

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 12/31/20**

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 12/31/20 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.

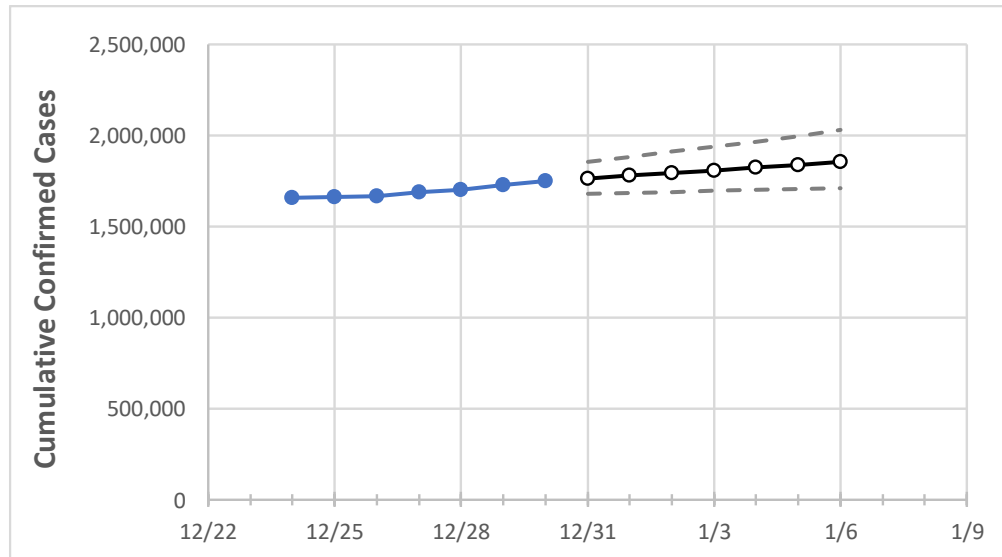
IEM's Modeling Lead

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:						
	12/27	12/28	12/29	12/30	12/31	1/1	1/2	1/3	1/4	1/5	1/6
Texas	1,690,986	1,700,549	1,730,084	1,750,250	1,764,675	1,779,794	1,795,200	1,809,681	1,825,391	1,840,142	1,855,579

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 20%, and are often within 10%, of actual confirmed cases.

Texas Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	12/27	12/28	12/29	12/30	12/31	1/1	1/2	1/3	1/4	1/5	1/6
Bexar	112,218	112,261	114,362	115,685	117,162	118,667	120,162	121,715	123,296	124,853	126,450
Brazoria	20,250	20,664	20,735	21,068	21,278	21,486	21,688	21,910	22,130	22,341	22,566
Brazos	13,828	13,950	14,077	14,273	14,368	14,464	14,562	14,657	14,750	14,846	14,941
Collin	45,600	46,018	47,197	47,757	48,540	49,328	50,125	50,917	51,723	52,537	53,360
Dallas	186,880	188,123	189,252	191,544	193,373	195,132	196,956	198,788	200,618	202,500	204,359
Denton	37,038	37,262	38,094	38,547	38,880	39,197	39,506	39,801	40,101	40,391	40,669
El Paso	97,178	97,409	97,710	98,017	98,264	98,512	98,748	98,979	99,203	99,428	99,649
Ellis	12,230	12,448	12,665	12,893	13,081	13,268	13,458	13,648	13,840	14,036	14,231
Fort Bend	34,290	34,391	34,493	35,705	36,038	36,388	36,721	37,068	37,398	37,775	38,093
Galveston	20,655	20,765	20,874	21,117	21,404	21,709	22,020	22,336	22,658	23,004	23,362
Harris	231,707	233,330	234,736	236,673	238,643	240,560	242,599	244,702	246,856	248,934	251,212
Hidalgo	49,956	50,032	50,361	50,965	51,156	51,353	51,545	51,745	51,951	52,141	52,338
Johnson	10,208	10,437	10,665	10,861	11,000	11,140	11,277	11,416	11,548	11,689	11,825
Lubbock	40,929	41,034	41,205	41,603	41,856	42,107	42,356	42,595	42,832	43,072	43,298
McLennan	18,134	18,242	18,350	18,559	18,695	18,833	18,968	19,101	19,235	19,368	19,502
Montgomery	25,708	26,044	26,379	26,650	27,035	27,422	27,824	28,229	28,642	29,059	29,479
Tarrant	137,456	138,010	144,001	145,279	146,857	148,438	150,035	151,626	153,261	154,922	156,589
Travis	48,424	48,951	49,648	50,194	50,695	51,199	51,730	52,249	52,763	53,307	53,871
Williamson	21,348	21,529	21,710	22,444	22,755	23,072	23,389	23,720	24,071	24,419	24,770

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:											
	12/27	12/28	12/29	12/30	1/1				1/3				1/5			
Bexar	112,218	112,261	114,362	115,685	118,667	(23,733)	[5,696]	{2,848}	121,715	(24,343)	[5,842]	{2,921}	124,853	(24,971)	[5,993]	{2,996}
Brazoria	20,250	20,664	20,735	21,068	21,486	(4,297)	[1,031]	{516}	21,910	(4,382)	[1,052]	{526}	22,341	(4,468)	[1,072]	{536}
Brazos	13,828	13,950	14,077	14,273	14,464	(2,893)	[694]	{347}	14,657	(2,931)	[704]	{352}	14,846	(2,969)	[713]	{356}
Collin	45,600	46,018	47,197	47,757	49,328	(9,866)	[2,368]	{1,184}	50,917	(10,183)	[2,444]	{1,222}	52,537	(10,507)	[2,522]	{1,261}
Dallas	186,880	188,123	189,252	191,544	195,132	(39,026)	[9,366]	{4,683}	198,788	(39,758)	[9,542]	{4,771}	202,500	(40,500)	[9,720]	{4,860}
Denton	37,038	37,262	38,094	38,547	39,197	(7,839)	[1,881]	{941}	39,801	(7,960)	[1,910]	{955}	40,391	(8,078)	[1,939]	{969}
El Paso	97,178	97,409	97,710	98,017	98,512	(19,702)	[4,729]	{2,364}	98,979	(19,796)	[4,751]	{2,376}	99,428	(19,886)	[4,773]	{2,386}
Ellis	12,230	12,448	12,665	12,893	13,268	(2,654)	[637]	{318}	13,648	(2,730)	[655]	{328}	14,036	(2,807)	[674]	{337}
Fort Bend	34,290	34,391	34,493	35,705	36,388	(7,278)	[1,747]	{873}	37,068	(7,414)	[1,779]	{890}	37,775	(7,555)	[1,813]	{907}
Galveston	20,655	20,765	20,874	21,117	21,709	(4,342)	[1,042]	{521}	22,336	(4,467)	[1,072]	{536}	23,004	(4,601)	[1,104]	{552}
Harris	231,707	233,330	234,736	236,673	240,560	(48,112)	[11,547]	{5,773}	244,702	(48,940)	[11,746]	{5,873}	248,934	(49,787)	[11,949]	{5,974}
Hidalgo	49,956	50,032	50,361	50,965	51,353	(10,271)	[2,465]	{1,232}	51,745	(10,349)	[2,484]	{1,242}	52,141	(10,428)	[2,503]	{1,251}
Johnson	10,208	10,437	10,665	10,861	11,140	(2,228)	[535]	{267}	11,416	(2,283)	[548]	{274}	11,689	(2,338)	[561]	{281}
Lubbock	40,929	41,034	41,205	41,603	42,107	(8,421)	[2,021]	{1,011}	42,595	(8,519)	[2,045]	{1,022}	43,072	(8,614)	[2,067]	{1,034}
McLennan	18,134	18,242	18,350	18,559	18,833	(3,767)	[904]	{452}	19,101	(3,820)	[917]	{458}	19,368	(3,874)	[930]	{465}
Montgomery	25,708	26,044	26,379	26,650	27,422	(5,484)	[1,316]	{658}	28,229	(5,646)	[1,355]	{678}	29,059	(5,812)	[1,395]	{697}
Tarrant	137,456	138,010	144,001	145,279	148,438	(29,688)	[7,125]	{3,563}	151,626	(30,325)	[7,278]	{3,639}	154,922	(30,984)	[7,436]	{3,718}
Travis	48,424	48,951	49,648	50,194	51,199	(10,240)	[2,458]	{1,229}	52,249	(10,450)	[2,508]	{1,254}	53,307	(10,661)	[2,559]	{1,279}
Williamson	21,348	21,529	21,710	22,444	23,072	(4,614)	[1,107]	{554}	23,720	(4,744)	[1,139]	{569}	24,419	(4,884)	[1,172]	{586}

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.