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

Date: 2/1/21

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 2/1/21 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.

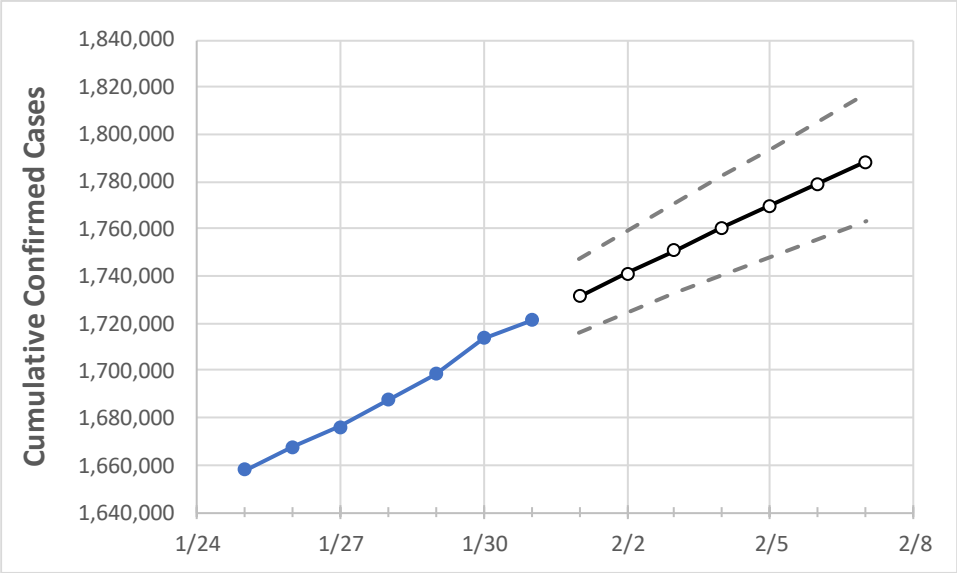
IEM's Modeling Lead

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:						
	1/28	1/29	1/30	1/31	2/1	2/2	2/3	2/4	2/5	2/6	2/7
Florida	1,687,594	1,698,570	1,713,589	1,721,377	1,731,249	1,741,021	1,750,819	1,760,405	1,769,860	1,779,323	1,788,416

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:						
	1/28	1/29	1/30	1/31	2/1	2/2	2/3	2/4	2/5	2/6	2/7
Alachua	20,227	20,361	20,566	20,655	20,774	20,890	21,006	21,119	21,231	21,343	21,451
Broward	169,691	170,709	172,082	172,864	173,783	174,672	175,551	176,417	177,276	178,121	178,946
Charlotte	9,550	9,614	9,688	9,719	9,762	9,803	9,842	9,881	9,919	9,957	9,993
Collier	27,416	27,543	27,723	27,810	27,942	28,075	28,208	28,337	28,464	28,588	28,709
Duval	79,790	80,580	81,530	81,927	82,365	82,793	83,205	83,624	84,028	84,420	84,817
Hillsborough	98,900	99,421	100,334	100,764	101,276	101,768	102,262	102,735	103,191	103,654	104,104
Lake	21,343	21,511	21,697	21,824	21,980	22,134	22,287	22,436	22,583	22,728	22,872
Lee	51,814	52,073	52,420	52,653	52,926	53,192	53,451	53,705	53,953	54,198	54,429
Manatee	27,924	28,160	28,468	28,589	28,749	28,913	29,074	29,236	29,393	29,551	29,711
Miami-Dade	366,127	368,137	370,642	372,120	373,901	375,636	377,364	379,076	380,763	382,393	384,039
Okaloosa	16,402	16,515	16,639	16,707	16,806	16,904	17,000	17,095	17,190	17,281	17,375
Orange	101,246	101,955	102,897	103,337	103,972	104,584	105,191	105,801	106,381	106,950	107,506
Osceola	32,977	33,174	33,447	33,608	33,797	33,981	34,159	34,336	34,517	34,685	34,851
Palm Beach	104,693	105,540	106,691	107,242	107,895	108,568	109,221	109,879	110,533	111,190	111,836
Pasco	29,020	29,171	29,432	29,608	29,783	29,955	30,121	30,287	30,454	30,616	30,773
Pinellas	58,125	58,591	59,207	59,475	59,803	60,133	60,453	60,769	61,094	61,415	61,713
Polk	49,348	49,692	50,201	50,474	50,779	51,073	51,364	51,653	51,940	52,222	52,497
Sarasota	24,119	24,353	24,645	24,759	24,887	25,014	25,146	25,266	25,392	25,514	25,643
Seminole	23,746	23,861	24,055	24,153	24,293	24,427	24,559	24,690	24,820	24,946	25,071
St. Johns	17,918	18,085	18,261	18,328	18,431	18,530	18,630	18,724	18,815	18,902	18,989
Sumter	6,933	6,997	7,070	7,104	7,149	7,193	7,236	7,280	7,323	7,366	7,408
Volusia	29,929	30,320	30,750	30,961	31,211	31,461	31,711	31,955	32,202	32,444	32,692

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:		
	1/28	1/29	1/30	1/31	2/2	2/4	2/6
Alachua	20,227	20,361	20,566	20,655	20,890 (4,178) [1,003] {501}	21,119 (4,224) [1,014] {507}	21,343 (4,269) [1,024] {512}
Broward	169,691	170,709	172,082	172,864	174,672 (34,934) [8,384] {4,192}	176,417 (35,283) [8,468] {4,234}	178,121 (35,624) [8,550] {4,275}
Charlotte	9,550	9,614	9,688	9,719	9,803 (1,961) [471] {235}	9,881 (1,976) [474] {237}	9,957 (1,991) [478] {239}
Collier	27,416	27,543	27,723	27,810	28,075 (5,615) [1,348] {674}	28,337 (5,667) [1,360] {680}	28,588 (5,718) [1,372] {686}
Duval	79,790	80,580	81,530	81,927	82,793 (16,559) [3,974] {1,987}	83,624 (16,725) [4,014] {2,007}	84,420 (16,884) [4,052] {2,026}
Hillsborough	98,900	99,421	100,334	100,764	101,768 (20,354) [4,885] {2,442}	102,735 (20,547) [4,931] {2,466}	103,654 (20,731) [4,975] {2,488}
Lake	21,343	21,511	21,697	21,824	22,134 (4,427) [1,062] {531}	22,436 (4,487) [1,077] {538}	22,728 (4,546) [1,091] {545}
Lee	51,814	52,073	52,420	52,653	53,192 (10,638) [2,553] {1,277}	53,705 (10,741) [2,578] {1,289}	54,198 (10,840) [2,601] {1,301}
Manatee	27,924	28,160	28,468	28,589	28,913 (5,783) [1,388] {694}	29,236 (5,847) [1,403] {702}	29,551 (5,910) [1,418] {709}
Miami-Dade	366,127	368,137	370,642	372,120	375,636 (75,127) [18,031] {9,015}	379,076 (75,815) [18,196] {9,098}	382,393 (76,479) [18,355] {9,177}
Okaloosa	16,402	16,515	16,639	16,707	16,904 (3,381) [811] {406}	17,095 (3,419) [821] {410}	17,281 (3,456) [829] {415}
Orange	101,246	101,955	102,897	103,337	104,584 (20,917) [5,020] {2,510}	105,801 (21,160) [5,078] {2,539}	106,950 (21,390) [5,134] {2,567}
Osceola	32,977	33,174	33,447	33,608	33,981 (6,796) [1,631] {816}	34,336 (6,867) [1,648] {824}	34,685 (6,937) [1,665] {832}
Palm Beach	104,693	105,540	106,691	107,242	108,568 (21,714) [5,211] {2,606}	109,879 (21,976) [5,274] {2,637}	111,190 (22,238) [5,337] {2,669}
Pasco	29,020	29,171	29,432	29,608	29,955 (5,991) [1,438] {719}	30,287 (6,057) [1,454] {727}	30,616 (6,123) [1,470] {735}
Pinellas	58,125	58,591	59,207	59,475	60,133 (12,027) [2,886] {1,443}	60,769 (12,154) [2,917] {1,458}	61,415 (12,283) [2,948] {1,474}
Polk	49,348	49,692	50,201	50,474	51,073 (10,215) [2,451] {1,226}	51,653 (10,331) [2,479] {1,240}	52,222 (10,444) [2,507] {1,253}
Sarasota	24,119	24,353	24,645	24,759	25,014 (5,003) [1,201] {600}	25,266 (5,053) [1,213] {606}	25,514 (5,103) [1,225] {612}
Seminole	23,746	23,861	24,055	24,153	24,427 (4,885) [1,172] {586}	24,690 (4,938) [1,185] {593}	24,946 (4,989) [1,197] {599}
St. Johns	17,918	18,085	18,261	18,328	18,530 (3,706) [889] {445}	18,724 (3,745) [899] {449}	18,902 (3,780) [907] {454}
Sumter	6,933	6,997	7,070	7,104	7,193 (1,439) [345] {173}	7,280 (1,456) [349] {175}	7,366 (1,473) [354] {177}
Volusia	29,929	30,320	30,750	30,961	31,461 (6,292) [1,510] {755}	31,955 (6,391) [1,534] {767}	32,444 (6,489) [1,557] {779}

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.