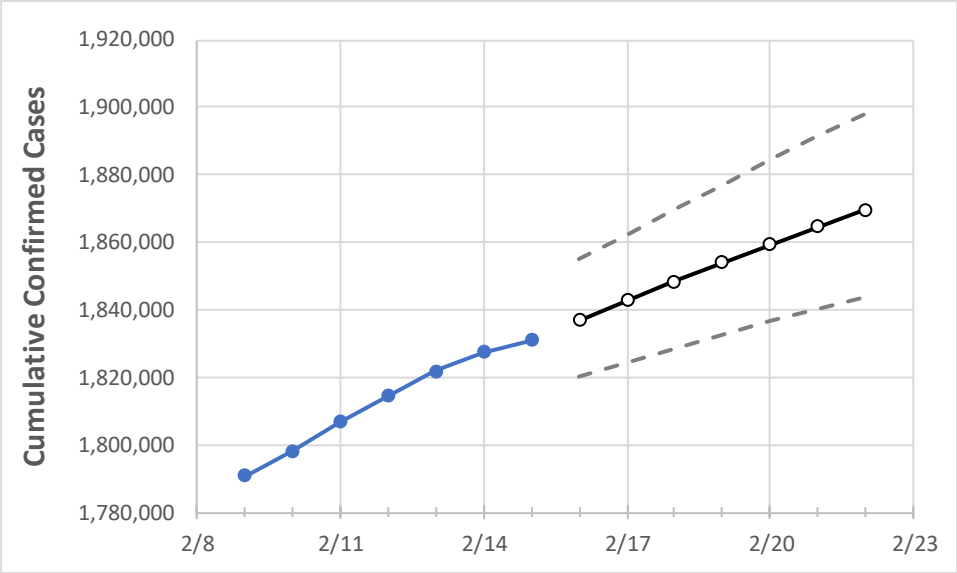
IEM's Modeling Lead

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:						
	2/12	2/13	2/14	2/15	2/16	2/17	2/18	2/19	2/20	2/21	2/22
Florida	1,814,422	1,821,937	1,827,373	1,830,988	1,837,039	1,842,810	1,848,386	1,853,998	1,859,349	1,864,624	1,869,784

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

Florida Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	2/12	2/13	2/14	2/15	2/16	2/17	2/18	2/19	2/20	2/21	2/22
Alachua	21,693	21,756	21,791	21,830	21,892	21,950	22,006	22,062	22,116	22,168	22,219
Broward	183,224	184,110	184,773	185,310	186,046	186,775	187,491	188,193	188,895	189,574	190,237
Charlotte	10,194	10,236	10,280	10,322	10,359	10,394	10,430	10,465	10,498	10,532	10,565
Collier	28,978	29,058	29,136	29,195	29,271	29,345	29,413	29,479	29,546	29,611	29,678
Duval	85,764	86,024	86,163	86,283	86,506	86,717	86,922	87,127	87,328	87,514	87,697
Hillsborough	105,621	106,060	106,420	106,661	106,984	107,308	107,613	107,912	108,212	108,498	108,776
Lake	23,215	23,346	23,442	23,498	23,592	23,681	23,772	23,857	23,942	24,021	24,097
Lee	55,176	55,346	55,513	55,652	55,809	55,957	56,099	56,238	56,376	56,513	56,646
Manatee	30,118	30,256	30,333	30,384	30,484	30,585	30,681	30,775	30,871	30,963	31,056
Miami-Dade	391,162	392,842	393,971	394,492	395,721	396,929	398,117	399,261	400,368	401,461	402,560
Okaloosa	17,823	17,879	17,927	17,983	18,058	18,132	18,206	18,277	18,350	18,418	18,487
Orange	108,617	109,087	109,453	109,650	109,991	110,315	110,612	110,901	111,182	111,459	111,732
Osceola	35,150	35,276	35,394	35,429	35,521	35,607	35,695	35,777	35,858	35,934	36,006
Palm Beach	113,457	114,083	114,467	114,800	115,235	115,662	116,079	116,483	116,884	117,275	117,670
Pasco	31,371	31,508	31,631	31,744	31,870	31,993	32,111	32,227	32,343	32,458	32,567
Pinellas	62,788	63,023	63,171	63,326	63,534	63,734	63,933	64,130	64,325	64,512	64,690
Polk	53,925	54,235	54,435	54,573	54,808	55,036	55,265	55,488	55,702	55,915	56,121
Sarasota	25,878	25,948	25,982	26,011	26,076	26,136	26,196	26,253	26,308	26,360	26,412
Seminole	25,606	25,714	25,821	25,879	25,979	26,075	26,171	26,263	26,353	26,441	26,525
St. Johns	19,401	19,457	19,532	19,568	19,632	19,692	19,751	19,805	19,859	19,913	19,963
Sumter	7,551	7,576	7,597	7,608	7,637	7,665	7,692	7,718	7,743	7,769	7,793
Volusia	33,034	33,196	33,264	33,308	33,429	33,547	33,664	33,769	33,874	33,980	34,079

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:		
	2/12	2/13	2/14	2/15	2/17	2/19	2/21
Alachua	21,693	21,756	21,791	21,830	21,950 (4,390) [1,054] {527}	22,062 (4,412) [1,059] {529}	22,168 (4,434) [1,064] {532}
Broward	183,224	184,110	184,773	185,310	186,775 (37,355) [8,965] {4,483}	188,193 (37,639) [9,033] {4,517}	189,574 (37,915) [9,100] {4,550}
Charlotte	10,194	10,236	10,280	10,322	10,394 (2,079) [499] {249}	10,465 (2,093) [502] {251}	10,532 (2,106) [506] {253}
Collier	28,978	29,058	29,136	29,195	29,345 (5,869) [1,409] {704}	29,479 (5,896) [1,415] {707}	29,611 (5,922) [1,421] {711}
Duval	85,764	86,024	86,163	86,283	86,717 (17,343) [4,162] {2,081}	87,127 (17,425) [4,182] {2,091}	87,514 (17,503) [4,201] {2,100}
Hillsborough	105,621	106,060	106,420	106,661	107,308 (21,462) [5,151] {2,575}	107,912 (21,582) [5,180] {2,590}	108,498 (21,700) [5,208] {2,604}
Lake	23,215	23,346	23,442	23,498	23,681 (4,736) [1,137] {568}	23,857 (4,771) [1,145] {573}	24,021 (4,804) [1,153] {577}
Lee	55,176	55,346	55,513	55,652	55,957 (11,191) [2,686] {1,343}	56,238 (11,248) [2,699] {1,350}	56,513 (11,303) [2,713] {1,356}
Manatee	30,118	30,256	30,333	30,384	30,585 (6,117) [1,468] {734}	30,775 (6,155) [1,477] {739}	30,963 (6,193) [1,486] {743}
Miami-Dade	391,162	392,842	393,971	394,492	396,929 (79,386) [19,053] {9,526}	399,261 (79,852) [19,165] {9,582}	401,461 (80,292) [19,270] {9,635}
Okaloosa	17,823	17,879	17,927	17,983	18,132 (3,626) [870] {435}	18,277 (3,655) [877] {439}	18,418 (3,684) [884] {442}
Orange	108,617	109,087	109,453	109,650	110,315 (22,063) [5,295] {2,648}	110,901 (22,180) [5,323] {2,662}	111,459 (22,292) [5,350] {2,675}
Osceola	35,150	35,276	35,394	35,429	35,607 (7,121) [1,709] {855}	35,777 (7,155) [1,717] {859}	35,934 (7,187) [1,725] {862}
Palm Beach	113,457	114,083	114,467	114,800	115,662 (23,132) [5,552] {2,776}	116,483 (23,297) [5,591] {2,796}	117,275 (23,455) [5,629] {2,815}
Pasco	31,371	31,508	31,631	31,744	31,993 (6,399) [1,536] {768}	32,227 (6,445) [1,547] {773}	32,458 (6,492) [1,558] {779}
Pinellas	62,788	63,023	63,171	63,326	63,734 (12,747) [3,059] {1,530}	64,130 (12,826) [3,078] {1,539}	64,512 (12,902) [3,097] {1,548}
Polk	53,925	54,235	54,435	54,573	55,036 (11,007) [2,642] {1,321}	55,488 (11,098) [2,663] {1,332}	55,915 (11,183) [2,684] {1,342}
Sarasota	25,878	25,948	25,982	26,011	26,136 (5,227) [1,255] {627}	26,253 (5,251) [1,260] {630}	26,360 (5,272) [1,265] {633}
Seminole	25,606	25,714	25,821	25,879	26,075 (5,215) [1,252] {626}	26,263 (5,253) [1,261] {630}	26,441 (5,288) [1,269] {635}
St. Johns	19,401	19,457	19,532	19,568	19,692 (3,938) [945] {473}	19,805 (3,961) [951] {475}	19,913 (3,983) [956] {478}
Sumter	7,551	7,576	7,597	7,608	7,665 (1,533) [368] {184}	7,718 (1,544) [370] {185}	7,769 (1,554) [373] {186}
Volusia	33,034	33,196	33,264	33,308	33,547 (6,709) [1,610] {805}	33,769 (6,754) [1,621] {810}	33,980 (6,796) [1,631] {816}

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.