IEM's AI Modeling: Short-term COVID-19 Projections
Date: 1/21/22

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 1/21/22 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
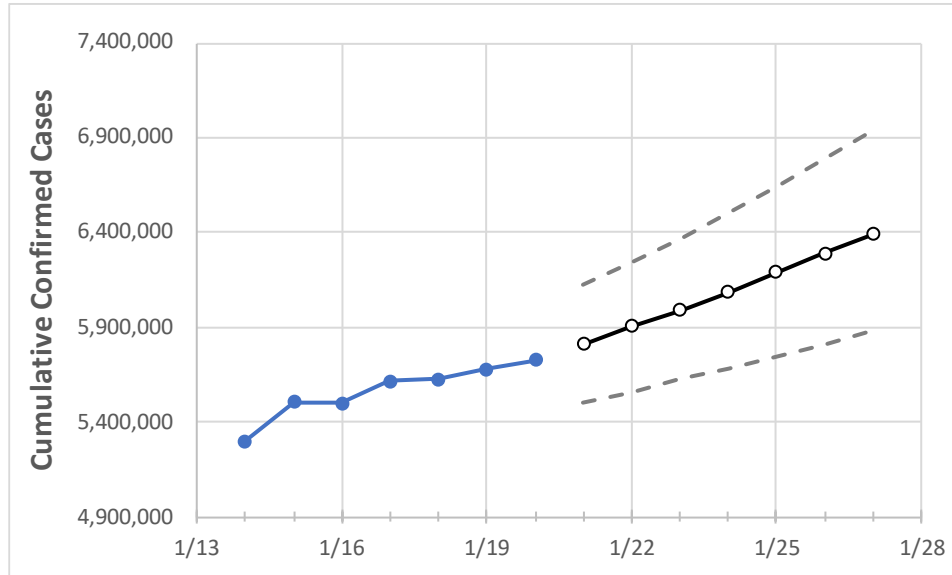
	Actual Confirmed Cases On:				Projected Cases For:						
	1/17	1/18	1/19	1/20	1/21	1/22	1/23	1/24	1/25	1/26	1/27
Texas	5,615,327	5,623,930	5,679,310	5,725,110	5,810,931	5,903,064	5,991,683	6,087,131	6,188,806	6,288,968	6,389,187

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:						
	1/17	1/18	1/19	1/20	1/21	1/22	1/23	1/24	1/25	1/26	1/27
Bexar	433,417	439,380	446,692	453,013	462,245	471,775	481,687	492,206	503,079	514,511	526,271
Brazoria	82,610	83,069	83,641	83,977	84,871	85,768	86,664	87,579	88,509	89,454	90,407
Brazos	50,792	51,025	51,550	52,003	52,670	53,320	54,024	54,714	55,410	56,162	56,885
Collin	171,234	173,083	174,766	176,364	178,616	180,914	183,328	185,746	188,334	190,878	193,628
Dallas	498,291	502,972	507,067	511,006	517,756	524,692	531,873	539,286	546,784	554,684	562,898
Denton	142,954	144,701	146,253	147,504	149,511	151,631	153,740	155,863	158,245	160,653	163,082
El Paso	168,580	170,175	172,163	173,784	176,202	178,795	181,431	184,302	187,268	190,433	193,801
Ellis	41,783	42,209	42,685	42,928	43,405	43,891	44,398	44,912	45,447	46,006	46,565
Fort Bend	152,766	153,761	154,596	155,218	157,473	159,737	161,973	164,222	166,556	168,893	171,193
Galveston	84,022	84,572	85,047	85,366	86,039	86,684	87,328	88,000	88,661	89,325	90,007
Harris	889,043	895,363	901,838	905,850	922,999	939,505	957,493	975,089	993,614	1,012,549	1,031,525
Hidalgo	152,060	153,461	154,865	155,925	159,379	163,045	166,662	170,722	175,027	179,945	184,660
Johnson	36,294	36,618	36,976	37,212	37,729	38,251	38,797	39,353	39,952	40,562	41,192
Lubbock	78,302	81,212	81,750	82,590	84,107	85,677	87,335	88,990	90,739	92,619	94,526
McLennan	48,484	48,838	49,233	49,577	50,285	51,012	51,764	52,566	53,370	54,250	55,142
Montgomery	118,054	118,833	120,001	120,682	122,144	123,625	125,136	126,645	128,220	129,817	131,410
Tarrant	469,379	475,901	481,629	484,208	491,787	499,905	507,971	516,887	525,221	534,599	544,646
Travis	183,640	185,806	188,047	190,267	194,158	197,992	201,965	206,019	210,413	214,747	219,190
Williamson	105,609	107,911	109,466	110,876	112,598	114,374	116,176	118,048	119,994	121,954	124,004

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:		
	1/17	1/18	1/19	1/20	1/22	1/24	1/26
Bexar	433,417	439,380	446,692	453,013	471,775 (94,355) [22,645] {11,323}	492,206 (98,441) [23,626] {11,813}	514,511 (102,902) [24,697] {12,348}
Brazoria	82,610	83,069	83,641	83,977	85,768 (17,154) [4,117] {2,058}	87,579 (17,516) [4,204] {2,102}	89,454 (17,891) [4,294] {2,147}
Brazos	50,792	51,025	51,550	52,003	53,320 (10,664) [2,559] {1,280}	54,714 (10,943) [2,626] {1,313}	56,162 (11,232) [2,696] {1,348}
Collin	171,234	173,083	174,766	176,364	180,914 (36,183) [8,684] {4,342}	185,746 (37,149) [8,916] {4,458}	190,878 (38,176) [9,162] {4,581}
Dallas	498,291	502,972	507,067	511,006	524,692 (104,938) [25,185] {12,593}	539,286 (107,857) [25,886] {12,943}	554,684 (110,937) [26,625] {13,312}
Denton	142,954	144,701	146,253	147,504	151,631 (30,326) [7,278] {3,639}	155,863 (31,173) [7,481] {3,741}	160,653 (32,131) [7,711] {3,856}
El Paso	168,580	170,175	172,163	173,784	178,795 (35,759) [8,582] {4,291}	184,302 (36,860) [8,847] {4,423}	190,433 (38,087) [9,141] {4,570}
Ellis	41,783	42,209	42,685	42,928	43,891 (8,778) [2,107] {1,053}	44,912 (8,982) [2,156] {1,078}	46,006 (9,201) [2,208] {1,104}
Fort Bend	152,766	153,761	154,596	155,218	159,737 (31,947) [7,667] {3,834}	164,222 (32,844) [7,883] {3,941}	168,893 (33,779) [8,107] {4,053}
Galveston	84,022	84,572	85,047	85,366	86,684 (17,337) [4,161] {2,080}	88,000 (17,600) [4,224] {2,112}	89,325 (17,865) [4,288] {2,144}
Harris	889,043	895,363	901,838	905,850	939,505 (187,901) [45,096] {22,548}	975,089 (195,018) [46,804] {23,402}	1,012,549 (202,510) [48,602] {24,301}
Hidalgo	152,060	153,461	154,865	155,925	163,045 (32,609) [7,826] {3,913}	170,722 (34,144) [8,195] {4,097}	179,945 (35,989) [8,637] {4,319}
Johnson	36,294	36,618	36,976	37,212	38,251 (7,650) [1,836] {918}	39,353 (7,871) [1,889] {944}	40,562 (8,112) [1,947] {973}
Lubbock	78,302	81,212	81,750	82,590	85,677 (17,135) [4,113] {2,056}	88,990 (17,798) [4,272] {2,136}	92,619 (18,524) [4,446] {2,223}
McLennan	48,484	48,838	49,233	49,577	51,012 (10,202) [2,449] {1,224}	52,566 (10,513) [2,523] {1,262}	54,250 (10,850) [2,604] {1,302}
Montgomery	118,054	118,833	120,001	120,682	123,625 (24,725) [5,934] {2,967}	126,645 (25,329) [6,079] {3,039}	129,817 (25,963) [6,231] {3,116}
Tarrant	469,379	475,901	481,629	484,208	499,905 (99,981) [23,995] {11,998}	516,887 (103,377) [24,811] {12,405}	534,599 (106,920) [25,661] {12,830}
Travis	183,640	185,806	188,047	190,267	197,992 (39,598) [9,504] {4,752}	206,019 (41,204) [9,889] {4,944}	214,747 (42,949) [10,308] {5,154}
Williamson	105,609	107,911	109,466	110,876	114,374 (22,875) [5,490] {2,745}	118,048 (23,610) [5,666] {2,833}	121,954 (24,391) [5,854] {2,927}

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.