

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

Date: 4/23/21

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 4/23/21 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.**

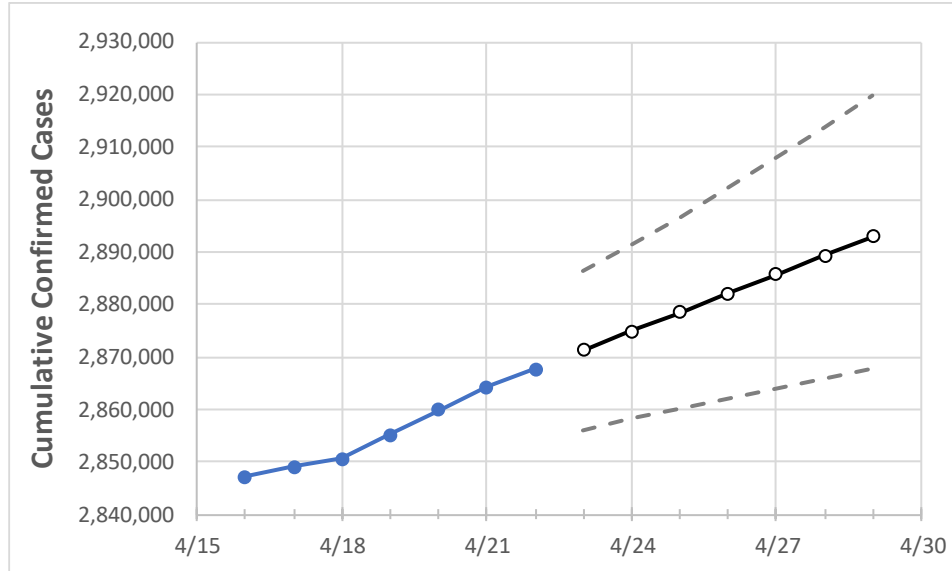
### IEM's Modeling Lead

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:							
	4/19	4/20	4/21	4/22	4/23	4/24	4/25	4/26	4/27	4/28	4/29	
Texas	2,855,052	2,859,892	2,864,319	2,867,748	2,871,360	2,874,959	2,878,558	2,882,170	2,885,661	2,889,259	2,892,846	

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:							
	4/19	4/20	4/21	4/22	4/23	4/24	4/25	4/26	4/27	4/28	4/29	
Bexar	213,677	214,071	214,382	214,631	215,058	215,490	215,903	216,359	216,784	217,229	217,682	
Brazoria	36,650	36,694	36,775	36,811	36,866	36,922	36,978	37,036	37,092	37,149	37,203	
Brazos	25,944	25,977	26,016	26,069	26,110	26,152	26,196	26,238	26,283	26,325	26,365	
Collin	88,563	88,767	88,856	88,926	89,036	89,147	89,259	89,371	89,486	89,596	89,711	
Dallas	296,066	296,327	296,606	296,790	297,021	297,252	297,480	297,703	297,922	298,140	298,358	
Denton	73,424	73,588	73,645	73,704	73,792	73,880	73,968	74,056	74,144	74,232	74,323	
El Paso	132,448	132,686	132,892	133,037	133,199	133,362	133,522	133,687	133,847	134,010	134,177	
Ellis	22,397	22,412	22,429	22,454	22,471	22,488	22,505	22,522	22,539	22,556	22,574	
Fort Bend	65,458	65,735	65,920	66,052	66,183	66,314	66,447	66,585	66,724	66,866	67,005	
Galveston	38,253	38,310	38,397	38,491	38,556	38,621	38,685	38,751	38,818	38,883	38,949	
Harris	386,620	387,012	387,758	388,423	388,913	389,394	389,878	390,349	390,828	391,301	391,757	
Hidalgo	87,159	87,367	87,602	87,744	87,893	88,044	88,197	88,354	88,510	88,672	88,842	
Johnson	19,524	19,535	19,543	19,561	19,569	19,578	19,586	19,594	19,602	19,610	19,617	
Lubbock	48,748	48,751	48,765	48,770	48,776	48,781	48,786	48,792	48,797	48,802	48,806	
McLennan	26,578	26,603	26,670	26,714	26,750	26,787	26,824	26,863	26,903	26,943	26,984	
Montgomery	51,224	51,425	51,558	51,582	51,678	51,774	51,871	51,968	52,063	52,160	52,256	
Tarrant	254,723	254,915	255,063	255,309	255,525	255,738	255,964	256,188	256,408	256,641	256,874	
Travis	81,342	81,470	81,551	81,600	81,716	81,833	81,950	82,068	82,186	82,305	82,422	
Williamson	44,523	44,664	44,731	44,828	44,912	44,995	45,079	45,164	45,253	45,337	45,428	

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:											
	4/19	4/20	4/21	4/22	4/24			4/26			4/28					
Bexar	213,677	214,071	214,382	214,631	215,490	(43,098)	[10,344]	{5,172}	216,359	(43,272)	[10,385]	{5,193}	217,229	(43,446)	[10,427]	{5,213}
Brazoria	36,650	36,694	36,775	36,811	36,922	(7,384)	[1,772]	{886}	37,036	(7,407)	[1,778]	{889}	37,149	(7,430)	[1,783]	{892}
Brazos	25,944	25,977	26,016	26,069	26,152	(5,230)	[1,255]	{628}	26,238	(5,248)	[1,259]	{630}	26,325	(5,265)	[1,264]	{632}
Collin	88,563	88,767	88,856	88,926	89,147	(17,829)	[4,279]	{2,140}	89,371	(17,874)	[4,290]	{2,145}	89,596	(17,919)	[4,301]	{2,150}
Dallas	296,066	296,327	296,606	296,790	297,252	(59,450)	[14,268]	{7,134}	297,703	(59,541)	[14,290]	{7,145}	298,140	(59,628)	[14,311]	{7,155}
Denton	73,424	73,588	73,645	73,704	73,880	(14,776)	[3,546]	{1,773}	74,056	(14,811)	[3,555]	{1,777}	74,232	(14,846)	[3,563]	{1,782}
El Paso	132,448	132,686	132,892	133,037	133,362	(26,672)	[6,401]	{3,201}	133,687	(26,737)	[6,417]	{3,208}	134,010	(26,802)	[6,433]	{3,216}
Ellis	22,397	22,412	22,429	22,454	22,488	(4,498)	[1,079]	{540}	22,522	(4,504)	[1,081]	{541}	22,556	(4,511)	[1,083]	{541}
Fort Bend	65,458	65,735	65,920	66,052	66,314	(13,263)	[3,183]	{1,592}	66,585	(13,317)	[3,196]	{1,598}	66,866	(13,373)	[3,210]	{1,605}
Galveston	38,253	38,310	38,397	38,491	38,621	(7,724)	[1,854]	{927}	38,751	(7,750)	[1,860]	{930}	38,883	(7,777)	[1,866]	{933}
Harris	386,620	387,012	387,758	388,423	389,394	(77,879)	[18,691]	{9,345}	390,349	(78,070)	[18,737]	{9,368}	391,301	(78,260)	[18,782]	{9,391}
Hidalgo	87,159	87,367	87,602	87,744	88,044	(17,609)	[4,226]	{2,113}	88,354	(17,671)	[4,241]	{2,120}	88,672	(17,734)	[4,256]	{2,128}
Johnson	19,524	19,535	19,543	19,561	19,578	(3,916)	[940]	{470}	19,594	(3,919)	[941]	{470}	19,610	(3,922)	[941]	{471}
Lubbock	48,748	48,751	48,765	48,770	48,781	(9,756)	[2,341]	{1,171}	48,792	(9,758)	[2,342]	{1,171}	48,802	(9,760)	[2,342]	{1,171}
McLennan	26,578	26,603	26,670	26,714	26,787	(5,357)	[1,286]	{643}	26,863	(5,373)	[1,289]	{645}	26,943	(5,389)	[1,293]	{647}
Montgomery	51,224	51,425	51,558	51,582	51,774	(10,355)	[2,485]	{1,243}	51,968	(10,394)	[2,494]	{1,247}	52,160	(10,432)	[2,504]	{1,252}
Tarrant	254,723	254,915	255,063	255,309	255,738	(51,148)	[12,275]	{6,138}	256,188	(51,238)	[12,297]	{6,149}	256,641	(51,328)	[12,319]	{6,159}
Travis	81,342	81,470	81,551	81,600	81,833	(16,367)	[3,928]	{1,964}	82,068	(16,414)	[3,939]	{1,970}	82,305	(16,461)	[3,951]	{1,975}
Williamson	44,523	44,664	44,731	44,828	44,995	(8,999)	[2,160]	{1,080}	45,164	(9,033)	[2,168]	{1,084}	45,337	(9,067)	[2,176]	{1,088}

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.