IEM's AI Modeling: Short-term COVID-19 Projections
Date: 1/12/21

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 1/12/21 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.

Texas State Projections
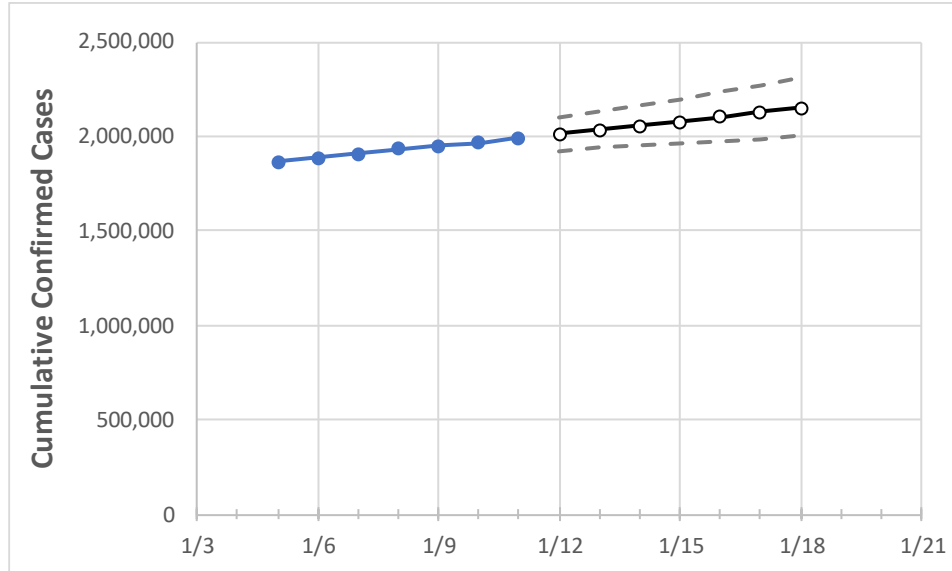
	Actual Confirmed Cases On:				Projected Cases For:						
	1/8	1/9	1/10	1/11	1/12	1/13	1/14	1/15	1/16	1/17	1/18
Texas	1,932,554	1,951,915	1,968,189	1,990,204	2,011,749	2,033,944	2,057,077	2,079,207	2,104,177	2,128,227	2,152,479

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.

Texas Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	1/8	1/9	1/10	1/11	1/12	1/13	1/14	1/15	1/16	1/17	1/18
Bexar	129,146	131,333	133,519	135,104	136,927	138,743	140,656	142,557	144,471	146,412	148,403
Brazoria	23,333	23,704	24,013	24,112	24,369	24,630	24,903	25,173	25,443	25,723	25,995
Brazos	15,475	15,694	15,816	15,965	16,135	16,315	16,492	16,681	16,875	17,069	17,269
Collin	55,259	56,236	56,988	57,870	58,766	59,682	60,612	61,537	62,480	63,434	64,380
Dallas	211,779	214,973	217,219	219,086	221,715	224,403	227,098	229,879	232,666	235,558	238,516
Denton	42,708	43,107	43,344	43,580	44,001	44,405	44,818	45,228	45,648	46,061	46,476
El Paso	102,472	102,889	103,197	103,787	104,327	104,881	105,456	106,052	106,655	107,275	107,919
Ellis	14,836	14,984	14,984	14,984	15,211	15,440	15,680	15,916	16,158	16,402	16,652
Fort Bend	39,662	39,822	39,983	40,143	40,517	40,905	41,293	41,706	42,133	42,564	42,968
Galveston	23,485	23,755	24,028	24,028	24,296	24,572	24,848	25,132	25,412	25,690	25,968
Harris	256,046	259,773	262,525	266,525	269,851	273,268	276,890	280,620	284,556	288,764	293,059
Hidalgo	54,600	54,779	54,959	55,138	55,520	55,908	56,331	56,759	57,160	57,637	58,098
Johnson	12,549	12,912	12,912	12,912	13,140	13,383	13,633	13,888	14,146	14,403	14,679
Lubbock	43,729	44,095	44,238	44,411	44,598	44,777	44,956	45,134	45,304	45,468	45,631
McLennan	20,303	20,471	20,594	20,594	20,798	21,003	21,212	21,427	21,648	21,874	22,102
Montgomery	29,994	30,362	30,731	31,099	31,489	31,884	32,285	32,691	33,104	33,524	33,944
Tarrant	170,730	172,285	173,840	178,977	181,695	184,469	187,308	190,294	193,176	196,183	199,259
Travis	55,406	55,870	56,348	56,825	57,437	58,070	58,706	59,363	60,043	60,718	61,413
Williamson	26,512	26,890	27,267	27,645	28,134	28,647	29,149	29,666	30,195	30,740	31,296

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:		
	1/8	1/9	1/10	1/11	1/13	1/15	1/17
Bexar	129,146	131,333	133,519	135,104	138,743 (27,749) [6,660] {3,330}	142,557 (28,511) [6,843] {3,421}	146,412 (29,282) [7,028] {3,514}
Brazoria	23,333	23,704	24,013	24,112	24,630 (4,926) [1,182] {591}	25,173 (5,035) [1,208] {604}	25,723 (5,145) [1,235] {617}
Brazos	15,475	15,694	15,816	15,965	16,315 (3,263) [783] {392}	16,681 (3,336) [801] {400}	17,069 (3,414) [819] {410}
Collin	55,259	56,236	56,988	57,870	59,682 (11,936) [2,865] {1,432}	61,537 (12,307) [2,954] {1,477}	63,434 (12,687) [3,045] {1,522}
Dallas	211,779	214,973	217,219	219,086	224,403 (44,881) [10,771] {5,386}	229,879 (45,976) [11,034] {5,517}	235,558 (47,112) [11,307] {5,653}
Denton	42,708	43,107	43,344	43,580	44,405 (8,881) [2,131] {1,066}	45,228 (9,046) [2,171] {1,085}	46,061 (9,212) [2,211] {1,105}
El Paso	102,472	102,889	103,197	103,787	104,881 (20,976) [5,034] {2,517}	106,052 (21,210) [5,090] {2,545}	107,275 (21,455) [5,149] {2,575}
Ellis	14,836	14,984	14,984	14,984	15,440 (3,088) [741] {371}	15,916 (3,183) [764] {382}	16,402 (3,280) [787] {394}
Fort Bend	39,662	39,822	39,983	40,143	40,905 (8,181) [1,963] {982}	41,706 (8,341) [2,002] {1,001}	42,564 (8,513) [2,043] {1,022}
Galveston	23,485	23,755	24,028	24,028	24,572 (4,914) [1,179] {590}	25,132 (5,026) [1,206] {603}	25,690 (5,138) [1,233] {617}
Harris	256,046	259,773	262,525	266,525	273,268 (54,654) [13,117] {6,558}	280,620 (56,124) [13,470] {6,735}	288,764 (57,753) [13,861] {6,930}
Hidalgo	54,600	54,779	54,959	55,138	55,908 (11,182) [2,684] {1,342}	56,759 (11,352) [2,724] {1,362}	57,637 (11,527) [2,767] {1,383}
Johnson	12,549	12,912	12,912	12,912	13,383 (2,677) [642] {321}	13,888 (2,778) [667] {333}	14,403 (2,881) [691] {346}
Lubbock	43,729	44,095	44,238	44,411	44,777 (8,955) [2,149] {1,075}	45,134 (9,027) [2,166] {1,083}	45,468 (9,094) [2,182] {1,091}
McLennan	20,303	20,471	20,594	20,594	21,003 (4,201) [1,008] {504}	21,427 (4,285) [1,028] {514}	21,874 (4,375) [1,050] {525}
Montgomery	29,994	30,362	30,731	31,099	31,884 (6,377) [1,530] {765}	32,691 (6,538) [1,569] {785}	33,524 (6,705) [1,609] {805}
Tarrant	170,730	172,285	173,840	178,977	184,469 (36,894) [8,855] {4,427}	190,294 (38,059) [9,134] {4,567}	196,183 (39,237) [9,417] {4,708}
Travis	55,406	55,870	56,348	56,825	58,070 (11,614) [2,787] {1,394}	59,363 (11,873) [2,849] {1,425}	60,718 (12,144) [2,914] {1,457}
Williamson	26,512	26,890	27,267	27,645	28,647 (5,729) [1,375] {688}	29,666 (5,933) [1,424] {712}	30,740 (6,148) [1,476] {738}

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.