IEM's AI Modeling: Short-term COVID-19 Projections

Date: 1/31/22

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 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 1/31/22 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.

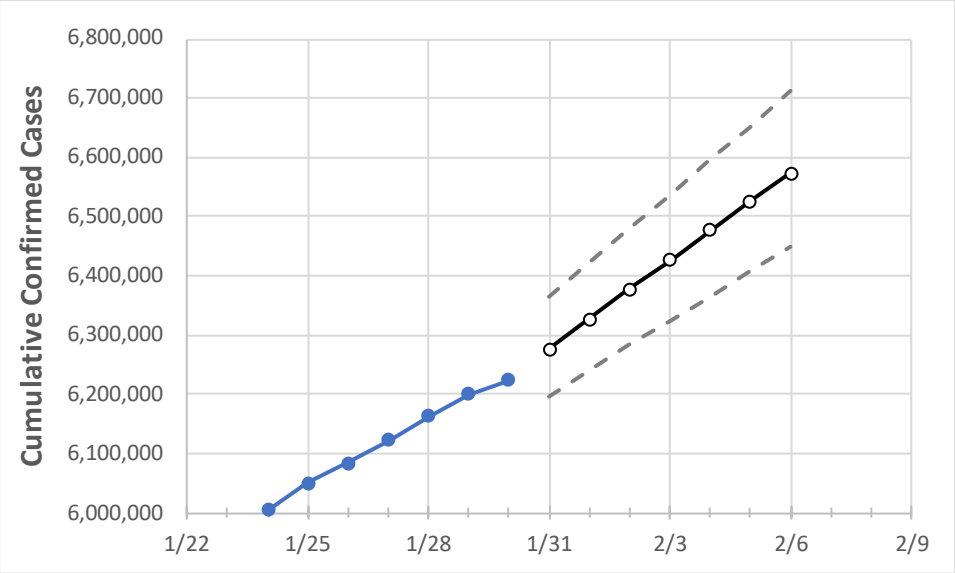
IEM's Modeling Lead

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:						
	1/27	1/28	1/29	1/30	1/31	2/1	2/2	2/3	2/4	2/5	2/6
Texas	6,121,818	6,162,552	6,201,110	6,224,480	6,275,723	6,327,374	6,377,267	6,425,819	6,476,453	6,525,352	6,574,053

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:						
	1/27	1/28	1/29	1/30	1/31	2/1	2/2	2/3	2/4	2/5	2/6
Bexar	491,290	496,799	502,209	504,899	510,930	516,984	522,966	528,948	534,979	541,086	547,065
Brazoria	87,288	87,650	88,081	88,498	88,901	89,289	89,674	90,037	90,409	90,774	91,113
Brazos	55,601	56,020	56,463	56,783	57,240	57,702	58,146	58,602	59,026	59,481	59,912
Collin	187,454	188,825	190,231	191,088	192,694	194,235	195,743	197,277	198,752	200,292	201,773
Dallas	533,154	537,084	540,704	542,113	545,390	548,669	551,694	554,922	557,826	560,924	563,960
Denton	158,688	160,096	160,205	160,314	161,806	163,211	164,602	165,994	167,447	168,806	170,227
El Paso	187,089	188,568	190,466	192,009	194,127	196,256	198,366	200,592	202,762	205,102	207,306
Ellis	45,431	45,638	45,907	46,050	46,402	46,735	47,064	47,404	47,732	48,061	48,393
Fort Bend	161,730	162,582	163,827	164,371	165,143	165,970	166,755	167,489	168,237	168,994	169,667
Galveston	89,067	89,452	89,770	90,105	90,510	90,898	91,276	91,635	91,992	92,338	92,685
Harris	939,380	942,932	947,954	950,863	954,912	958,798	962,634	966,293	970,033	973,578	976,985
Hidalgo	168,656	169,764	171,699	172,568	174,407	176,161	177,999	179,813	181,647	183,508	185,544
Johnson	39,165	39,334	39,608	39,760	40,035	40,313	40,596	40,858	41,124	41,407	41,668
Lubbock	88,264	88,829	89,501	89,751	90,702	91,702	92,657	93,569	94,550	95,527	96,522
McLennan	52,416	52,638	52,958	53,229	53,631	54,053	54,444	54,857	55,266	55,659	56,064
Montgomery	126,676	127,340	128,049	128,567	129,305	130,028	130,701	131,401	132,079	132,745	133,380
Tarrant	513,272	517,202	517,202	517,202	521,762	526,292	530,638	535,121	539,528	544,157	548,487
Travis	204,208	205,339	207,027	207,934	209,769	211,649	213,397	215,187	216,945	218,798	220,450
Williamson	120,291	121,288	121,427	121,565	122,824	124,046	125,259	126,468	127,720	128,997	130,143

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:		
	1/27	1/28	1/29	1/30	2/1	2/3	2/5
Bexar	491,290	496,799	502,209	504,899	516,984 (103,397) [24,815] {12,408}	528,948 (105,790) [25,390] {12,695}	541,086 (108,217) [25,972] {12,986}
Brazoria	87,288	87,650	88,081	88,498	89,289 (17,858) [4,286] {2,143}	90,037 (18,007) [4,322] {2,161}	90,774 (18,155) [4,357] {2,179}
Brazos	55,601	56,020	56,463	56,783	57,702 (11,540) [2,770] {1,385}	58,602 (11,720) [2,813] {1,406}	59,481 (11,896) [2,855] {1,428}
Collin	187,454	188,825	190,231	191,088	194,235 (38,847) [9,323] {4,662}	197,277 (39,455) [9,469] {4,735}	200,292 (40,058) [9,614] {4,807}
Dallas	533,154	537,084	540,704	542,113	548,669 (109,734) [26,336] {13,168}	554,922 (110,984) [26,636] {13,318}	560,924 (112,185) [26,924] {13,462}
Denton	158,688	160,096	160,205	160,314	163,211 (32,642) [7,834] {3,917}	165,994 (33,199) [7,968] {3,984}	168,806 (33,761) [8,103] {4,051}
El Paso	187,089	188,568	190,466	192,009	196,256 (39,251) [9,420] {4,710}	200,592 (40,118) [9,628] {4,814}	205,102 (41,020) [9,845] {4,922}
Ellis	45,431	45,638	45,907	46,050	46,735 (9,347) [2,243] {1,122}	47,404 (9,481) [2,275] {1,138}	48,061 (9,612) [2,307] {1,153}
Fort Bend	161,730	162,582	163,827	164,371	165,970 (33,194) [7,967] {3,983}	167,489 (33,498) [8,039] {4,020}	168,994 (33,799) [8,112] {4,056}
Galveston	89,067	89,452	89,770	90,105	90,898 (18,180) [4,363] {2,182}	91,635 (18,327) [4,398] {2,199}	92,338 (18,468) [4,432] {2,216}
Harris	939,380	942,932	947,954	950,863	958,798 (191,760) [46,022] {23,011}	966,293 (193,259) [46,382] {23,191}	973,578 (194,716) [46,732] {23,366}
Hidalgo	168,656	169,764	171,699	172,568	176,161 (35,232) [8,456] {4,228}	179,813 (35,963) [8,631] {4,316}	183,508 (36,702) [8,808] {4,404}
Johnson	39,165	39,334	39,608	39,760	40,313 (8,063) [1,935] {968}	40,858 (8,172) [1,961] {981}	41,407 (8,281) [1,988] {994}
Lubbock	88,264	88,829	89,501	89,751	91,702 (18,340) [4,402] {2,201}	93,569 (18,714) [4,491] {2,246}	95,527 (19,105) [4,585] {2,293}
McLennan	52,416	52,638	52,958	53,229	54,053 (10,811) [2,595] {1,297}	54,857 (10,971) [2,633] {1,317}	55,659 (11,132) [2,672] {1,336}
Montgomery	126,676	127,340	128,049	128,567	130,028 (26,006) [6,241] {3,121}	131,401 (26,280) [6,307] {3,154}	132,745 (26,549) [6,372] {3,186}
Tarrant	513,272	517,202	517,202	517,202	526,292 (105,258) [25,262] {12,631}	535,121 (107,024) [25,686] {12,843}	544,157 (108,831) [26,120] {13,060}
Travis	204,208	205,339	207,027	207,934	211,649 (42,330) [10,159] {5,080}	215,187 (43,037) [10,329] {5,164}	218,798 (43,760) [10,502] {5,251}
Williamson	120,291	121,288	121,427	121,565	124,046 (24,809) [5,954] {2,977}	126,468 (25,294) [6,070] {3,035}	128,997 (25,799) [6,192] {3,096}

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.