

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

Date: 4/27/21

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 4/27/21 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.**

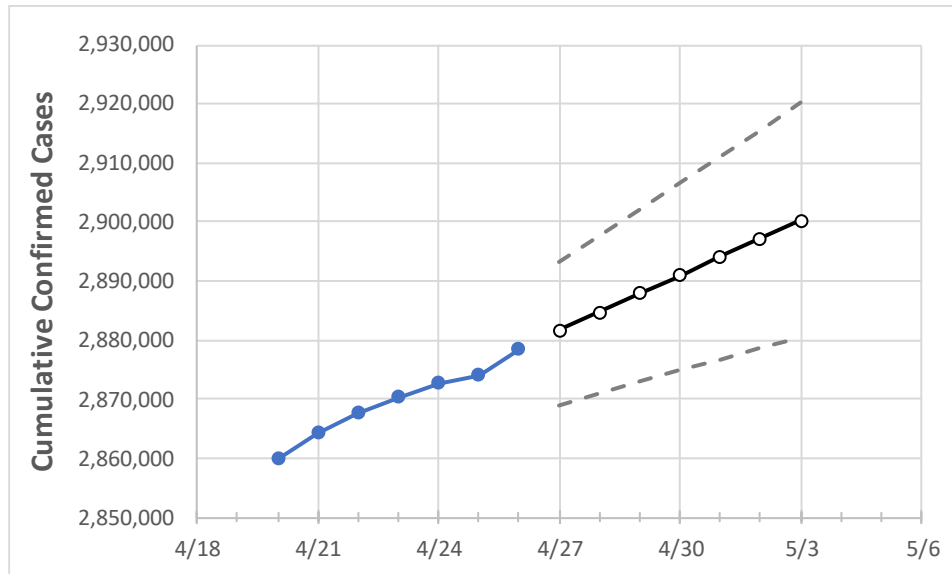
### IEM's Modeling Lead

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:						
	4/23	4/24	4/25	4/26	4/27	4/28	4/29	4/30	5/1	5/2	5/3

Texas 2,870,407 2,872,756 2,873,995 2,878,438 2,881,631 2,884,754 2,887,970 2,891,009 2,894,128 2,897,218 2,900,315

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:						
	4/23	4/24	4/25	4/26	4/27	4/28	4/29	4/30	5/1	5/2	5/3
Bexar	214,699	215,246	215,792	216,339	216,755	217,175	217,606	218,032	218,453	218,895	219,334
Brazoria	36,880	36,895	36,958	36,992	37,042	37,090	37,136	37,183	37,232	37,278	37,326
Brazos	26,094	26,133	26,133	26,133	26,177	26,218	26,263	26,307	26,351	26,396	26,440
Collin	89,051	89,160	89,290	89,285	89,402	89,518	89,638	89,765	89,886	90,011	90,131
Dallas	297,012	297,315	297,476	297,637	297,846	298,057	298,269	298,475	298,675	298,879	299,082
Denton	73,793	73,837	73,881	73,925	73,999	74,070	74,143	74,212	74,283	74,351	74,420
El Paso	133,120	133,270	133,366	133,458	133,591	133,724	133,853	133,984	134,113	134,237	134,364
Ellis	22,462	22,468	22,468	22,468	22,482	22,495	22,509	22,522	22,535	22,548	22,562
Fort Bend	66,192	66,221	66,250	66,279	66,386	66,489	66,597	66,701	66,808	66,916	67,028
Galveston	38,553	38,612	38,647	38,647	38,704	38,759	38,816	38,873	38,930	38,987	39,044
Harris	388,649	389,731	390,174	390,547	391,020	391,504	391,973	392,418	392,888	393,350	393,809
Hidalgo	87,810	87,833	87,856	87,879	87,980	88,081	88,178	88,274	88,369	88,467	88,556
Johnson	19,563	19,573	19,573	19,573	19,581	19,589	19,596	19,604	19,611	19,618	19,625
Lubbock	48,779	48,798	48,798	48,798	48,806	48,813	48,821	48,828	48,836	48,843	48,850
McLennan	26,738	26,761	26,761	26,761	26,793	26,827	26,860	26,895	26,930	26,965	27,001
Montgomery	51,683	51,765	51,846	51,928	52,017	52,105	52,191	52,277	52,365	52,450	52,538
Tarrant	255,483	255,582	255,681	255,984	256,178	256,370	256,568	256,768	256,970	257,170	257,373
Travis	81,686	81,739	81,811	81,906	82,001	82,095	82,187	82,276	82,367	82,457	82,545
Williamson	44,883	44,951	45,018	45,086	45,162	45,236	45,306	45,383	45,459	45,535	45,615

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:											
	4/23	4/24	4/25	4/26	4/28				4/30				5/2			
Bexar	214,699	215,246	215,792	216,339	217,175	(43,435)	[10,424]	{5,212}	218,032	(43,606)	[10,466]	{5,233}	218,895	(43,779)	[10,507]	{5,253}
Brazoria	36,880	36,895	36,958	36,992	37,090	(7,418)	[1,780]	{890}	37,183	(7,437)	[1,785]	{892}	37,278	(7,456)	[1,789]	{895}
Brazos	26,094	26,133	26,133	26,133	26,218	(5,244)	[1,258]	{629}	26,307	(5,261)	[1,263]	{631}	26,396	(5,279)	[1,267]	{634}
Collin	89,051	89,160	89,290	89,285	89,518	(17,904)	[4,297]	{2,148}	89,765	(17,953)	[4,309]	{2,154}	90,011	(18,002)	[4,321]	{2,160}
Dallas	297,012	297,315	297,476	297,637	298,057	(59,611)	[14,307]	{7,153}	298,475	(59,695)	[14,327]	{7,163}	298,879	(59,776)	[14,346]	{7,173}
Denton	73,793	73,837	73,881	73,925	74,070	(14,814)	[3,555]	{1,778}	74,212	(14,842)	[3,562]	{1,781}	74,351	(14,870)	[3,569]	{1,784}
El Paso	133,120	133,270	133,366	133,458	133,724	(26,745)	[6,419]	{3,209}	133,984	(26,797)	[6,431]	{3,216}	134,237	(26,847)	[6,443]	{3,222}
Ellis	22,462	22,468	22,468	22,468	22,495	(4,499)	[1,080]	{540}	22,522	(4,504)	[1,081]	{541}	22,548	(4,510)	[1,082]	{541}
Fort Bend	66,192	66,221	66,250	66,279	66,489	(13,298)	[3,191]	{1,596}	66,701	(13,340)	[3,202]	{1,601}	66,916	(13,383)	[3,212]	{1,606}
Galveston	38,553	38,612	38,647	38,647	38,759	(7,752)	[1,860]	{930}	38,873	(7,775)	[1,866]	{933}	38,987	(7,797)	[1,871]	{936}
Harris	388,649	389,731	390,174	390,547	391,504	(78,301)	[18,792]	{9,396}	392,418	(78,484)	[18,836]	{9,418}	393,350	(78,670)	[18,881]	{9,440}
Hidalgo	87,810	87,833	87,856	87,879	88,081	(17,616)	[4,228]	{2,114}	88,274	(17,655)	[4,237]	{2,119}	88,467	(17,693)	[4,246]	{2,123}
Johnson	19,563	19,573	19,573	19,573	19,589	(3,918)	[940]	{470}	19,604	(3,921)	[941]	{470}	19,618	(3,924)	[942]	{471}
Lubbock	48,779	48,798	48,798	48,798	48,813	(9,763)	[2,343]	{1,172}	48,828	(9,766)	[2,344]	{1,172}	48,843	(9,769)	[2,344]	{1,172}
McLennan	26,738	26,761	26,761	26,761	26,827	(5,365)	[1,288]	{644}	26,895	(5,379)	[1,291]	{645}	26,965	(5,393)	[1,294]	{647}
Montgomery	51,683	51,765	51,846	51,928	52,105	(10,421)	[2,501]	{1,251}	52,277	(10,455)	[2,509]	{1,255}	52,450	(10,490)	[2,518]	{1,259}
Tarrant	255,483	255,582	255,681	255,984	256,370	(51,274)	[12,306]	{6,153}	256,768	(51,354)	[12,325]	{6,162}	257,170	(51,434)	[12,344]	{6,172}
Travis	81,686	81,739	81,811	81,906	82,095	(16,419)	[3,941]	{1,970}	82,276	(16,455)	[3,949]	{1,975}	82,457	(16,491)	[3,958]	{1,979}
Williamson	44,883	44,951	45,018	45,086	45,236	(9,047)	[2,171]	{1,086}	45,383	(9,077)	[2,178]	{1,089}	45,535	(9,107)	[2,186]	{1,093}

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.