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

Date: 7/30/20

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 20%, and are often within 10%, of actual confirmed cases.

The projections shown in this document are based on data pulled in as of 7/30/20 11 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.

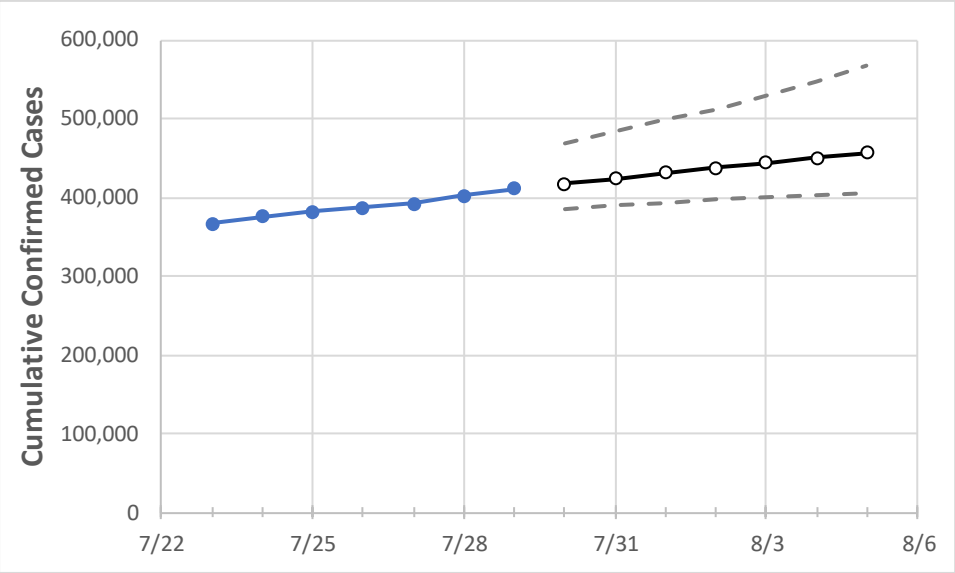
IEM's Modeling Lead

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.

Texas State Projections



	Actual Confirmed Cases On:				Projected Cases For:						
	7/26	7/27	7/28	7/29	7/30	7/31	8/1	8/2	8/3	8/4	8/5
Texas	387,410	391,827	401,676	410,433	417,265	424,022	430,704	437,315	443,856	450,330	456,738

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 20%, and are often within 10%, of actual confirmed cases.

Texas Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	7/26	7/27	7/28	7/29	7/30	7/31	8/1	8/2	8/3	8/4	8/5
Bexar	36,083	36,438	37,984	38,930	39,610	40,287	40,961	41,633	42,302	42,968	43,632
Brazoria	5,443	5,573	5,896	6,032	6,150	6,268	6,387	6,507	6,627	6,748	6,870
Brazos	3,688	3,724	3,747	3,781	3,815	3,848	3,880	3,912	3,943	3,973	4,003
Collin	5,762	5,789	5,938	6,147	6,202	6,256	6,308	6,359	6,408	6,455	6,501
Dallas	46,013	46,813	47,239	48,028	48,680	49,321	49,952	50,573	51,184	51,785	52,375
Denton	6,043	6,121	6,208	6,331	6,457	6,583	6,711	6,839	6,969	7,099	7,230
El Paso	13,240	13,396	13,552	13,807	14,000	14,191	14,378	14,562	14,744	14,922	15,098
Ellis	2,289	2,311	2,332	2,387	2,420	2,452	2,484	2,516	2,548	2,579	2,610
Fort Bend	6,530	6,605	6,679	6,772	6,847	6,922	6,999	7,075	7,153	7,231	7,310
Galveston	8,046	8,126	8,205	8,367	8,472	8,574	8,673	8,770	8,864	8,955	9,044
Harris	64,113	65,349	66,195	67,660	68,887	70,118	71,355	72,597	73,844	75,096	76,354
Hidalgo	15,355	15,557	15,759	16,088	16,525	16,974	17,435	17,908	18,393	18,892	19,405
Johnson	1,274	1,314	1,354	1,403	1,450	1,500	1,551	1,605	1,662	1,721	1,782
Lubbock	5,014	5,100	5,150	5,254	5,329	5,403	5,476	5,549	5,621	5,692	5,763
McLennan	3,957	3,986	4,042	4,108	4,172	4,236	4,300	4,363	4,427	4,490	4,554
Montgomery	5,658	5,719	5,780	5,852	5,942	6,031	6,119	6,207	6,294	6,381	6,468
Tarrant	25,146	25,499	25,739	26,315	26,726	27,136	27,545	27,952	28,358	28,763	29,166
Travis	19,401	19,480	19,720	19,952	20,140	20,324	20,503	20,677	20,846	21,011	21,172
Williamson	5,246	5,304	5,366	5,433	5,492	5,550	5,606	5,661	5,714	5,766	5,816

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.*

Texas Medical Demands by County

	Actual Confirmed Cases On:				Projected Cases (Hospitalized) [ICU] {Ventilator} For:		
	7/26	7/27	7/28	7/29	7/31	8/2	8/4
Bexar	36,083	36,438	37,984	38,930	40,287 (8,057) [1,934] {967}	41,633 (8,327) [1,998] {999}	42,968 (8,594) [2,062] {1,031}
Brazoria	5,443	5,573	5,896	6,032	6,268 (1,254) [301] {150}	6,507 (1,301) [312] {156}	6,748 (1,350) [324] {162}
Brazos	3,688	3,724	3,747	3,781	3,848 (770) [185] {92}	3,912 (782) [188] {94}	3,973 (795) [191] {95}
Collin	5,762	5,789	5,938	6,147	6,256 (1,251) [300] {150}	6,359 (1,272) [305] {153}	6,455 (1,291) [310] {155}
Dallas	46,013	46,813	47,239	48,028	49,321 (9,864) [2,367] {1,184}	50,573 (10,115) [2,428] {1,214}	51,785 (10,357) [2,486] {1,243}
Denton	6,043	6,121	6,208	6,331	6,583 (1,317) [316] {158}	6,839 (1,368) [328] {164}	7,099 (1,420) [341] {170}
El Paso	13,240	13,396	13,552	13,807	14,191 (2,838) [681] {341}	14,562 (2,912) [699] {349}	14,922 (2,984) [716] {358}
Ellis	2,289	2,311	2,332	2,387	2,452 (490) [118] {59}	2,516 (503) [121] {60}	2,579 (516) [124] {62}
Fort Bend	6,530	6,605	6,679	6,772	6,922 (1,384) [332] {166}	7,075 (1,415) [340] {170}	7,231 (1,446) [347] {174}
Galveston	8,046	8,126	8,205	8,367	8,574 (1,715) [412] {206}	8,770 (1,754) [421] {210}	8,955 (1,791) [430] {215}
Harris	64,113	65,349	66,195	67,660	70,118 (14,024) [3,366] {1,683}	72,597 (14,519) [3,485] {1,742}	75,096 (15,019) [3,605] {1,802}
Hidalgo	15,355	15,557	15,759	16,088	16,974 (3,395) [815] {407}	17,908 (3,582) [860] {430}	18,892 (3,778) [907] {453}
Johnson	1,274	1,314	1,354	1,403	1,500 (300) [72] {36}	1,605 (321) [77] {39}	1,721 (344) [83] {41}
Lubbock	5,014	5,100	5,150	5,254	5,403 (1,081) [259] {130}	5,549 (1,110) [266] {133}	5,692 (1,138) [273] {137}
McLennan	3,957	3,986	4,042	4,108	4,236 (847) [203] {102}	4,363 (873) [209] {105}	4,490 (898) [216] {108}
Montgomery	5,658	5,719	5,780	5,852	6,031 (1,206) [289] {145}	6,207 (1,241) [298] {149}	6,381 (1,276) [306] {153}
Tarrant	25,146	25,499	25,739	26,315	27,136 (5,427) [1,303] {651}	27,952 (5,590) [1,342] {671}	28,763 (5,753) [1,381] {690}
Travis	19,401	19,480	19,720	19,952	20,324 (4,065) [976] {488}	20,677 (4,135) [992] {496}	21,011 (4,202) [1,009] {504}
Williamson	5,246	5,304	5,366	5,433	5,550 (1,110) [266] {133}	5,661 (1,132) [272] {136}	5,766 (1,153) [277] {138}

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.