IEM's AI Modeling: Short-term COVID-19 Projections
Date: 7/22/20

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 7/22/20 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.

Texas State Projections
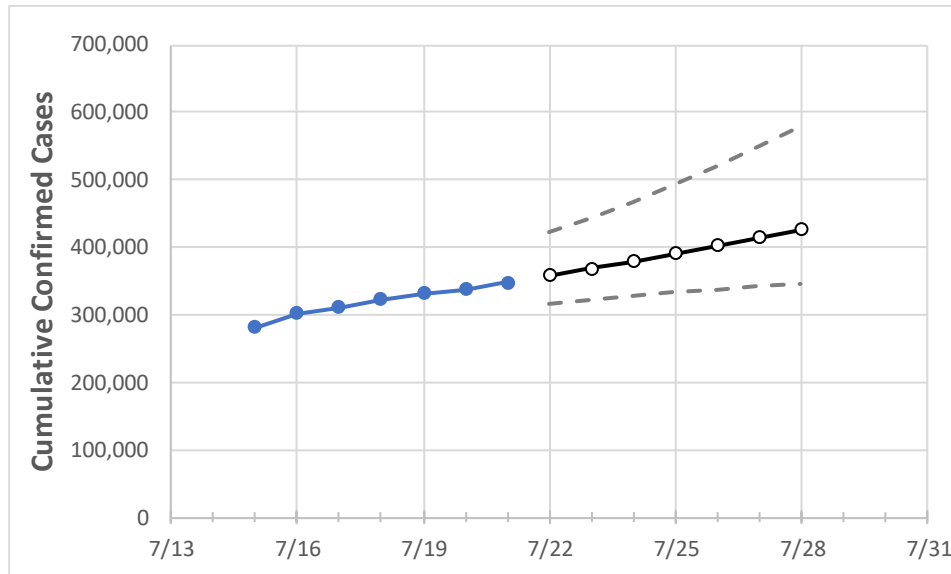
	Actual Confirmed Cases On:				Projected Cases For:						
	7/18	7/19	7/20	7/21	7/22	7/23	7/24	7/25	7/26	7/27	7/28
Texas	322,518	331,147	337,068	347,774	358,108	368,713	379,596	390,767	402,233	414,004	426,089

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:						
	7/18	7/19	7/20	7/21	7/22	7/23	7/24	7/25	7/26	7/27	7/28
Bexar	28,633	30,835	31,316	32,896	34,346	35,883	37,512	39,239	41,071	43,013	45,072
Brazoria	4,545	4,675	4,767	4,896	5,060	5,232	5,411	5,598	5,793	5,997	6,211
Brazos	3,313	3,373	3,397	3,407	3,450	3,492	3,533	3,574	3,614	3,653	3,692
Collin	5,154	5,291	5,374	5,456	5,558	5,661	5,763	5,866	5,969	6,072	6,175
Dallas	39,191	40,222	41,266	42,292	43,436	44,608	45,810	47,042	48,305	49,599	50,925
Denton	4,765	4,887	4,968	5,098	5,239	5,386	5,539	5,698	5,862	6,033	6,209
El Paso	11,132	11,573	11,769	12,041	12,337	12,638	12,943	13,254	13,569	13,890	14,216
Ellis	1,972	2,011	2,051	2,090	2,135	2,179	2,224	2,269	2,315	2,360	2,406
Fort Bend	5,689	5,979	5,987	5,995	6,064	6,133	6,203	6,274	6,346	6,419	6,493
Galveston	6,911	7,125	7,240	7,354	7,511	7,668	7,825	7,981	8,136	8,291	8,446
Harris	53,555	54,806	55,769	57,095	58,677	60,310	61,996	63,736	65,533	67,389	69,304
Hidalgo	10,492	10,943	12,263	12,787	13,426	14,119	14,870	15,684	16,565	17,520	18,553
Johnson	973	1,001	1,029	1,057	1,087	1,117	1,148	1,180	1,213	1,246	1,281
Lubbock	4,309	4,445	4,482	4,556	4,646	4,736	4,826	4,917	5,007	5,098	5,189
McLennan	3,210	3,291	3,413	3,472	3,552	3,633	3,716	3,800	3,885	3,972	4,060
Montgomery	4,721	4,836	4,952	5,067	5,260	5,468	5,691	5,930	6,188	6,465	6,763
Tarrant	20,907	21,195	21,617	22,002	22,485	22,975	23,473	23,980	24,495	25,019	25,552
Travis	17,215	17,454	17,646	17,791	18,072	18,349	18,623	18,894	19,161	19,425	19,685
Williamson	4,490	4,686	4,792	4,888	5,007	5,128	5,251	5,377	5,506	5,636	5,770

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:		
	7/18	7/19	7/20	7/21	7/23	7/25	7/27
Bexar	28,633	30,835	31,316	32,896	35,883 (7,177) [1,722] {861}	39,239 (7,848) [1,883] {942}	43,013 (8,603) [2,065] {1,032}
Brazoria	4,545	4,675	4,767	4,896	5,232 (1,046) [251] {126}	5,598 (1,120) [269] {134}	5,997 (1,199) [288] {144}
Brazos	3,313	3,373	3,397	3,407	3,492 (698) [168] {84}	3,574 (715) [172] {86}	3,653 (731) [175] {88}
Collin	5,154	5,291	5,374	5,456	5,661 (1,132) [272] {136}	5,866 (1,173) [282] {141}	6,072 (1,214) [291] {146}
Dallas	39,191	40,222	41,266	42,292	44,608 (8,922) [2,141] {1,071}	47,042 (9,408) [2,258] {1,129}	49,599 (9,920) [2,381] {1,190}
Denton	4,765	4,887	4,968	5,098	5,386 (1,077) [259] {129}	5,698 (1,140) [273] {137}	6,033 (1,207) [290] {145}
El Paso	11,132	11,573	11,769	12,041	12,638 (2,528) [607] {303}	13,254 (2,651) [636] {318}	13,890 (2,778) [667] {333}
Ellis	1,972	2,011	2,051	2,090	2,179 (436) [105] {52}	2,269 (454) [109] {54}	2,360 (472) [113] {57}
Fort Bend	5,689	5,979	5,987	5,995	6,133 (1,227) [294] {147}	6,274 (1,255) [301] {151}	6,419 (1,284) [308] {154}
Galveston	6,911	7,125	7,240	7,354	7,668 (1,534) [368] {184}	7,981 (1,596) [383] {192}	8,291 (1,658) [398] {199}
Harris	53,555	54,806	55,769	57,095	60,310 (12,062) [2,895] {1,447}	63,736 (12,747) [3,059] {1,530}	67,389 (13,478) [3,235] {1,617}
Hidalgo	10,492	10,943	12,263	12,787	14,119 (2,824) [678] {339}	15,684 (3,137) [753] {376}	17,520 (3,504) [841] {420}
Johnson	973	1,001	1,029	1,057	1,117 (223) [54] {27}	1,180 (236) [57] {28}	1,246 (249) [60] {30}
Lubbock	4,309	4,445	4,482	4,556	4,736 (947) [227] {114}	4,917 (983) [236] {118}	5,098 (1,020) [245] {122}
McLennan	3,210	3,291	3,413	3,472	3,633 (727) [174] {87}	3,800 (760) [182] {91}	3,972 (794) [191] {95}
Montgomery	4,721	4,836	4,952	5,067	5,468 (1,094) [262] {131}	5,930 (1,186) [285] {142}	6,465 (1,293) [310] {155}
Tarrant	20,907	21,195	21,617	22,002	22,975 (4,595) [1,103] {551}	23,980 (4,796) [1,151] {576}	25,019 (5,004) [1,201] {600}
Travis	17,215	17,454	17,646	17,791	18,349 (3,670) [881] {440}	18,894 (3,779) [907] {453}	19,425 (3,885) [932] {466}
Williamson	4,490	4,686	4,792	4,888	5,128 (1,026) [246] {123}	5,377 (1,075) [258] {129}	5,636 (1,127) [271] {135}

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.