

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

Date: 7/24/20

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

The projections shown in this document are based on data pulled in as of 7/24/20 11 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.

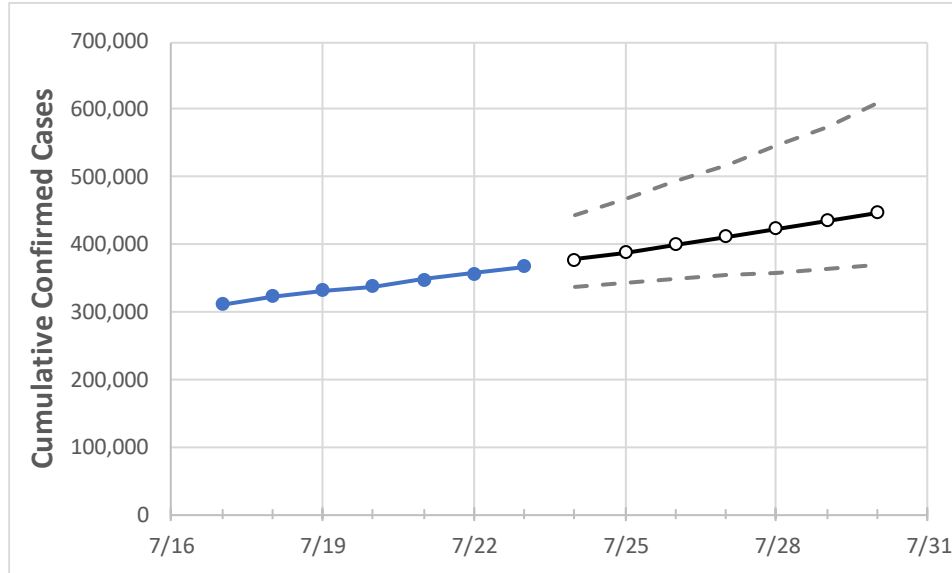
IEM's Modeling Lead

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:						
	7/20	7/21	7/22	7/23	7/24	7/25	7/26	7/27	7/28	7/29	7/30
Texas	337,258	347,762	357,245	366,982	377,561	388,426	399,586	411,048	422,824	434,921	447,348

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:						
	7/20	7/21	7/22	7/23	7/24	7/25	7/26	7/27	7/28	7/29	7/30
Bexar	31,316	32,896	33,555	34,633	35,818	37,047	38,322	39,644	41,015	42,436	43,910
Brazoria	4,767	4,896	5,068	5,177	5,351	5,533	5,723	5,922	6,129	6,346	6,572
Brazos	3,397	3,407	3,442	3,522	3,561	3,600	3,638	3,676	3,712	3,749	3,784
Collin	5,374	5,456	5,614	5,748	5,863	5,978	6,093	6,209	6,326	6,443	6,561
Dallas	41,266	42,292	43,026	43,439	44,282	45,123	45,964	46,802	47,639	48,474	49,307
Denton	4,968	5,098	5,316	5,544	5,712	5,888	6,071	6,262	6,460	6,668	6,883
El Paso	11,769	12,041	12,297	12,501	12,759	13,018	13,278	13,539	13,800	14,061	14,323
Ellis	2,051	2,090	2,129	2,183	2,228	2,273	2,318	2,364	2,410	2,457	2,504
Fort Bend	5,987	5,995	6,130	6,239	6,312	6,387	6,462	6,537	6,614	6,692	6,770
Galveston	7,240	7,354	7,479	7,663	7,809	7,954	8,097	8,238	8,379	8,517	8,655
Harris	55,769	57,095	58,480	59,924	61,538	63,200	64,912	66,674	68,488	70,355	72,277
Hidalgo	12,263	12,787	13,126	13,776	14,404	15,072	15,785	16,545	17,354	18,216	19,135
Johnson	1,029	1,057	1,085	1,133	1,168	1,205	1,243	1,283	1,324	1,367	1,412
Lubbock	4,482	4,556	4,656	4,769	4,862	4,954	5,047	5,140	5,233	5,327	5,420
McLennan	3,413	3,472	3,575	3,688	3,785	3,885	3,990	4,099	4,211	4,329	4,451
Montgomery	4,952	5,067	5,169	5,294	5,462	5,600	5,725	5,867	6,015	6,165	6,293
Tarrant	21,617	22,002	22,665	23,536	24,098	24,674	25,265	25,872	26,495	27,135	27,793
Travis	17,646	17,791	18,394	18,696	18,969	19,238	19,504	19,767	20,026	20,282	20,535
Williamson	4,792	4,888	4,981	5,071	5,189	5,309	5,431	5,556	5,682	5,811	5,942

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:											
	7/20	7/21	7/22	7/23	7/25				7/27				7/29			
Bexar	31,316	32,896	33,555	34,633	37,047	(7,409)	[1,778]	{889}	39,644	(7,929)	[1,903]	{951}	42,436	(8,487)	[2,037]	{1,018}
Brazoria	4,767	4,896	5,068	5,177	5,533	(1,107)	[266]	{133}	5,922	(1,184)	[284]	{142}	6,346	(1,269)	[305]	{152}
Brazos	3,397	3,407	3,442	3,522	3,600	(720)	[173]	{86}	3,676	(735)	[176]	{88}	3,749	(750)	[180]	{90}
Collin	5,374	5,456	5,614	5,748	5,978	(1,196)	[287]	{143}	6,209	(1,242)	[298]	{149}	6,443	(1,289)	[309]	{155}
Dallas	41,266	42,292	43,026	43,439	45,123	(9,025)	[2,166]	{1,083}	46,802	(9,360)	[2,246]	{1,123}	48,474	(9,695)	[2,327]	{1,163}
Denton	4,968	5,098	5,316	5,544	5,888	(1,178)	[283]	{141}	6,262	(1,252)	[301]	{150}	6,668	(1,334)	[320]	{160}
El Paso	11,769	12,041	12,297	12,501	13,018	(2,604)	[625]	{312}	13,539	(2,708)	[650]	{325}	14,061	(2,812)	[675]	{337}
Ellis	2,051	2,090	2,129	2,183	2,273	(455)	[109]	{55}	2,364	(473)	[113]	{57}	2,457	(491)	[118]	{59}
Fort Bend	5,987	5,995	6,130	6,239	6,387	(1,277)	[307]	{153}	6,537	(1,307)	[314]	{157}	6,692	(1,338)	[321]	{161}
Galveston	7,240	7,354	7,479	7,663	7,954	(1,591)	[382]	{191}	8,238	(1,648)	[395]	{198}	8,517	(1,703)	[409]	{204}
Harris	55,769	57,095	58,480	59,924	63,200	(12,640)	[3,034]	{1,517}	66,674	(13,335)	[3,200]	{1,600}	70,355	(14,071)	[3,377]	{1,689}
Hidalgo	12,263	12,787	13,126	13,776	15,072	(3,014)	[723]	{362}	16,545	(3,309)	[794]	{397}	18,216	(3,643)	[874]	{437}
Johnson	1,029	1,057	1,085	1,133	1,205	(241)	[58]	{29}	1,283	(257)	[62]	{31}	1,367	(273)	[66]	{33}
Lubbock	4,482	4,556	4,656	4,769	4,954	(991)	[238]	{119}	5,140	(1,028)	[247]	{123}	5,327	(1,065)	[256]	{128}
McLennan	3,413	3,472	3,575	3,688	3,885	(777)	[187]	{93}	4,099	(820)	[197]	{98}	4,329	(866)	[208]	{104}
Montgomery	4,952	5,067	5,169	5,294	5,600	(1,120)	[269]	{134}	5,867	(1,173)	[282]	{141}	6,165	(1,233)	[296]	{148}
Tarrant	21,617	22,002	22,665	23,536	24,674	(4,935)	[1,184]	{592}	25,872	(5,174)	[1,242]	{621}	27,135	(5,427)	[1,302]	{651}
Travis	17,646	17,791	18,394	18,696	19,238	(3,848)	[923]	{462}	19,767	(3,953)	[949]	{474}	20,282	(4,056)	[974]	{487}
Williamson	4,792	4,888	4,981	5,071	5,309	(1,062)	[255]	{127}	5,556	(1,111)	[267]	{133}	5,811	(1,162)	[279]	{139}

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.