IEM's AI Modeling: Short-term COVID-19 Projections
Date: 7/23/20

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 7/23/20 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
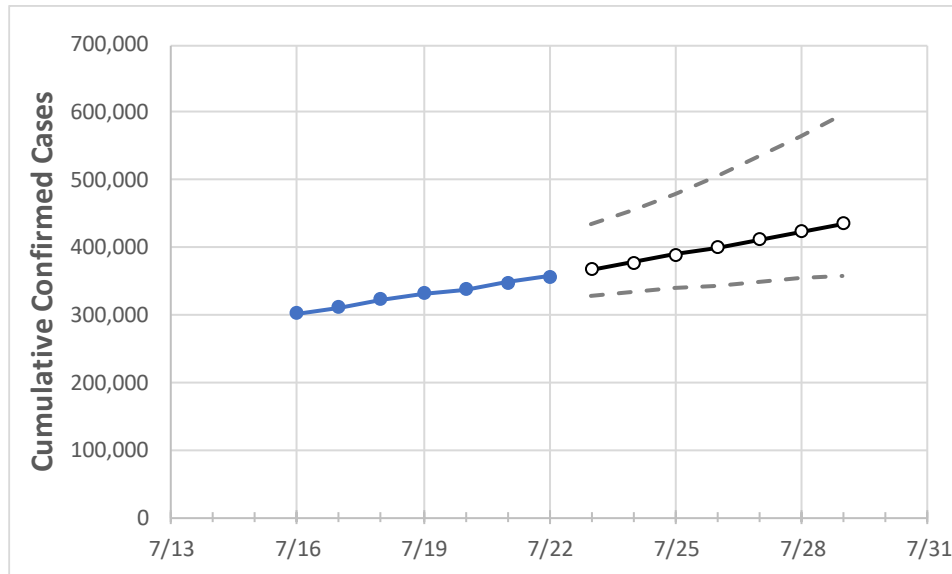
	Actual Confirmed Cases On:				Projected Cases For:						
	7/19	7/20	7/21	7/22	7/23	7/24	7/25	7/26	7/27	7/28	7/29
Texas	331,338	337,258	347,765	357,248	367,541	378,127	389,012	400,199	411,696	423,509	435,646

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:						
	7/19	7/20	7/21	7/22	7/23	7/24	7/25	7/26	7/27	7/28	7/29
Bexar	30,835	31,316	32,896	33,555	34,813	36,127	37,499	38,933	40,430	41,995	43,629
Brazoria	4,675	4,767	4,896	5,068	5,228	5,393	5,565	5,744	5,929	6,122	6,321
Brazos	3,373	3,397	3,407	3,442	3,479	3,515	3,551	3,585	3,619	3,653	3,686
Collin	5,291	5,374	5,456	5,614	5,727	5,840	5,954	6,069	6,185	6,301	6,418
Dallas	40,222	41,266	42,292	43,026	44,049	45,082	46,128	47,185	48,254	49,335	50,429
Denton	4,887	4,968	5,098	5,316	5,471	5,632	5,800	5,973	6,154	6,341	6,535
El Paso	11,573	11,769	12,041	12,297	12,570	12,846	13,123	13,402	13,683	13,966	14,251
Ellis	2,011	2,051	2,090	2,129	2,173	2,218	2,263	2,308	2,354	2,400	2,446
Fort Bend	5,979	5,987	5,995	6,130	6,203	6,276	6,351	6,426	6,502	6,580	6,658
Galveston	7,125	7,240	7,354	7,479	7,624	7,766	7,908	8,047	8,185	8,322	8,456
Harris	54,806	55,769	57,095	58,480	60,097	61,771	63,505	65,299	67,157	69,079	71,068
Hidalgo	10,943	12,263	12,787	13,126	13,702	14,316	14,970	15,667	16,408	17,198	18,038
Johnson	1,001	1,029	1,057	1,085	1,117	1,151	1,186	1,221	1,258	1,297	1,336
Lubbock	4,445	4,482	4,556	4,656	4,748	4,839	4,931	5,022	5,114	5,207	5,299
McLennan	3,291	3,413	3,472	3,575	3,671	3,771	3,874	3,980	4,089	4,202	4,319
Montgomery	4,836	4,952	5,067	5,169	5,340	5,492	5,626	5,775	5,912	6,061	6,194
Tarrant	21,195	21,617	22,002	22,665	23,207	23,759	24,323	24,899	25,489	26,093	26,711
Travis	17,454	17,646	17,791	18,394	18,686	18,975	19,261	19,544	19,824	20,101	20,375
Williamson	4,686	4,792	4,888	4,981	5,092	5,206	5,320	5,437	5,555	5,675	5,797

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:		
	7/19	7/20	7/21	7/22	7/24	7/26	7/28
Bexar	30,835	31,316	32,896	33,555	36,127 (7,225) [1,734] {867}	38,933 (7,787) [1,869] {934}	41,995 (8,399) [2,016] {1,008}
Brazoria	4,675	4,767	4,896	5,068	5,393 (1,079) [259] {129}	5,744 (1,149) [276] {138}	6,122 (1,224) [294] {147}
Brazos	3,373	3,397	3,407	3,442	3,515 (703) [169] {84}	3,585 (717) [172] {86}	3,653 (731) [175] {88}
Collin	5,291	5,374	5,456	5,614	5,840 (1,168) [280] {140}	6,069 (1,214) [291] {146}	6,301 (1,260) [302] {151}
Dallas	40,222	41,266	42,292	43,026	45,082 (9,016) [2,164] {1,082}	47,185 (9,437) [2,265] {1,132}	49,335 (9,867) [2,368] {1,184}
Denton	4,887	4,968	5,098	5,316	5,632 (1,126) [270] {135}	5,973 (1,195) [287] {143}	6,341 (1,268) [304] {152}
El Paso	11,573	11,769	12,041	12,297	12,846 (2,569) [617] {308}	13,402 (2,680) [643] {322}	13,966 (2,793) [670] {335}
Ellis	2,011	2,051	2,090	2,129	2,218 (444) [106] {53}	2,308 (462) [111] {55}	2,400 (480) [115] {58}
Fort Bend	5,979	5,987	5,995	6,130	6,276 (1,255) [301] {151}	6,426 (1,285) [308] {154}	6,580 (1,316) [316] {158}
Galveston	7,125	7,240	7,354	7,479	7,766 (1,553) [373] {186}	8,047 (1,609) [386] {193}	8,322 (1,664) [399] {200}
Harris	54,806	55,769	57,095	58,480	61,771 (12,354) [2,965] {1,483}	65,299 (13,060) [3,134] {1,567}	69,079 (13,816) [3,316] {1,658}
Hidalgo	10,943	12,263	12,787	13,126	14,316 (2,863) [687] {344}	15,667 (3,133) [752] {376}	17,198 (3,440) [825] {413}
Johnson	1,001	1,029	1,057	1,085	1,151 (230) [55] {28}	1,221 (244) [59] {29}	1,297 (259) [62] {31}
Lubbock	4,445	4,482	4,556	4,656	4,839 (968) [232] {116}	5,022 (1,004) [241] {121}	5,207 (1,041) [250] {125}
McLennan	3,291	3,413	3,472	3,575	3,771 (754) [181] {91}	3,980 (796) [191] {96}	4,202 (840) [202] {101}
Montgomery	4,836	4,952	5,067	5,169	5,492 (1,098) [264] {132}	5,775 (1,155) [277] {139}	6,061 (1,212) [291] {145}
Tarrant	21,195	21,617	22,002	22,665	23,759 (4,752) [1,140] {570}	24,899 (4,980) [1,195] {598}	26,093 (5,219) [1,252] {626}
Travis	17,454	17,646	17,791	18,394	18,975 (3,795) [911] {455}	19,544 (3,909) [938] {469}	20,101 (4,020) [965] {482}
Williamson	4,686	4,792	4,888	4,981	5,206 (1,041) [250] {125}	5,437 (1,087) [261] {130}	5,675 (1,135) [272] {136}

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.