

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 12/2/20**

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 12/2/20 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.

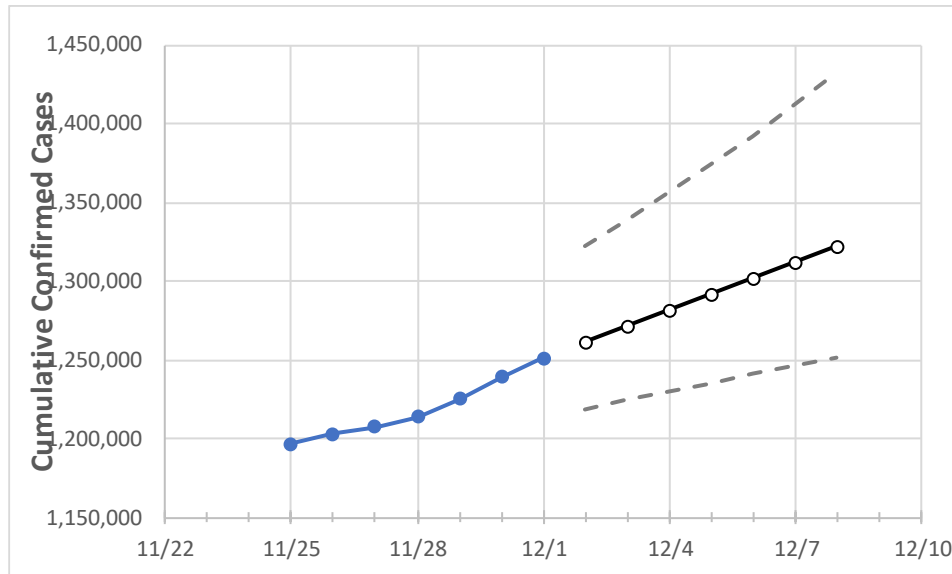
IEM's Modeling Lead

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:							
	11/28	11/29	11/30	12/1	12/2	12/3	12/4	12/5	12/6	12/7	12/8	
Texas	1,213,577	1,225,118	1,238,752	1,250,934	1,261,035	1,271,148	1,281,271	1,291,407	1,301,556	1,311,716	1,321,889	

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:							
	11/28	11/29	11/30	12/1	12/2	12/3	12/4	12/5	12/6	12/7	12/8	
Bexar	78,411	80,057	81,174	81,626	82,734	83,913	85,169	86,506	87,929	89,444	91,057	
Brazoria	14,255	14,389	14,511	14,609	14,713	14,821	14,933	15,049	15,171	15,297	15,428	
Brazos	10,998	11,021	11,094	11,185	11,231	11,275	11,319	11,361	11,402	11,442	11,481	
Collin	25,566	26,192	26,600	26,990	27,390	27,817	28,272	28,758	29,277	29,831	30,421	
Dallas	134,793	137,096	138,798	139,977	140,875	141,762	142,641	143,510	144,370	145,220	146,061	
Denton	23,276	23,460	23,644	24,133	24,416	24,703	24,995	25,291	25,591	25,897	26,207	
El Paso	85,318	85,696	86,172	86,752	87,175	87,573	87,947	88,300	88,633	88,945	89,240	
Ellis	6,875	6,898	6,898	6,898	6,961	7,025	7,091	7,159	7,228	7,300	7,373	
Fort Bend	20,440	20,504	20,567	20,739	20,899	21,068	21,245	21,431	21,627	21,833	22,050	
Galveston	14,635	14,691	14,961	14,961	15,041	15,123	15,207	15,292	15,379	15,468	15,559	
Harris	187,932	190,631	191,513	192,127	192,612	193,086	193,548	193,999	194,439	194,869	195,288	
Hidalgo	42,903	42,961	43,020	43,546	43,872	44,211	44,563	44,928	45,307	45,701	46,110	
Johnson	5,380	5,407	5,407	5,407	5,470	5,535	5,602	5,670	5,741	5,815	5,890	
Lubbock	31,499	31,858	32,236	32,426	32,821	33,215	33,606	33,995	34,381	34,766	35,148	
McLennan	14,181	14,258	14,334	14,410	14,514	14,614	14,713	14,809	14,902	14,993	15,082	
Montgomery	17,542	17,728	17,915	18,183	18,423	18,668	18,919	19,176	19,439	19,707	19,981	
Tarrant	96,968	97,294	100,650	102,051	102,845	103,630	104,405	105,171	105,928	106,676	107,416	
Travis	37,898	38,045	38,377	38,757	39,029	39,305	39,587	39,873	40,165	40,462	40,765	
Williamson	12,958	13,130	13,301	13,515	13,776	14,055	14,353	14,673	15,014	15,380	15,770	

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:											
	11/28	11/29	11/30	12/1	12/3			12/5			12/7					
Bexar	78,411	80,057	81,174	81,626	83,913	(16,783)	[4,028]	{2,014}	86,506	(17,301)	[4,152]	{2,076}	89,444	(17,889)	[4,293]	{2,147}
Brazoria	14,255	14,389	14,511	14,609	14,821	(2,964)	[711]	{356}	15,049	(3,010)	[722]	{361}	15,297	(3,059)	[734]	{367}
Brazos	10,998	11,021	11,094	11,185	11,275	(2,255)	[541]	{271}	11,361	(2,272)	[545]	{273}	11,442	(2,288)	[549]	{275}
Collin	25,566	26,192	26,600	26,990	27,817	(5,563)	[1,335]	{668}	28,758	(5,752)	[1,380]	{690}	29,831	(5,966)	[1,432]	{716}
Dallas	134,793	137,096	138,798	139,977	141,762	(28,352)	[6,805]	{3,402}	143,510	(28,702)	[6,888]	{3,444}	145,220	(29,044)	[6,971]	{3,485}
Denton	23,276	23,460	23,644	24,133	24,703	(4,941)	[1,186]	{593}	25,291	(5,058)	[1,214]	{607}	25,897	(5,179)	[1,243]	{622}
El Paso	85,318	85,696	86,172	86,752	87,573	(17,515)	[4,203]	{2,102}	88,300	(17,660)	[4,238]	{2,119}	88,945	(17,789)	[4,269]	{2,135}
Ellis	6,875	6,898	6,898	6,898	7,025	(1,405)	[337]	{169}	7,159	(1,432)	[344]	{172}	7,300	(1,460)	[350]	{175}
Fort Bend	20,440	20,504	20,567	20,739	21,068	(4,214)	[1,011]	{506}	21,431	(4,286)	[1,029]	{514}	21,833	(4,367)	[1,048]	{524}
Galveston	14,635	14,691	14,961	14,961	15,123	(3,025)	[726]	{363}	15,292	(3,058)	[734]	{367}	15,468	(3,094)	[742]	{371}
Harris	187,932	190,631	191,513	192,127	193,086	(38,617)	[9,268]	{4,634}	193,999	(38,800)	[9,312]	{4,656}	194,869	(38,974)	[9,354]	{4,677}
Hidalgo	42,903	42,961	43,020	43,546	44,211	(8,842)	[2,122]	{1,061}	44,928	(8,986)	[2,157]	{1,078}	45,701	(9,140)	[2,194]	{1,097}
Johnson	5,380	5,407	5,407	5,407	5,535	(1,107)	[266]	{133}	5,670	(1,134)	[272]	{136}	5,815	(1,163)	[279]	{140}
Lubbock	31,499	31,858	32,236	32,426	33,215	(6,643)	[1,594]	{797}	33,995	(6,799)	[1,632]	{816}	34,766	(6,953)	[1,669]	{834}
McLennan	14,181	14,258	14,334	14,410	14,614	(2,923)	[701]	{351}	14,809	(2,962)	[711]	{355}	14,993	(2,999)	[720]	{360}
Montgomery	17,542	17,728	17,915	18,183	18,668	(3,734)	[896]	{448}	19,176	(3,835)	[920]	{460}	19,707	(3,941)	[946]	{473}
Tarrant	96,968	97,294	100,650	102,051	103,630	(20,726)	[4,974]	{2,487}	105,171	(21,034)	[5,048]	{2,524}	106,676	(21,335)	[5,120]	{2,560}
Travis	37,898	38,045	38,377	38,757	39,305	(7,861)	[1,887]	{943}	39,873	(7,975)	[1,914]	{957}	40,462	(8,092)	[1,942]	{971}
Williamson	12,958	13,130	13,301	13,515	14,055	(2,811)	[675]	{337}	14,673	(2,935)	[704]	{352}	15,380	(3,076)	[738]	{369}

For additional information from IEM, please contact Bryan Koon, Vice President of Emergency Management and Homeland Security at bryan.koon@iem.com or 850-519-7966 or Stephanie Tennyson at stephanie.tennyson@iem.com or 202-309-4257.