

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

Date: 12/8/20

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 12/8/20 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.**

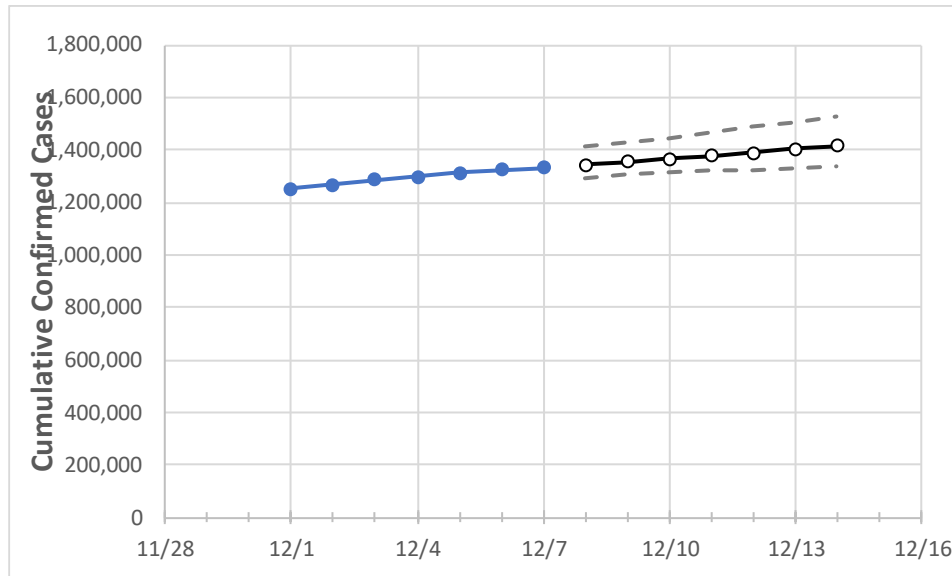
### IEM's Modeling Lead

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:							
	12/4	12/5	12/6	12/7	12/8	12/9	12/10	12/11	12/12	12/13	12/14	
Texas	1,299,469	1,311,643	1,322,738	1,331,719	1,343,211	1,354,808	1,366,508	1,378,312	1,390,220	1,402,230	1,414,344	

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 20%, and are often within 10%, of actual confirmed cases.

Texas Counties

	Actual Confirmed Cases On:				Projected Cases For:							
	12/4	12/5	12/6	12/7	12/8	12/9	12/10	12/11	12/12	12/13	12/14	
Bexar	85,201	85,895	86,986	88,196	89,482	90,838	92,267	93,773	95,359	97,030	98,789	
Brazoria	15,418	15,622	15,734	15,841	16,025	16,220	16,427	16,647	16,880	17,128	17,390	
Brazos	11,531	11,616	11,672	11,748	11,814	11,879	11,944	12,010	12,075	12,140	12,206	
Collin	28,105	28,547	29,239	29,554	30,073	30,618	31,189	31,787	32,413	33,070	33,758	
Dallas	144,645	146,320	148,172	148,172	149,363	150,570	151,792	153,029	154,282	155,550	156,833	
Denton	25,645	26,034	26,329	26,623	26,991	27,371	27,761	28,163	28,576	29,002	29,440	
El Paso	89,100	89,540	89,762	90,222	90,574	90,908	91,225	91,527	91,813	92,084	92,342	
Ellis	7,817	7,905	7,905	7,905	7,995	8,089	8,186	8,288	8,394	8,504	8,619	
Fort Bend	22,104	23,389	24,372	24,372	24,966	25,632	26,379	27,215	28,152	29,201	30,375	
Galveston	15,240	15,348	15,537	15,537	15,595	15,654	15,713	15,773	15,833	15,894	15,955	
Harris	195,558	196,658	198,961	199,597	200,265	200,932	201,596	202,259	202,920	203,579	204,237	
Hidalgo	45,387	45,387	45,387	45,387	45,661	45,946	46,244	46,554	46,877	47,215	47,567	
Johnson	6,213	6,364	6,364	6,364	6,461	6,563	6,669	6,781	6,899	7,022	7,152	
Lubbock	33,864	34,074	34,445	34,722	35,075	35,426	35,775	36,121	36,465	36,806	37,145	
McLennan	14,813	14,937	15,092	15,092	15,202	15,311	15,419	15,526	15,633	15,739	15,844	
Montgomery	18,934	19,151	19,367	19,584	19,853	20,130	20,415	20,709	21,011	21,323	21,644	
Tarrant	107,178	108,480	110,015	111,865	113,076	114,310	115,566	116,845	118,147	119,472	120,820	
Travis	39,566	39,925	40,209	40,481	40,778	41,082	41,391	41,707	42,029	42,358	42,693	
Williamson	14,012	14,186	14,359	14,533	14,750	14,972	15,199	15,431	15,668	15,911	16,160	

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:											
	12/4	12/5	12/6	12/7	12/9		12/11		12/13							
Bexar	85,201	85,895	86,986	88,196	90,838	(18,168)	[4,360]	{2,180}	93,773	(18,755)	[4,501]	{2,251}	97,030	(19,406)	[4,657]	{2,329}
Brazoria	15,418	15,622	15,734	15,841	16,220	(3,244)	[779]	{389}	16,647	(3,329)	[799]	{400}	17,128	(3,426)	[822]	{411}
Brazos	11,531	11,616	11,672	11,748	11,879	(2,376)	[570]	{285}	12,010	(2,402)	[576]	{288}	12,140	(2,428)	[583]	{291}
Collin	28,105	28,547	29,239	29,554	30,618	(6,124)	[1,470]	{735}	31,787	(6,357)	[1,526]	{763}	33,070	(6,614)	[1,587]	{794}
Dallas	144,645	146,320	148,172	148,172	150,570	(30,114)	[7,227]	{3,614}	153,029	(30,606)	[7,345]	{3,673}	155,550	(31,110)	[7,466]	{3,733}
Denton	25,645	26,034	26,329	26,623	27,371	(5,474)	[1,314]	{657}	28,163	(5,633)	[1,352]	{676}	29,002	(5,800)	[1,392]	{696}
El Paso	89,100	89,540	89,762	90,222	90,908	(18,182)	[4,364]	{2,182}	91,527	(18,305)	[4,393]	{2,197}	92,084	(18,417)	[4,420]	{2,210}
Ellis	7,817	7,905	7,905	7,905	8,089	(1,618)	[388]	{194}	8,288	(1,658)	[398]	{199}	8,504	(1,701)	[408]	{204}
Fort Bend	22,104	23,389	24,372	24,372	25,632	(5,126)	[1,230]	{615}	27,215	(5,443)	[1,306]	{653}	29,201	(5,840)	[1,402]	{701}
Galveston	15,240	15,348	15,537	15,537	15,654	(3,131)	[751]	{376}	15,773	(3,155)	[757]	{379}	15,894	(3,179)	[763]	{381}
Harris	195,558	196,658	198,961	199,597	200,932	(40,186)	[9,645]	{4,822}	202,259	(40,452)	[9,708]	{4,854}	203,579	(40,716)	[9,772]	{4,886}
Hidalgo	45,387	45,387	45,387	45,387	45,946	(9,189)	[2,205]	{1,103}	46,554	(9,311)	[2,235]	{1,117}	47,215	(9,443)	[2,266]	{1,133}
Johnson	6,213	6,364	6,364	6,364	6,563	(1,313)	[315]	{158}	6,781	(1,356)	[326]	{163}	7,022	(1,404)	[337]	{169}
Lubbock	33,864	34,074	34,445	34,722	35,426	(7,085)	[1,700]	{850}	36,121	(7,224)	[1,734]	{867}	36,806	(7,361)	[1,767]	{883}
McLennan	14,813	14,937	15,092	15,092	15,311	(3,062)	[735]	{367}	15,526	(3,105)	[745]	{373}	15,739	(3,148)	[755]	{378}
Montgomery	18,934	19,151	19,367	19,584	20,130	(4,026)	[966]	{483}	20,709	(4,142)	[994]	{497}	21,323	(4,265)	[1,023]	{512}
Tarrant	107,178	108,480	110,015	111,865	114,310	(22,862)	[5,487]	{2,743}	116,845	(23,369)	[5,609]	{2,804}	119,472	(23,894)	[5,735]	{2,867}
Travis	39,566	39,925	40,209	40,481	41,082	(8,216)	[1,972]	{986}	41,707	(8,341)	[2,002]	{1,001}	42,358	(8,472)	[2,033]	{1,017}
Williamson	14,012	14,186	14,359	14,533	14,972	(2,994)	[719]	{359}	15,431	(3,086)	[741]	{370}	15,911	(3,182)	[764]	{382}

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.