IEM's AI Modeling: Short-term COVID-19 Projections
Date: 1/26/21

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 <u>not</u> 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 1/26/21 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
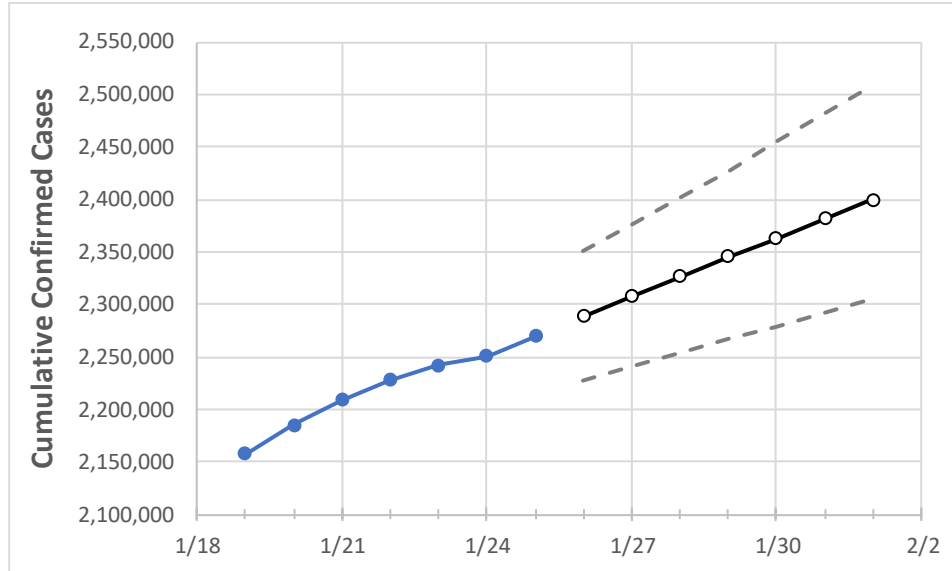
	Actual Confirmed Cases On:				Projected Cases For:						
	1/22	1/23	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31	2/1
Texas	2,227,789	2,242,473	2,250,421	2,269,424	2,288,262	2,307,398	2,326,563	2,345,673	2,363,110	2,381,886	2,400,111

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:						
	1/22	1/23	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31	2/1
Bexar	157,835	159,519	160,026	162,108	164,140	166,182	168,267	170,324	172,431	174,560	176,726
Brazoria	27,130	27,300	27,581	27,639	27,879	28,127	28,362	28,603	28,846	29,084	29,326
Brazos	17,490	17,650	17,780	17,916	18,057	18,194	18,333	18,472	18,608	18,744	18,882
Collin	66,967	67,863	68,108	68,943	69,686	70,417	71,134	71,849	72,565	73,261	73,974
Dallas	243,726	245,646	246,820	248,518	250,376	252,193	253,984	255,753	257,515	259,200	260,858
Denton	49,600	49,816	50,128	50,439	50,919	51,404	51,900	52,386	52,892	53,372	53,862
El Paso	109,108	109,589	110,125	111,061	111,625	112,184	112,761	113,352	113,972	114,580	115,198
Ellis	17,459	17,597	17,597	17,597	17,757	17,916	18,076	18,230	18,386	18,535	18,681
Fort Bend	47,021	47,156	47,292	47,427	47,890	48,356	48,818	49,295	49,795	50,288	50,793
Galveston	28,296	28,624	28,878	28,878	29,248	29,627	29,996	30,383	30,771	31,142	31,529
Harris	294,266	296,521	297,629	301,173	303,734	306,319	308,918	311,487	314,135	316,696	319,382
Hidalgo	60,213	60,466	60,718	60,971	61,423	61,887	62,336	62,809	63,260	63,717	64,202
Johnson	15,446	15,615	15,615	15,615	15,811	16,007	16,202	16,401	16,605	16,801	17,003
Lubbock	45,994	46,104	46,163	46,241	46,342	46,436	46,526	46,615	46,696	46,776	46,854
McLennan	22,506	22,587	22,657	22,657	22,785	22,910	23,028	23,144	23,260	23,377	23,487
Montgomery	35,480	35,768	36,056	36,344	36,686	37,015	37,342	37,667	37,989	38,306	38,624
Tarrant	203,174	204,252	205,329	208,325	210,405	212,450	214,495	216,552	218,656	220,674	222,725
Travis	64,291	64,658	64,963	65,507	66,138	66,756	67,383	68,013	68,667	69,324	69,979
Williamson	32,949	33,239	33,528	33,818	34,250	34,681	35,104	35,526	35,948	36,359	36,768

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:		
	1/22	1/23	1/24	1/25	1/27	1/29	1/31
Bexar	157,835	159,519	160,026	162,108	166,182 (33,236) [7,977] {3,988}	170,324 (34,065) [8,176] {4,088}	174,560 (34,912) [8,379] {4,189}
Brazoria	27,130	27,300	27,581	27,639	28,127 (5,625) [1,350] {675}	28,603 (5,721) [1,373] {686}	29,084 (5,817) [1,396] {698}
Brazos	17,490	17,650	17,780	17,916	18,194 (3,639) [873] {437}	18,472 (3,694) [887] {443}	18,744 (3,749) [900] {450}
Collin	66,967	67,863	68,108	68,943	70,417 (14,083) [3,380] {1,690}	71,849 (14,370) [3,449] {1,724}	73,261 (14,652) [3,517] {1,758}
Dallas	243,726	245,646	246,820	248,518	252,193 (50,439) [12,105] {6,053}	255,753 (51,151) [12,276] {6,138}	259,200 (51,840) [12,442] {6,221}
Denton	49,600	49,816	50,128	50,439	51,404 (10,281) [2,467] {1,234}	52,386 (10,477) [2,515] {1,257}	53,372 (10,674) [2,562] {1,281}
El Paso	109,108	109,589	110,125	111,061	112,184 (22,437) [5,385] {2,692}	113,352 (22,670) [5,441] {2,720}	114,580 (22,916) [5,500] {2,750}
Ellis	17,459	17,597	17,597	17,597	17,916 (3,583) [860] {430}	18,230 (3,646) [875] {438}	18,535 (3,707) [890] {445}
Fort Bend	47,021	47,156	47,292	47,427	48,356 (9,671) [2,321] {1,161}	49,295 (9,859) [2,366] {1,183}	50,288 (10,058) [2,414] {1,207}
Galveston	28,296	28,624	28,878	28,878	29,627 (5,925) [1,422] {711}	30,383 (6,077) [1,458] {729}	31,142 (6,228) [1,495] {747}
Harris	294,266	296,521	297,629	301,173	306,319 (61,264) [14,703] {7,352}	311,487 (62,297) [14,951] {7,476}	316,696 (63,339) [15,201] {7,601}
Hidalgo	60,213	60,466	60,718	60,971	61,887 (12,377) [2,971] {1,485}	62,809 (12,562) [3,015] {1,507}	63,717 (12,743) [3,058] {1,529}
Johnson	15,446	15,615	15,615	15,615	16,007 (3,201) [768] {384}	16,401 (3,280) [787] {394}	16,801 (3,360) [806] {403}
Lubbock	45,994	46,104	46,163	46,241	46,436 (9,287) [2,229] {1,114}	46,615 (9,323) [2,238] {1,119}	46,776 (9,355) [2,245] {1,123}
McLennan	22,506	22,587	22,657	22,657	22,910 (4,582) [1,100] {550}	23,144 (4,629) [1,111] {555}	23,377 (4,675) [1,122] {561}
Montgomery	35,480	35,768	36,056	36,344	37,015 (7,403) [1,777] {888}	37,667 (7,533) [1,808] {904}	38,306 (7,661) [1,839] {919}
Tarrant	203,174	204,252	205,329	208,325	212,450 (42,490) [10,198] {5,099}	216,552 (43,310) [10,394] {5,197}	220,674 (44,135) [10,592] {5,296}
Travis	64,291	64,658	64,963	65,507	66,756 (13,351) [3,204] {1,602}	68,013 (13,603) [3,265] {1,632}	69,324 (13,865) [3,328] {1,664}
Williamson	32,949	33,239	33,528	33,818	34,681 (6,936) [1,665] {832}	35,526 (7,105) [1,705] {853}	36,359 (7,272) [1,745] {873}

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.