

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

Date: 2/2/21

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 2/2/21 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.**

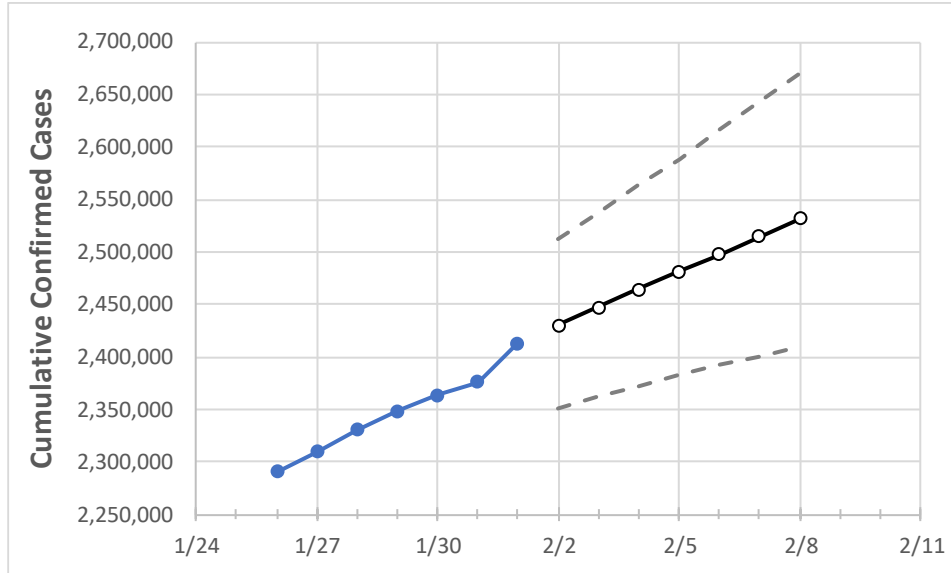
### IEM's Modeling Lead

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:							
	1/29	1/30	1/31	2/1	2/2	2/3	2/4	2/5	2/6	2/7	2/8	
Texas	2,348,188	2,363,266	2,376,344	2,412,627	2,429,928	2,447,076	2,464,079	2,481,112	2,497,860	2,514,925	2,531,833	

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:							
	1/29	1/30	1/31	2/1	2/2	2/3	2/4	2/5	2/6	2/7	2/8	
Bexar	167,567	169,688	173,154	175,530	177,403	179,255	181,117	183,009	184,926	186,813	188,665	
Brazoria	28,617	28,746	28,981	29,105	29,292	29,483	29,669	29,854	30,033	30,207	30,381	
Brazos	18,572	18,698	18,804	18,928	19,065	19,202	19,338	19,474	19,610	19,747	19,882	
Collin	71,865	72,370	72,705	73,580	74,186	74,792	75,376	75,949	76,521	77,070	77,637	
Dallas	255,493	256,900	258,517	259,944	261,399	262,850	264,303	265,702	267,032	268,380	269,688	
Denton	53,248	53,554	53,854	54,154	54,656	55,160	55,674	56,190	56,685	57,198	57,711	
El Paso	112,652	113,145	113,637	114,058	114,522	114,980	115,443	115,901	116,340	116,818	117,322	
Ellis	18,450	18,561	18,561	18,561	18,678	18,792	18,907	19,017	19,127	19,230	19,334	
Fort Bend	49,992	50,117	50,243	50,368	50,716	51,052	51,384	51,721	52,049	52,367	52,688	
Galveston	30,058	30,376	30,529	30,529	30,757	30,970	31,195	31,407	31,614	31,818	32,023	
Harris	311,665	314,697	317,654	319,800	322,178	324,490	326,779	329,101	331,401	333,777	336,186	
Hidalgo	63,551	63,795	64,040	64,284	64,740	65,196	65,644	66,102	66,588	67,063	67,529	
Johnson	16,357	16,483	16,483	16,483	16,590	16,696	16,798	16,898	16,994	17,087	17,177	
Lubbock	46,705	46,802	46,862	46,942	47,017	47,088	47,159	47,226	47,290	47,353	47,413	
McLennan	23,074	23,140	23,200	23,200	23,256	23,312	23,364	23,413	23,460	23,507	23,548	
Montgomery	39,241	39,508	39,775	40,042	40,466	40,892	41,316	41,741	42,154	42,571	43,001	
Tarrant	215,048	215,979	216,910	220,685	222,243	223,850	225,431	226,987	228,573	230,102	231,602	
Travis	68,020	68,290	68,731	69,408	69,910	70,416	70,921	71,420	71,917	72,403	72,886	
Williamson	35,657	36,054	36,451	36,848	37,246	37,645	38,040	38,426	38,820	39,206	39,595	

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:											
	1/29	1/30	1/31	2/1	2/3		2/5		2/7							
Bexar	167,567	169,688	173,154	175,530	179,255	(35,851)	[8,604]	{4,302}	183,009	(36,602)	[8,784]	{4,392}	186,813	(37,363)	[8,967]	{4,484}
Brazoria	28,617	28,746	28,981	29,105	29,483	(5,897)	[1,415]	{708}	29,854	(5,971)	[1,433]	{717}	30,207	(6,041)	[1,450]	{725}
Brazos	18,572	18,698	18,804	18,928	19,202	(3,840)	[922]	{461}	19,474	(3,895)	[935]	{467}	19,747	(3,949)	[948]	{474}
Collin	71,865	72,370	72,705	73,580	74,792	(14,958)	[3,590]	{1,795}	75,949	(15,190)	[3,646]	{1,823}	77,070	(15,414)	[3,699]	{1,850}
Dallas	255,493	256,900	258,517	259,944	262,850	(52,570)	[12,617]	{6,308}	265,702	(53,140)	[12,754]	{6,377}	268,380	(53,676)	[12,882]	{6,441}
Denton	53,248	53,554	53,854	54,154	55,160	(11,032)	[2,648]	{1,324}	56,190	(11,238)	[2,697]	{1,349}	57,198	(11,440)	[2,745]	{1,373}
El Paso	112,652	113,145	113,637	114,058	114,980	(22,996)	[5,519]	{2,760}	115,901	(23,180)	[5,563]	{2,782}	116,818	(23,364)	[5,607]	{2,804}
Ellis	18,450	18,561	18,561	18,561	18,792	(3,758)	[902]	{451}	19,017	(3,803)	[913]	{456}	19,230	(3,846)	[923]	{462}
Fort Bend	49,992	50,117	50,243	50,368	51,052	(10,210)	[2,450]	{1,225}	51,721	(10,344)	[2,483]	{1,241}	52,367	(10,473)	[2,514]	{1,257}
Galveston	30,058	30,376	30,529	30,529	30,970	(6,194)	[1,487]	{743}	31,407	(6,281)	[1,508]	{754}	31,818	(6,364)	[1,527]	{764}
Harris	311,665	314,697	317,654	319,800	324,490	(64,898)	[15,575]	{7,788}	329,101	(65,820)	[15,797]	{7,898}	333,777	(66,755)	[16,021]	{8,011}
Hidalgo	63,551	63,795	64,040	64,284	65,196	(13,039)	[3,129]	{1,565}	66,102	(13,220)	[3,173]	{1,586}	67,063	(13,413)	[3,219]	{1,610}
Johnson	16,357	16,483	16,483	16,483	16,696	(3,339)	[801]	{401}	16,898	(3,380)	[811]	{406}	17,087	(3,417)	[820]	{410}
Lubbock	46,705	46,802	46,862	46,942	47,088	(9,418)	[2,260]	{1,130}	47,226	(9,445)	[2,267]	{1,133}	47,353	(9,471)	[2,273]	{1,136}
McLennan	23,074	23,140	23,200	23,200	23,312	(4,662)	[1,119]	{559}	23,413	(4,683)	[1,124]	{562}	23,507	(4,701)	[1,128]	{564}
Montgomery	39,241	39,508	39,775	40,042	40,892	(8,178)	[1,963]	{981}	41,741	(8,348)	[2,004]	{1,002}	42,571	(8,514)	[2,043]	{1,022}
Tarrant	215,048	215,979	216,910	220,685	223,850	(44,770)	[10,745]	{5,372}	226,987	(45,397)	[10,895]	{5,448}	230,102	(46,020)	[11,045]	{5,522}
Travis	68,020	68,290	68,731	69,408	70,416	(14,083)	[3,380]	{1,690}	71,420	(14,284)	[3,428]	{1,714}	72,403	(14,481)	[3,475]	{1,738}
Williamson	35,657	36,054	36,451	36,848	37,645	(7,529)	[1,807]	{903}	38,426	(7,685)	[1,844]	{922}	39,206	(7,841)	[1,882]	{941}

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.