

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

Date: 2/1/21

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 2/1/21 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.**

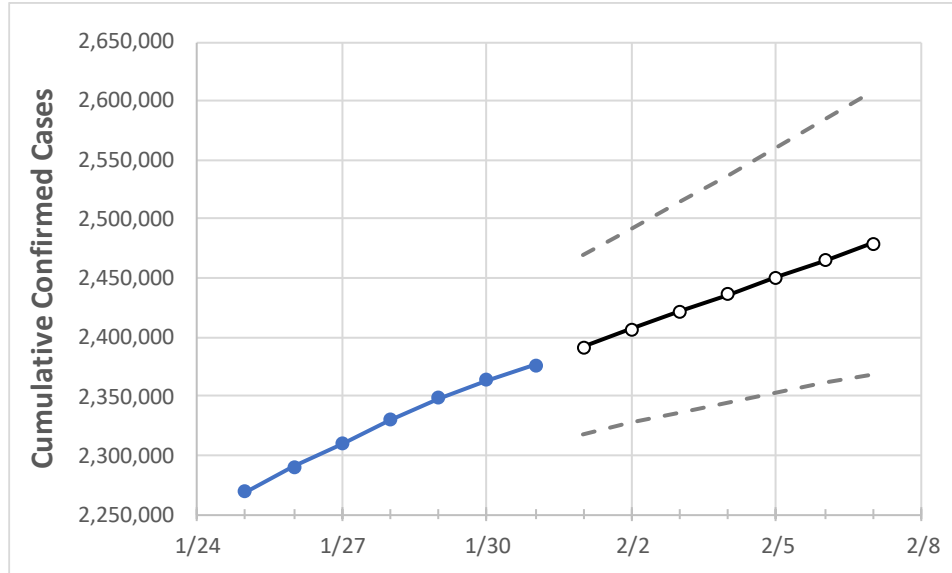
### IEM's Modeling Lead

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:						
	1/28	1/29	1/30	1/31	2/1	2/2	2/3	2/4	2/5	2/6	2/7
Texas	2,330,272	2,348,188	2,363,266	2,376,344	2,391,677	2,406,549	2,421,754	2,436,211	2,450,671	2,465,017	2,479,123

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:						
	1/28	1/29	1/30	1/31	2/1	2/2	2/3	2/4	2/5	2/6	2/7
Bexar	166,022	167,567	169,688	173,154	174,906	176,684	178,484	180,230	182,005	183,818	185,557
Brazoria	28,314	28,617	28,746	28,981	29,176	29,375	29,570	29,765	29,956	30,149	30,333
Brazos	18,374	18,572	18,698	18,804	18,944	19,086	19,227	19,368	19,510	19,649	19,789
Collin	71,179	71,865	72,370	72,705	73,281	73,852	74,404	74,944	75,464	75,988	76,498
Dallas	253,684	255,493	256,900	258,517	260,051	261,562	263,044	264,460	265,925	267,346	268,737
Denton	52,594	53,248	53,554	53,554	54,108	54,666	55,227	55,777	56,348	56,925	57,493
El Paso	112,259	112,652	113,145	113,637	114,112	114,591	115,077	115,555	116,036	116,502	116,984
Ellis	18,313	18,450	18,561	18,561	18,679	18,791	18,904	19,015	19,121	19,230	19,337
Fort Bend	49,529	49,992	49,992	49,992	50,474	51,000	51,508	52,006	52,485	52,988	53,487
Galveston	29,713	30,058	30,376	30,529	30,757	30,978	31,197	31,416	31,638	31,850	32,067
Harris	308,902	311,665	314,697	317,654	320,034	322,367	324,720	327,039	329,394	331,749	334,076
Hidalgo	62,833	63,551	63,551	63,551	64,144	64,736	65,358	65,987	66,646	67,318	67,981
Johnson	16,258	16,357	16,483	16,483	16,600	16,714	16,825	16,932	17,033	17,138	17,235
Lubbock	46,572	46,705	46,802	46,862	46,942	47,016	47,088	47,154	47,220	47,282	47,342
McLennan	22,994	23,074	23,140	23,200	23,260	23,318	23,371	23,423	23,470	23,515	23,559
Montgomery	38,904	39,241	39,241	39,241	39,780	40,317	40,881	41,451	42,004	42,580	43,177
Tarrant	213,611	215,048	215,979	216,910	218,405	219,931	221,387	222,786	224,141	225,537	226,851
Travis	67,566	68,020	68,290	68,731	69,213	69,693	70,169	70,645	71,095	71,539	71,979
Williamson	35,165	35,657	35,657	35,657	36,047	36,442	36,843	37,236	37,616	38,008	38,396

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:											
	1/28	1/29	1/30	1/31	2/2				2/4				2/6			
Bexar	166,022	167,567	169,688	173,154	176,684	(35,337)	[8,481]	{4,240}	180,230	(36,046)	[8,651]	{4,326}	183,818	(36,764)	[8,823]	{4,412}
Brazoria	28,314	28,617	28,746	28,981	29,375	(5,875)	[1,410]	{705}	29,765	(5,953)	[1,429]	{714}	30,149	(6,030)	[1,447]	{724}
Brazos	18,374	18,572	18,698	18,804	19,086	(3,817)	[916]	{458}	19,368	(3,874)	[930]	{465}	19,649	(3,930)	[943]	{472}
Collin	71,179	71,865	72,370	72,705	73,852	(14,770)	[3,545]	{1,772}	74,944	(14,989)	[3,597]	{1,799}	75,988	(15,198)	[3,647]	{1,824}
Dallas	253,684	255,493	256,900	258,517	261,562	(52,312)	[12,555]	{6,277}	264,460	(52,892)	[12,694]	{6,347}	267,346	(53,469)	[12,833]	{6,416}
Denton	52,594	53,248	53,554	53,554	54,666	(10,933)	[2,624]	{1,312}	55,777	(11,155)	[2,677]	{1,339}	56,925	(11,385)	[2,732]	{1,366}
El Paso	112,259	112,652	113,145	113,637	114,591	(22,918)	[5,500]	{2,750}	115,555	(23,111)	[5,547]	{2,773}	116,502	(23,300)	[5,592]	{2,796}
Ellis	18,313	18,450	18,561	18,561	18,791	(3,758)	[902]	{451}	19,015	(3,803)	[913]	{456}	19,230	(3,846)	[923]	{462}
Fort Bend	49,529	49,992	49,992	49,992	51,000	(10,200)	[2,448]	{1,224}	52,006	(10,401)	[2,496]	{1,248}	52,988	(10,598)	[2,543]	{1,272}
Galveston	29,713	30,058	30,376	30,529	30,978	(6,196)	[1,487]	{743}	31,416	(6,283)	[1,508]	{754}	31,850	(6,370)	[1,529]	{764}
Harris	308,902	311,665	314,697	317,654	322,367	(64,473)	[15,474]	{7,737}	327,039	(65,408)	[15,698]	{7,849}	331,749	(66,350)	[15,924]	{7,962}
Hidalgo	62,833	63,551	63,551	63,551	64,736	(12,947)	[3,107]	{1,554}	65,987	(13,197)	[3,167]	{1,584}	67,318	(13,464)	[3,231]	{1,616}
Johnson	16,258	16,357	16,483	16,483	16,714	(3,343)	[802]	{401}	16,932	(3,386)	[813]	{406}	17,138	(3,428)	[823]	{411}
Lubbock	46,572	46,705	46,802	46,862	47,016	(9,403)	[2,257]	{1,128}	47,154	(9,431)	[2,263]	{1,132}	47,282	(9,456)	[2,270]	{1,135}
McLennan	22,994	23,074	23,140	23,200	23,318	(4,664)	[1,119]	{560}	23,423	(4,685)	[1,124]	{562}	23,515	(4,703)	[1,129]	{564}
Montgomery	38,904	39,241	39,241	39,241	40,317	(8,063)	[1,935]	{968}	41,451	(8,290)	[1,990]	{995}	42,580	(8,516)	[2,044]	{1,022}
Tarrant	213,611	215,048	215,979	216,910	219,931	(43,986)	[10,557]	{5,278}	222,786	(44,557)	[10,694]	{5,347}	225,537	(45,107)	[10,826]	{5,413}
Travis	67,566	68,020	68,290	68,731	69,693	(13,939)	[3,345]	{1,673}	70,645	(14,129)	[3,391]	{1,695}	71,539	(14,308)	[3,434]	{1,717}
Williamson	35,165	35,657	35,657	35,657	36,442	(7,288)	[1,749]	{875}	37,236	(7,447)	[1,787]	{894}	38,008	(7,602)	[1,824]	{912}

For additional information from IEM, please contact Bryan Koon, Vice President of Emergency Management and Homeland Security at [bryan.koon@iem.com](mailto:bryan.koon@iem.com) or 850-519-7966 or Stephanie Tennyson at [stephanie.tennyson@iem.com](mailto:stephanie.tennyson@iem.com) or 202-309-4257.