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

Date: 1/28/21

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 1/28/21 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.

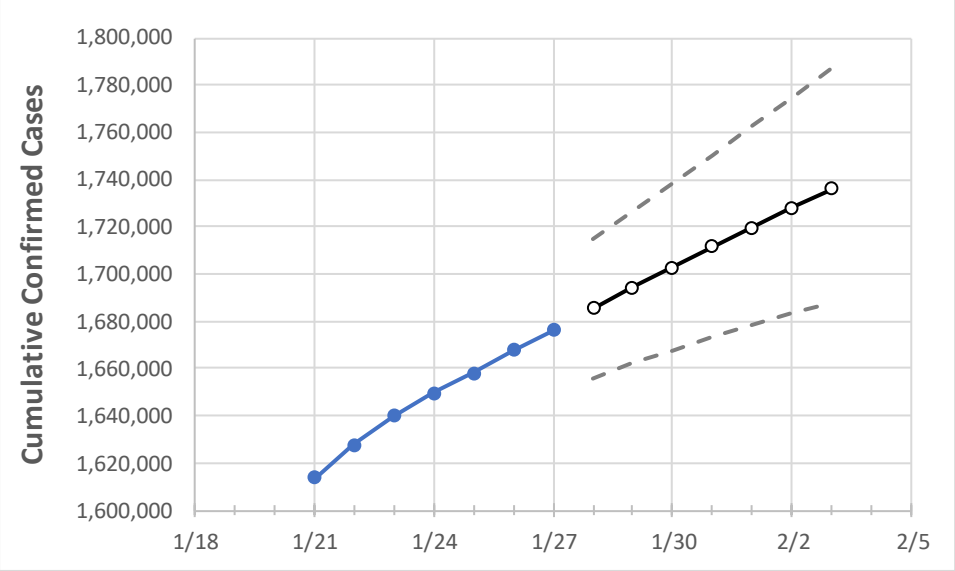
IEM's Modeling Lead

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:						
	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31	2/1	2/2	2/3
Florida	1,649,449	1,658,169	1,667,763	1,676,171	1,685,416	1,694,308	1,702,969	1,711,582	1,719,913	1,728,196	1,736,323

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:						
	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31	2/1	2/2	2/3
Alachua	19,723	19,799	19,928	20,062	20,174	20,286	20,394	20,500	20,602	20,700	20,800
Broward	166,058	167,025	168,000	168,653	169,569	170,462	171,334	172,198	173,042	173,882	174,681
Charlotte	9,367	9,410	9,442	9,493	9,533	9,573	9,610	9,645	9,680	9,712	9,743
Collier	26,832	26,924	27,060	27,214	27,346	27,473	27,601	27,721	27,840	27,954	28,065
Duval	78,492	78,776	79,090	79,391	79,746	80,074	80,399	80,717	80,999	81,298	81,551
Hillsborough	96,795	97,288	97,809	98,230	98,730	99,211	99,682	100,130	100,572	101,014	101,435
Lake	20,664	20,797	20,972	21,131	21,290	21,446	21,601	21,753	21,903	22,050	22,193
Lee	50,625	50,892	51,203	51,455	51,747	52,029	52,306	52,573	52,839	53,097	53,341
Manatee	27,381	27,464	27,641	27,716	27,861	28,004	28,143	28,280	28,415	28,550	28,681
Miami-Dade	358,801	360,831	362,601	364,123	365,875	367,607	369,301	370,926	372,521	374,076	375,575
Okaloosa	15,932	15,988	16,135	16,235	16,325	16,413	16,501	16,587	16,667	16,750	16,826
Orange	98,491	99,143	99,849	100,571	101,204	101,831	102,477	103,096	103,696	104,277	104,861
Osceola	32,273	32,427	32,599	32,760	32,952	33,135	33,315	33,491	33,661	33,828	33,985
Palm Beach	102,367	102,968	103,495	103,862	104,420	104,968	105,491	106,001	106,503	106,993	107,476
Pasco	28,299	28,466	28,624	28,795	28,962	29,128	29,291	29,447	29,600	29,748	29,891
Pinellas	56,935	57,197	57,493	57,774	58,088	58,385	58,680	58,958	59,237	59,506	59,764
Polk	48,119	48,371	48,656	48,974	49,278	49,576	49,858	50,140	50,414	50,681	50,940
Sarasota	23,806	23,878	23,963	24,042	24,149	24,254	24,350	24,451	24,547	24,633	24,725
Seminole	23,088	23,195	23,404	23,548	23,689	23,826	23,956	24,087	24,211	24,331	24,454
St. Johns	17,492	17,573	17,695	17,784	17,884	17,977	18,068	18,152	18,238	18,317	18,395
Sumter	6,750	6,777	6,818	6,867	6,907	6,945	6,983	7,019	7,054	7,089	7,124
Volusia	29,245	29,371	29,574	29,740	29,946	30,150	30,344	30,543	30,725	30,910	31,095

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:		
	1/24	1/25	1/26	1/27	1/29	1/31	2/2
Alachua	19,723	19,799	19,928	20,062	20,286 (4,057) [974] {487}	20,500 (4,100) [984] {492}	20,700 (4,140) [994] {497}
Broward	166,058	167,025	168,000	168,653	170,462 (34,092) [8,182] {4,091}	172,198 (34,440) [8,266] {4,133}	173,882 (34,776) [8,346] {4,173}
Charlotte	9,367	9,410	9,442	9,493	9,573 (1,915) [460] {230}	9,645 (1,929) [463] {231}	9,712 (1,942) [466] {233}
Collier	26,832	26,924	27,060	27,214	27,473 (5,495) [1,319] {659}	27,721 (5,544) [1,331] {665}	27,954 (5,591) [1,342] {671}
Duval	78,492	78,776	79,090	79,391	80,074 (16,015) [3,844] {1,922}	80,717 (16,143) [3,874] {1,937}	81,298 (16,260) [3,902] {1,951}
Hillsborough	96,795	97,288	97,809	98,230	99,211 (19,842) [4,762] {2,381}	100,130 (20,026) [4,806] {2,403}	101,014 (20,203) [4,849] {2,424}
Lake	20,664	20,797	20,972	21,131	21,446 (4,289) [1,029] {515}	21,753 (4,351) [1,044] {522}	22,050 (4,410) [1,058] {529}
Lee	50,625	50,892	51,203	51,455	52,029 (10,406) [2,497] {1,249}	52,573 (10,515) [2,524] {1,262}	53,097 (10,619) [2,549] {1,274}
Manatee	27,381	27,464	27,641	27,716	28,004 (5,601) [1,344] {672}	28,280 (5,656) [1,357] {679}	28,550 (5,710) [1,370] {685}
Miami-Dade	358,801	360,831	362,601	364,123	367,607 (73,521) [17,645] {8,823}	370,926 (74,185) [17,804] {8,902}	374,076 (74,815) [17,956] {8,978}
Okaloosa	15,932	15,988	16,135	16,235	16,413 (3,283) [788] {394}	16,587 (3,317) [796] {398}	16,750 (3,350) [804] {402}
Orange	98,491	99,143	99,849	100,571	101,831 (20,366) [4,888] {2,444}	103,096 (20,619) [4,949] {2,474}	104,277 (20,855) [5,005] {2,503}
Osceola	32,273	32,427	32,599	32,760	33,135 (6,627) [1,590] {795}	33,491 (6,698) [1,608] {804}	33,828 (6,766) [1,624] {812}
Palm Beach	102,367	102,968	103,495	103,862	104,968 (20,994) [5,038] {2,519}	106,001 (21,200) [5,088] {2,544}	106,993 (21,399) [5,136] {2,568}
Pasco	28,299	28,466	28,624	28,795	29,128 (5,826) [1,398] {699}	29,447 (5,889) [1,413] {707}	29,748 (5,950) [1,428] {714}
Pinellas	56,935	57,197	57,493	57,774	58,385 (11,677) [2,802] {1,401}	58,958 (11,792) [2,830] {1,415}	59,506 (11,901) [2,856] {1,428}
Polk	48,119	48,371	48,656	48,974	49,576 (9,915) [2,380] {1,190}	50,140 (10,028) [2,407] {1,203}	50,681 (10,136) [2,433] {1,216}
Sarasota	23,806	23,878	23,963	24,042	24,254 (4,851) [1,164] {582}	24,451 (4,890) [1,174] {587}	24,633 (4,927) [1,182] {591}
Seminole	23,088	23,195	23,404	23,548	23,826 (4,765) [1,144] {572}	24,087 (4,817) [1,156] {578}	24,331 (4,866) [1,168] {584}
St. Johns	17,492	17,573	17,695	17,784	17,977 (3,595) [863] {431}	18,152 (3,630) [871] {436}	18,317 (3,663) [879] {440}
Sumter	6,750	6,777	6,818	6,867	6,945 (1,389) [333] {167}	7,019 (1,404) [337] {168}	7,089 (1,418) [340] {170}
Volusia	29,245	29,371	29,574	29,740	30,150 (6,030) [1,447] {724}	30,543 (6,109) [1,466] {733}	30,910 (6,182) [1,484] {742}

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.