

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

Date: 4/21/21

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 4/21/21 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.**

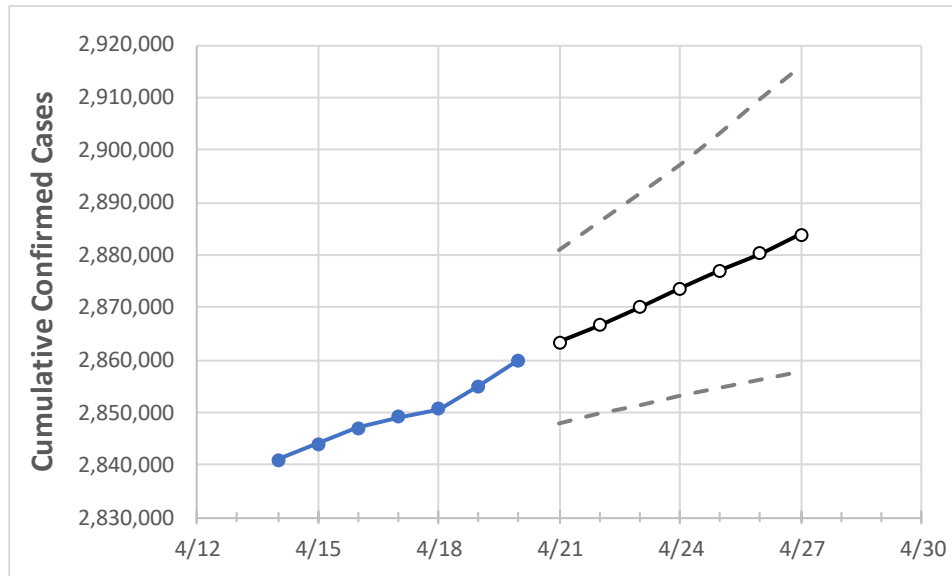
### IEM's Modeling Lead

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:							
	4/17	4/18	4/19	4/20	4/21	4/22	4/23	4/24	4/25	4/26	4/27	
Texas	2,849,072	2,850,575	2,855,052	2,859,892	2,863,291	2,866,677	2,870,093	2,873,580	2,877,005	2,880,349	2,883,851	

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:							
	4/17	4/18	4/19	4/20	4/21	4/22	4/23	4/24	4/25	4/26	4/27	
Bexar	212,174	212,925	213,677	214,071	214,550	215,039	215,536	216,037	216,566	217,085	217,625	
Brazoria	36,530	36,587	36,650	36,694	36,749	36,804	36,859	36,913	36,967	37,021	37,072	
Brazos	25,879	25,912	25,944	25,977	26,019	26,062	26,103	26,146	26,187	26,229	26,272	
Collin	88,361	88,478	88,563	88,767	88,888	89,009	89,130	89,255	89,384	89,509	89,636	
Dallas	295,543	295,804	296,066	296,327	296,545	296,756	296,964	297,175	297,375	297,568	297,762	
Denton	73,279	73,352	73,424	73,588	73,686	73,784	73,881	73,979	74,082	74,182	74,285	
El Paso	132,132	132,355	132,448	132,686	132,841	132,998	133,158	133,316	133,477	133,634	133,792	
Ellis	22,368	22,383	22,397	22,412	22,427	22,443	22,458	22,473	22,488	22,503	22,519	
Fort Bend	65,435	65,447	65,458	65,735	65,851	65,970	66,091	66,209	66,328	66,444	66,569	
Galveston	38,158	38,196	38,253	38,310	38,366	38,423	38,479	38,534	38,591	38,645	38,700	
Harris	385,924	386,436	386,620	387,012	387,435	387,848	388,274	388,688	389,084	389,488	389,875	
Hidalgo	87,032	87,096	87,159	87,367	87,502	87,637	87,773	87,906	88,040	88,178	88,312	
Johnson	19,503	19,514	19,524	19,535	19,544	19,552	19,560	19,568	19,575	19,583	19,590	
Lubbock	48,741	48,744	48,748	48,751	48,756	48,761	48,766	48,771	48,775	48,779	48,784	
McLennan	26,528	26,553	26,578	26,603	26,629	26,655	26,680	26,706	26,732	26,757	26,783	
Montgomery	51,059	51,141	51,224	51,425	51,530	51,637	51,744	51,851	51,962	52,070	52,181	
Tarrant	254,306	254,424	254,723	254,915	255,141	255,364	255,589	255,823	256,053	256,289	256,525	
Travis	81,138	81,199	81,342	81,470	81,600	81,730	81,863	81,999	82,135	82,272	82,410	
Williamson	44,405	44,464	44,523	44,664	44,746	44,830	44,913	44,999	45,088	45,175	45,263	

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:											
	4/17	4/18	4/19	4/20	4/22				4/24				4/26			
Bexar	212,174	212,925	213,677	214,071	215,039	(43,008)	[10,322]	{5,161}	216,037	(43,207)	[10,370]	{5,185}	217,085	(43,417)	[10,420]	{5,210}
Brazoria	36,530	36,587	36,650	36,694	36,804	(7,361)	[1,767]	{883}	36,913	(7,383)	[1,772]	{886}	37,021	(7,404)	[1,777]	{889}
Brazos	25,879	25,912	25,944	25,977	26,062	(5,212)	[1,251]	{625}	26,146	(5,229)	[1,255]	{627}	26,229	(5,246)	[1,259]	{629}
Collin	88,361	88,478	88,563	88,767	89,009	(17,802)	[4,272]	{2,136}	89,255	(17,851)	[4,284]	{2,142}	89,509	(17,902)	[4,296]	{2,148}
Dallas	295,543	295,804	296,066	296,327	296,756	(59,351)	[14,244]	{7,122}	297,175	(59,435)	[14,264]	{7,132}	297,568	(59,514)	[14,283]	{7,142}
Denton	73,279	73,352	73,424	73,588	73,784	(14,757)	[3,542]	{1,771}	73,979	(14,796)	[3,551]	{1,776}	74,182	(14,836)	[3,561]	{1,780}
El Paso	132,132	132,355	132,448	132,686	132,998	(26,600)	[6,384]	{3,192}	133,316	(26,663)	[6,399]	{3,200}	133,634	(26,727)	[6,414]	{3,207}
Ellis	22,368	22,383	22,397	22,412	22,443	(4,489)	[1,077]	{539}	22,473	(4,495)	[1,079]	{539}	22,503	(4,501)	[1,080]	{540}
Fort Bend	65,435	65,447	65,458	65,735	65,970	(13,194)	[3,167]	{1,583}	66,209	(13,242)	[3,178]	{1,589}	66,444	(13,289)	[3,189]	{1,595}
Galveston	38,158	38,196	38,253	38,310	38,423	(7,685)	[1,844]	{922}	38,534	(7,707)	[1,850]	{925}	38,645	(7,729)	[1,855]	{927}
Harris	385,924	386,436	386,620	387,012	387,848	(77,570)	[18,617]	{9,308}	388,688	(77,738)	[18,657]	{9,329}	389,488	(77,898)	[18,695]	{9,348}
Hidalgo	87,032	87,096	87,159	87,367	87,637	(17,527)	[4,207]	{2,103}	87,906	(17,581)	[4,219]	{2,110}	88,178	(17,636)	[4,233]	{2,116}
Johnson	19,503	19,514	19,524	19,535	19,552	(3,910)	[938]	{469}	19,568	(3,914)	[939]	{470}	19,583	(3,917)	[940]	{470}
Lubbock	48,741	48,744	48,748	48,751	48,761	(9,752)	[2,341]	{1,170}	48,771	(9,754)	[2,341]	{1,171}	48,779	(9,756)	[2,341]	{1,171}
McLennan	26,528	26,553	26,578	26,603	26,655	(5,331)	[1,279]	{640}	26,706	(5,341)	[1,282]	{641}	26,757	(5,351)	[1,284]	{642}
Montgomery	51,059	51,141	51,224	51,425	51,637	(10,327)	[2,479]	{1,239}	51,851	(10,370)	[2,489]	{1,244}	52,070	(10,414)	[2,499]	{1,250}
Tarrant	254,306	254,424	254,723	254,915	255,364	(51,073)	[12,257]	{6,129}	255,823	(51,165)	[12,280]	{6,140}	256,289	(51,258)	[12,302]	{6,151}
Travis	81,138	81,199	81,342	81,470	81,730	(16,346)	[3,923]	{1,962}	81,999	(16,400)	[3,936]	{1,968}	82,272	(16,454)	[3,949]	{1,975}
Williamson	44,405	44,464	44,523	44,664	44,830	(8,966)	[2,152]	{1,076}	44,999	(9,000)	[2,160]	{1,080}	45,175	(9,035)	[2,168]	{1,084}

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.