

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

Date: 4/14/21

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 4/14/21 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.**

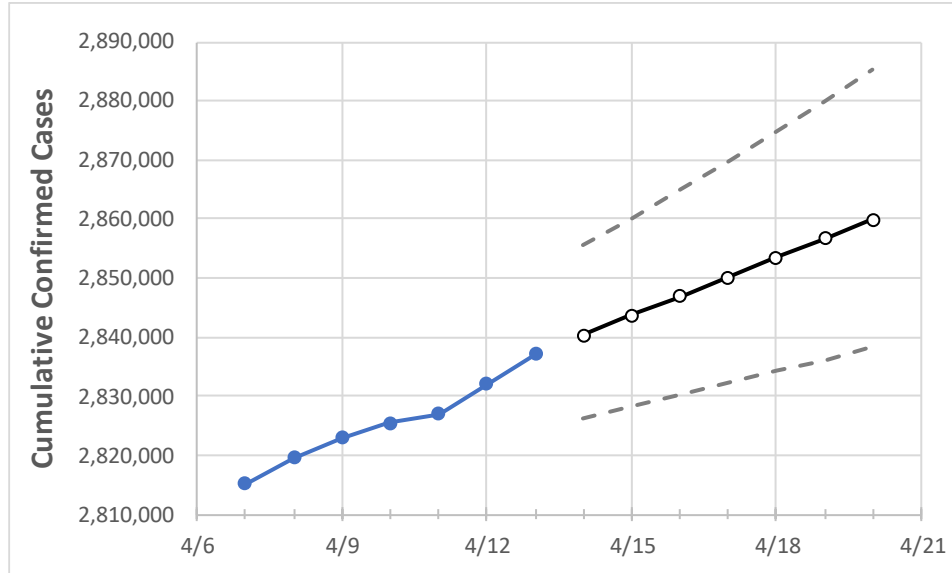
### IEM's Modeling Lead

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:							
	4/10	4/11	4/12	4/13	4/14	4/15	4/16	4/17	4/18	4/19	4/20	
Texas	2,825,551	2,826,977	2,831,972	2,837,160	2,840,389	2,843,653	2,846,955	2,850,077	2,853,410	2,856,623	2,859,869	

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:							
	4/10	4/11	4/12	4/13	4/14	4/15	4/16	4/17	4/18	4/19	4/20	
Bexar	209,500	210,148	210,796	211,069	211,577	212,081	212,583	213,118	213,668	214,218	214,788	
Brazoria	36,134	36,152	36,222	36,323	36,377	36,431	36,485	36,540	36,592	36,645	36,699	
Brazos	25,507	25,531	25,555	25,579	25,606	25,632	25,656	25,680	25,703	25,725	25,746	
Collin	87,634	87,709	87,845	87,982	88,090	88,199	88,310	88,417	88,527	88,637	88,748	
Dallas	293,934	294,160	294,386	294,612	294,845	295,076	295,301	295,520	295,745	295,971	296,182	
Denton	72,648	72,714	72,779	72,928	73,000	73,070	73,139	73,207	73,274	73,342	73,407	
El Paso	131,159	131,283	131,459	131,561	131,720	131,879	132,033	132,187	132,345	132,500	132,655	
Ellis	22,252	22,273	22,293	22,314	22,331	22,347	22,364	22,381	22,397	22,412	22,428	
Fort Bend	64,440	64,473	64,506	64,901	65,015	65,134	65,248	65,361	65,468	65,579	65,687	
Galveston	37,747	37,807	37,874	37,941	38,002	38,063	38,123	38,184	38,244	38,303	38,363	
Harris	382,209	382,779	383,325	383,709	384,153	384,589	385,025	385,456	385,869	386,289	386,689	
Hidalgo	86,106	86,137	86,167	86,339	86,421	86,497	86,576	86,650	86,722	86,795	86,864	
Johnson	19,429	19,445	19,461	19,477	19,488	19,499	19,510	19,521	19,531	19,541	19,550	
Lubbock	48,687	48,695	48,702	48,710	48,719	48,728	48,737	48,746	48,754	48,763	48,771	
McLennan	26,347	26,367	26,386	26,406	26,426	26,445	26,464	26,483	26,501	26,519	26,536	
Montgomery	50,411	50,536	50,660	50,740	50,831	50,924	51,016	51,107	51,197	51,285	51,372	
Tarrant	252,771	252,872	253,211	253,402	253,598	253,802	254,003	254,198	254,398	254,603	254,813	
Travis	80,272	80,446	80,533	80,642	80,761	80,881	81,003	81,127	81,252	81,380	81,507	
Williamson	43,914	43,995	44,077	44,167	44,247	44,328	44,408	44,490	44,574	44,660	44,744	

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:											
	4/10	4/11	4/12	4/13	4/15				4/17				4/19			
Bexar	209,500	210,148	210,796	211,069	212,081	(42,416)	[10,180]	{5,090}	213,118	(42,624)	[10,230]	{5,115}	214,218	(42,844)	[10,282]	{5,141}
Brazoria	36,134	36,152	36,222	36,323	36,431	(7,286)	[1,749]	{874}	36,540	(7,308)	[1,754]	{877}	36,645	(7,329)	[1,759]	{879}
Brazos	25,507	25,531	25,555	25,579	25,632	(5,126)	[1,230]	{615}	25,680	(5,136)	[1,233]	{616}	25,725	(5,145)	[1,235]	{617}
Collin	87,634	87,709	87,845	87,982	88,199	(17,640)	[4,234]	{2,117}	88,417	(17,683)	[4,244]	{2,122}	88,637	(17,727)	[4,255]	{2,127}
Dallas	293,934	294,160	294,386	294,612	295,076	(59,015)	[14,164]	{7,082}	295,520	(59,104)	[14,185]	{7,092}	295,971	(59,194)	[14,207]	{7,103}
Denton	72,648	72,714	72,779	72,928	73,070	(14,614)	[3,507]	{1,754}	73,207	(14,641)	[3,514]	{1,757}	73,342	(14,668)	[3,520]	{1,760}
El Paso	131,159	131,283	131,459	131,561	131,879	(26,376)	[6,330]	{3,165}	132,187	(26,437)	[6,345]	{3,172}	132,500	(26,500)	[6,360]	{3,180}
Ellis	22,252	22,273	22,293	22,314	22,347	(4,469)	[1,073]	{536}	22,381	(4,476)	[1,074]	{537}	22,412	(4,482)	[1,076]	{538}
Fort Bend	64,440	64,473	64,506	64,901	65,134	(13,027)	[3,126]	{1,563}	65,361	(13,072)	[3,137]	{1,569}	65,579	(13,116)	[3,148]	{1,574}
Galveston	37,747	37,807	37,874	37,941	38,063	(7,613)	[1,827]	{914}	38,184	(7,637)	[1,833]	{916}	38,303	(7,661)	[1,839]	{919}
Harris	382,209	382,779	383,325	383,709	384,589	(76,918)	[18,460]	{9,230}	385,456	(77,091)	[18,502]	{9,251}	386,289	(77,258)	[18,542]	{9,271}
Hidalgo	86,106	86,137	86,167	86,339	86,497	(17,299)	[4,152]	{2,076}	86,650	(17,330)	[4,159]	{2,080}	86,795	(17,359)	[4,166]	{2,083}
Johnson	19,429	19,445	19,461	19,477	19,499	(3,900)	[936]	{468}	19,521	(3,904)	[937]	{468}	19,541	(3,908)	[938]	{469}
Lubbock	48,687	48,695	48,702	48,710	48,728	(9,746)	[2,339]	{1,169}	48,746	(9,749)	[2,340]	{1,170}	48,763	(9,753)	[2,341]	{1,170}
McLennan	26,347	26,367	26,386	26,406	26,445	(5,289)	[1,269]	{635}	26,483	(5,297)	[1,271]	{636}	26,519	(5,304)	[1,273]	{636}
Montgomery	50,411	50,536	50,660	50,740	50,924	(10,185)	[2,444]	{1,222}	51,107	(10,221)	[2,453]	{1,227}	51,285	(10,257)	[2,462]	{1,231}
Tarrant	252,771	252,872	253,211	253,402	253,802	(50,760)	[12,182]	{6,091}	254,198	(50,840)	[12,202]	{6,101}	254,603	(50,921)	[12,221]	{6,110}
Travis	80,272	80,446	80,533	80,642	80,881	(16,176)	[3,882]	{1,941}	81,127	(16,225)	[3,894]	{1,947}	81,380	(16,276)	[3,906]	{1,953}
Williamson	43,914	43,995	44,077	44,167	44,328	(8,866)	[2,128]	{1,064}	44,490	(8,898)	[2,136]	{1,068}	44,660	(8,932)	[2,144]	{1,072}

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.