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

Date: 5/11/21

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 5/11/21 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.

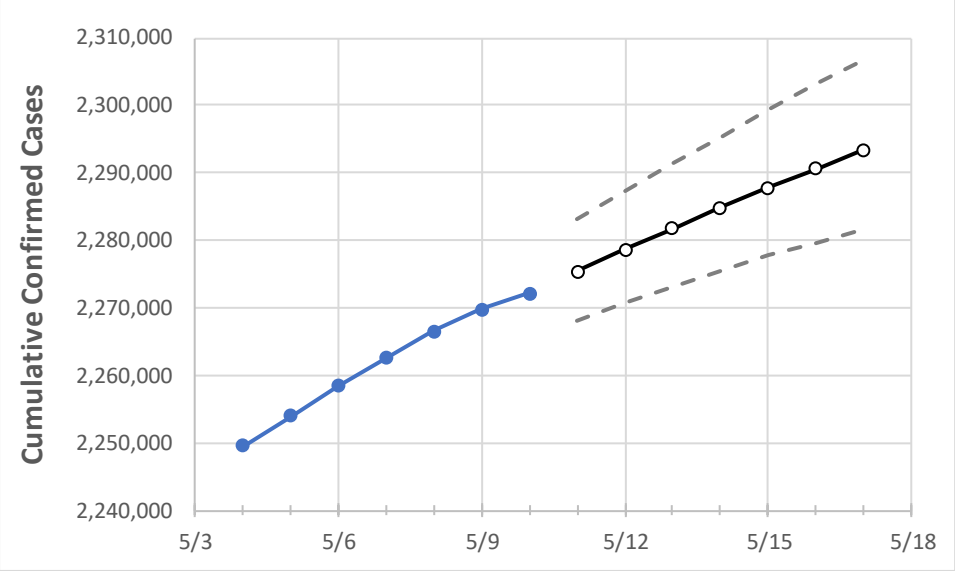
IEM's Modeling Lead

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:						
	5/7	5/8	5/9	5/10	5/11	5/12	5/13	5/14	5/15	5/16	5/17
Florida	2,262,598	2,266,575	2,269,806	2,272,102	2,275,461	2,278,689	2,281,785	2,284,857	2,287,767	2,290,648	2,293,396

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:						
	5/7	5/8	5/9	5/10	5/11	5/12	5/13	5/14	5/15	5/16	5/17
Alachua	24,842	24,871	24,892	24,915	24,939	24,962	24,984	25,007	25,029	25,050	25,071
Broward	239,249	239,602	239,941	240,143	240,478	240,802	241,108	241,399	241,684	241,956	242,214
Charlotte	12,907	12,934	12,957	12,973	12,996	13,019	13,042	13,063	13,085	13,106	13,127
Collier	35,866	35,941	36,010	36,044	36,109	36,173	36,235	36,297	36,357	36,417	36,477
Duval	98,282	98,417	98,524	98,611	98,734	98,856	98,973	99,086	99,203	99,316	99,426
Hillsborough	137,651	137,950	138,161	138,312	138,586	138,849	139,112	139,364	139,607	139,842	140,076
Lake	29,736	29,808	29,856	29,885	29,939	29,992	30,042	30,091	30,138	30,186	30,232
Lee	70,689	70,939	71,111	71,242	71,419	71,593	71,766	71,939	72,106	72,268	72,428
Manatee	38,711	38,785	38,828	38,879	38,947	39,013	39,078	39,142	39,203	39,261	39,321
Miami-Dade	489,014	489,839	490,499	491,028	491,665	492,288	492,893	493,476	494,022	494,562	495,090
Okaloosa	20,566	20,578	20,597	20,609	20,629	20,648	20,668	20,687	20,707	20,726	20,745
Orange	138,414	138,735	138,989	139,136	139,385	139,626	139,861	140,089	140,309	140,527	140,734
Osceola	44,768	44,867	44,960	45,010	45,090	45,167	45,241	45,312	45,382	45,449	45,512
Palm Beach	144,892	145,126	145,331	145,485	145,694	145,894	146,086	146,281	146,470	146,648	146,827
Pasco	41,431	41,555	41,638	41,687	41,773	41,854	41,937	42,014	42,094	42,171	42,245
Pinellas	79,657	79,767	79,881	79,947	80,044	80,138	80,229	80,316	80,404	80,486	80,564
Polk	68,800	68,925	69,056	69,142	69,281	69,415	69,547	69,671	69,795	69,916	70,036
Sarasota	32,808	32,862	32,922	32,954	32,997	33,039	33,079	33,117	33,153	33,188	33,223
Seminole	34,169	34,230	34,274	34,325	34,376	34,427	34,477	34,524	34,568	34,612	34,651
St. Johns	22,656	22,687	22,718	22,742	22,774	22,806	22,838	22,870	22,900	22,931	22,961
Sumter	9,341	9,345	9,352	9,356	9,364	9,372	9,379	9,387	9,394	9,401	9,408
Volusia	43,351	43,430	43,499	43,553	43,618	43,681	43,744	43,803	43,863	43,918	43,973

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:		
	5/7	5/8	5/9	5/10	5/12	5/14	5/16
Alachua	24,842	24,871	24,892	24,915	24,962 (4,992) [1,198] {599}	25,007 (5,001) [1,200] {600}	25,050 (5,010) [1,202] {601}
Broward	239,249	239,602	239,941	240,143	240,802 (48,160) [11,558] {5,779}	241,399 (48,280) [11,587] {5,794}	241,956 (48,391) [11,614] {5,807}
Charlotte	12,907	12,934	12,957	12,973	13,019 (2,604) [625] {312}	13,063 (2,613) [627] {314}	13,106 (2,621) [629] {315}
Collier	35,866	35,941	36,010	36,044	36,173 (7,235) [1,736] {868}	36,297 (7,259) [1,742] {871}	36,417 (7,283) [1,748] {874}
Duval	98,282	98,417	98,524	98,611	98,856 (19,771) [4,745] {2,373}	99,086 (19,817) [4,756] {2,378}	99,316 (19,863) [4,767] {2,384}
Hillsborough	137,651	137,950	138,161	138,312	138,849 (27,770) [6,665] {3,332}	139,364 (27,873) [6,689] {3,345}	139,842 (27,968) [6,712] {3,356}
Lake	29,736	29,808	29,856	29,885	29,992 (5,998) [1,440] {720}	30,091 (6,018) [1,444] {722}	30,186 (6,037) [1,449] {724}
Lee	70,689	70,939	71,111	71,242	71,593 (14,319) [3,436] {1,718}	71,939 (14,388) [3,453] {1,727}	72,268 (14,454) [3,469] {1,734}
Manatee	38,711	38,785	38,828	38,879	39,013 (7,803) [1,873] {936}	39,142 (7,828) [1,879] {939}	39,261 (7,852) [1,885] {942}
Miami-Dade	489,014	489,839	490,499	491,028	492,288 (98,458) [23,630] {11,815}	493,476 (98,695) [23,687] {11,843}	494,562 (98,912) [23,739] {11,869}
Okaloosa	20,566	20,578	20,597	20,609	20,648 (4,130) [991] {496}	20,687 (4,137) [993] {496}	20,726 (4,145) [995] {497}
Orange	138,414	138,735	138,989	139,136	139,626 (27,925) [6,702] {3,351}	140,089 (28,018) [6,724] {3,362}	140,527 (28,105) [6,745] {3,373}
Osceola	44,768	44,867	44,960	45,010	45,167 (9,033) [2,168] {1,084}	45,312 (9,062) [2,175] {1,087}	45,449 (9,090) [2,182] {1,091}
Palm Beach	144,892	145,126	145,331	145,485	145,894 (29,179) [7,003] {3,501}	146,281 (29,256) [7,021] {3,511}	146,648 (29,330) [7,039] {3,520}
Pasco	41,431	41,555	41,638	41,687	41,854 (8,371) [2,009] {1,004}	42,014 (8,403) [2,017] {1,008}	42,171 (8,434) [2,024] {1,012}
Pinellas	79,657	79,767	79,881	79,947	80,138 (16,028) [3,847] {1,923}	80,316 (16,063) [3,855] {1,928}	80,486 (16,097) [3,863] {1,932}
Polk	68,800	68,925	69,056	69,142	69,415 (13,883) [3,332] {1,666}	69,671 (13,934) [3,344] {1,672}	69,916 (13,983) [3,356] {1,678}
Sarasota	32,808	32,862	32,922	32,954	33,039 (6,608) [1,586] {793}	33,117 (6,623) [1,590] {795}	33,188 (6,638) [1,593] {797}
Seminole	34,169	34,230	34,274	34,325	34,427 (6,885) [1,653] {826}	34,524 (6,905) [1,657] {829}	34,612 (6,922) [1,661] {831}
St. Johns	22,656	22,687	22,718	22,742	22,806 (4,561) [1,095] {547}	22,870 (4,574) [1,098] {549}	22,931 (4,586) [1,101] {550}
Sumter	9,341	9,345	9,352	9,356	9,372 (1,874) [450] {225}	9,387 (1,877) [451] {225}	9,401 (1,880) [451] {226}
Volusia	43,351	43,430	43,499	43,553	43,681 (8,736) [2,097] {1,048}	43,803 (8,761) [2,103] {1,051}	43,918 (8,784) [2,108] {1,054}

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.