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

Date: 5/3/21

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 5/3/21 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.

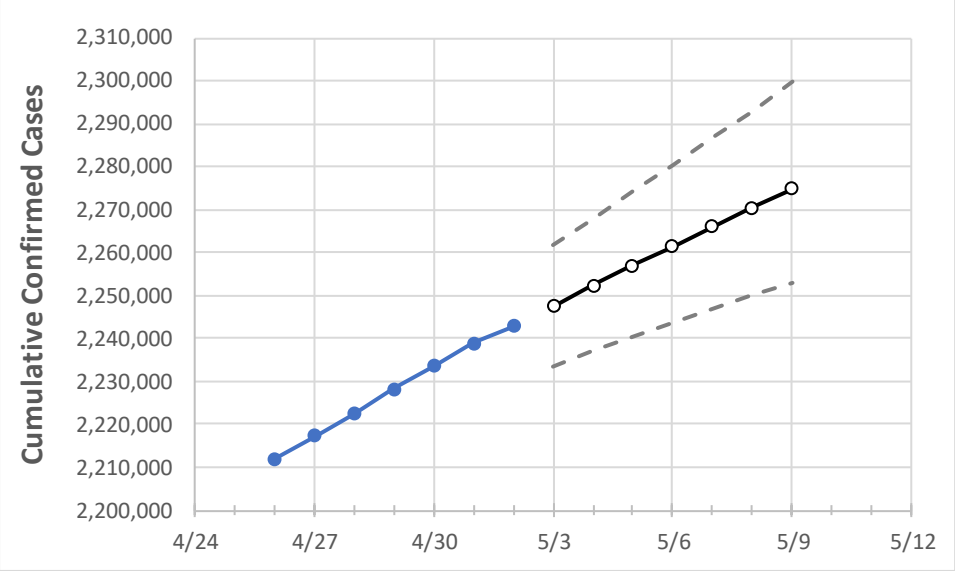
IEM's Modeling Lead

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:						
	4/29	4/30	5/1	5/2	5/3	5/4	5/5	5/6	5/7	5/8	5/9
Florida	2,228,212	2,233,518	2,238,937	2,242,778	2,247,583	2,252,345	2,256,958	2,261,533	2,266,109	2,270,566	2,274,990

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:						
	4/29	4/30	5/1	5/2	5/3	5/4	5/5	5/6	5/7	5/8	5/9
Alachua	24,607	24,635	24,678	24,701	24,739	24,775	24,812	24,848	24,885	24,922	24,958
Broward	235,335	235,971	236,592	237,067	237,613	238,140	238,673	239,192	239,699	240,204	240,687
Charlotte	12,691	12,716	12,750	12,775	12,804	12,832	12,860	12,888	12,914	12,941	12,966
Collier	35,229	35,358	35,451	35,525	35,609	35,692	35,775	35,857	35,938	36,018	36,100
Duval	97,106	97,248	97,495	97,619	97,786	97,954	98,120	98,293	98,465	98,636	98,809
Hillsborough	134,761	135,278	135,705	136,014	136,424	136,829	137,229	137,627	138,034	138,429	138,820
Lake	29,228	29,290	29,369	29,429	29,503	29,577	29,649	29,720	29,791	29,860	29,927
Lee	69,161	69,446	69,651	69,837	70,075	70,312	70,547	70,780	71,017	71,249	71,484
Manatee	38,028	38,128	38,237	38,303	38,393	38,484	38,571	38,659	38,744	38,831	38,916
Miami-Dade	482,443	483,371	484,514	485,300	486,190	487,109	487,973	488,818	489,646	490,475	491,259
Okaloosa	20,391	20,418	20,448	20,462	20,483	20,505	20,527	20,549	20,570	20,591	20,613
Orange	135,932	136,327	136,673	136,967	137,312	137,647	137,981	138,319	138,654	138,983	139,309
Osceola	43,924	44,050	44,174	44,302	44,433	44,567	44,696	44,825	44,953	45,078	45,202
Palm Beach	142,829	143,129	143,471	143,709	144,016	144,326	144,628	144,929	145,236	145,526	145,821
Pasco	40,556	40,692	40,808	40,895	41,017	41,137	41,256	41,372	41,486	41,598	41,712
Pinellas	78,647	78,803	78,971	79,072	79,222	79,368	79,510	79,654	79,790	79,926	80,058
Polk	67,355	67,607	67,819	67,979	68,195	68,409	68,624	68,837	69,053	69,263	69,476
Sarasota	32,343	32,385	32,479	32,545	32,617	32,687	32,758	32,824	32,887	32,952	33,015
Seminole	33,583	33,689	33,775	33,833	33,927	34,016	34,106	34,192	34,278	34,362	34,441
St. Johns	22,357	22,392	22,434	22,463	22,496	22,528	22,560	22,591	22,621	22,652	22,682
Sumter	9,249	9,263	9,270	9,281	9,292	9,304	9,315	9,326	9,337	9,347	9,357
Volusia	42,617	42,709	42,824	42,904	42,999	43,091	43,179	43,266	43,350	43,430	43,509

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:		
	4/29	4/30	5/1	5/2	5/4	5/6	5/8
Alachua	24,607	24,635	24,678	24,701	24,775 (4,955) [1,189] {595}	24,848 (4,970) [1,193] {596}	24,922 (4,984) [1,196] {598}
Broward	235,335	235,971	236,592	237,067	238,140 (47,628) [11,431] {5,715}	239,192 (47,838) [11,481] {5,741}	240,204 (48,041) [11,530] {5,765}
Charlotte	12,691	12,716	12,750	12,775	12,832 (2,566) [616] {308}	12,888 (2,578) [619] {309}	12,941 (2,588) [621] {311}
Collier	35,229	35,358	35,451	35,525	35,692 (7,138) [1,713] {857}	35,857 (7,171) [1,721] {861}	36,018 (7,204) [1,729] {864}
Duval	97,106	97,248	97,495	97,619	97,954 (19,591) [4,702] {2,351}	98,293 (19,659) [4,718] {2,359}	98,636 (19,727) [4,735] {2,367}
Hillsborough	134,761	135,278	135,705	136,014	136,829 (27,366) [6,568] {3,284}	137,627 (27,525) [6,606] {3,303}	138,429 (27,686) [6,645] {3,322}
Lake	29,228	29,290	29,369	29,429	29,577 (5,915) [1,420] {710}	29,720 (5,944) [1,427] {713}	29,860 (5,972) [1,433] {717}
Lee	69,161	69,446	69,651	69,837	70,312 (14,062) [3,375] {1,687}	70,780 (14,156) [3,397] {1,699}	71,249 (14,250) [3,420] {1,710}
Manatee	38,028	38,128	38,237	38,303	38,484 (7,697) [1,847] {924}	38,659 (7,732) [1,856] {928}	38,831 (7,766) [1,864] {932}
Miami-Dade	482,443	483,371	484,514	485,300	487,109 (97,422) [23,381] {11,691}	488,818 (97,764) [23,463] {11,732}	490,475 (98,095) [23,543] {11,771}
Okaloosa	20,391	20,418	20,448	20,462	20,505 (4,101) [984] {492}	20,549 (4,110) [986] {493}	20,591 (4,118) [988] {494}
Orange	135,932	136,327	136,673	136,967	137,647 (27,529) [6,607] {3,304}	138,319 (27,664) [6,639] {3,320}	138,983 (27,797) [6,671] {3,336}
Osceola	43,924	44,050	44,174	44,302	44,567 (8,913) [2,139] {1,070}	44,825 (8,965) [2,152] {1,076}	45,078 (9,016) [2,164] {1,082}
Palm Beach	142,829	143,129	143,471	143,709	144,326 (28,865) [6,928] {3,464}	144,929 (28,986) [6,957] {3,478}	145,526 (29,105) [6,985] {3,493}
Pasco	40,556	40,692	40,808	40,895	41,137 (8,227) [1,975] {987}	41,372 (8,274) [1,986] {993}	41,598 (8,320) [1,997] {998}
Pinellas	78,647	78,803	78,971	79,072	79,368 (15,874) [3,810] {1,905}	79,654 (15,931) [3,823] {1,912}	79,926 (15,985) [3,836] {1,918}
Polk	67,355	67,607	67,819	67,979	68,409 (13,682) [3,284] {1,642}	68,837 (13,767) [3,304] {1,652}	69,263 (13,853) [3,325] {1,662}
Sarasota	32,343	32,385	32,479	32,545	32,687 (6,537) [1,569] {784}	32,824 (6,565) [1,576] {788}	32,952 (6,590) [1,582] {791}
Seminole	33,583	33,689	33,775	33,833	34,016 (6,803) [1,633] {816}	34,192 (6,838) [1,641] {821}	34,362 (6,872) [1,649] {825}
St. Johns	22,357	22,392	22,434	22,463	22,528 (4,506) [1,081] {541}	22,591 (4,518) [1,084] {542}	22,652 (4,530) [1,087] {544}
Sumter	9,249	9,263	9,270	9,281	9,304 (1,861) [447] {223}	9,326 (1,865) [448] {224}	9,347 (1,869) [449] {224}
Volusia	42,617	42,709	42,824	42,904	43,091 (8,618) [2,068] {1,034}	43,266 (8,653) [2,077] {1,038}	43,430 (8,686) [2,085] {1,042}

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.