

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

Date: 11/9/20

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 11/9/20 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.**

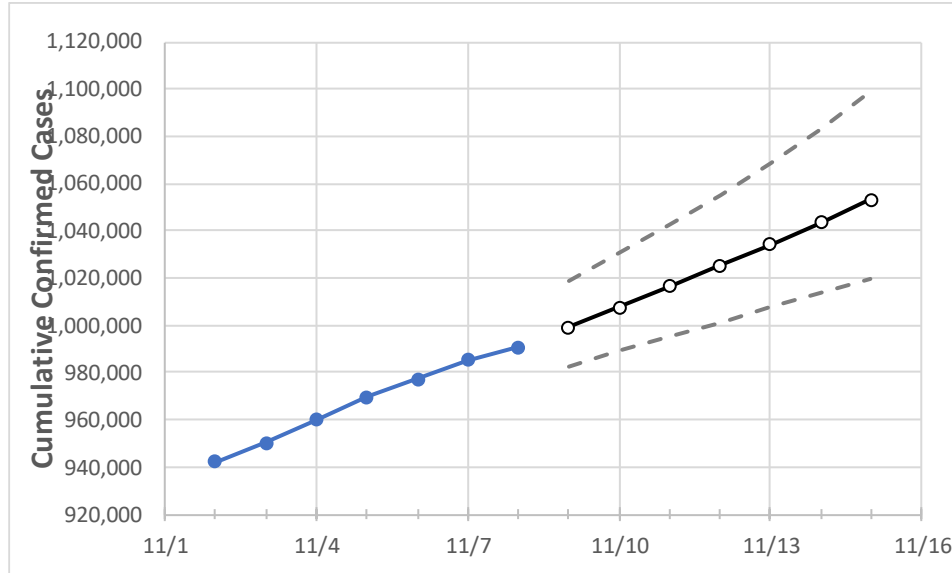
### IEM's Modeling Lead

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:							
	11/5	11/6	11/7	11/8	11/9	11/10	11/11	11/12	11/13	11/14	11/15	
Texas	969,490	977,222	985,061	990,930	999,173	1,007,623	1,016,287	1,025,171	1,034,281	1,043,622	1,053,204	

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:							
	11/5	11/6	11/7	11/8	11/9	11/10	11/11	11/12	11/13	11/14	11/15	
Bexar	66,909	67,127	67,365	67,627	67,858	68,092	68,328	68,568	68,810	69,055	69,304	
Brazoria	12,731	12,806	12,850	12,904	12,942	12,981	13,020	13,059	13,099	13,139	13,180	
Brazos	7,942	7,974	8,052	8,106	8,155	8,205	8,256	8,309	8,363	8,418	8,475	
Collin	19,480	19,701	19,810	20,165	20,386	20,619	20,864	21,123	21,396	21,684	21,987	
Dallas	99,160	99,761	100,628	101,282	101,872	102,469	103,074	103,685	104,303	104,929	105,562	
Denton	15,415	15,566	15,737	15,777	15,891	16,007	16,125	16,245	16,366	16,489	16,614	
El Paso	58,429	59,852	61,104	63,161	65,221	67,353	69,561	71,845	74,208	76,650	79,174	
Ellis	5,190	5,229	5,229	5,229	5,253	5,277	5,301	5,326	5,351	5,377	5,404	
Fort Bend	18,025	18,090	18,135	18,135	18,182	18,230	18,280	18,332	18,385	18,439	18,496	
Galveston	12,910	12,979	13,023	13,078	13,142	13,209	13,279	13,352	13,428	13,509	13,593	
Harris	165,252	165,967	166,545	167,331	167,997	168,678	169,376	170,091	170,822	171,571	172,337	
Hidalgo	36,493	36,686	36,686	36,686	36,785	36,886	36,988	37,092	37,197	37,304	37,413	
Johnson	3,972	4,006	4,007	4,007	4,022	4,037	4,052	4,067	4,082	4,096	4,110	
Lubbock	21,319	21,746	22,184	22,323	22,725	23,138	23,562	23,999	24,448	24,909	25,383	
McLennan	10,674	10,784	10,917	11,093	11,222	11,359	11,505	11,659	11,822	11,995	12,178	
Montgomery	14,280	14,280	14,280	14,280	14,329	14,378	14,427	14,476	14,524	14,572	14,620	
Tarrant	71,166	72,118	73,180	73,636	74,434	75,249	76,080	76,928	77,793	78,675	79,576	
Travis	32,748	32,928	33,016	33,168	33,308	33,453	33,602	33,756	33,916	34,081	34,251	
Williamson	9,815	9,848	9,848	9,848	9,878	9,909	9,939	9,971	10,002	10,034	10,066	

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:											
	11/5	11/6	11/7	11/8	11/10			11/12			11/14					
Bexar	66,909	67,127	67,365	67,627	68,092	(13,618)	[3,268]	{1,634}	68,568	(13,714)	[3,291]	{1,646}	69,055	(13,811)	[3,315]	{1,657}
Brazoria	12,731	12,806	12,850	12,904	12,981	(2,596)	[623]	{312}	13,059	(2,612)	[627]	{313}	13,139	(2,628)	[631]	{315}
Brazos	7,942	7,974	8,052	8,106	8,205	(1,641)	[394]	{197}	8,309	(1,662)	[399]	{199}	8,418	(1,684)	[404]	{202}
Collin	19,480	19,701	19,810	20,165	20,619	(4,124)	[990]	{495}	21,123	(4,225)	[1,014]	{507}	21,684	(4,337)	[1,041]	{520}
Dallas	99,160	99,761	100,628	101,282	102,469	(20,494)	[4,919]	{2,459}	103,685	(20,737)	[4,977]	{2,488}	104,929	(20,986)	[5,037]	{2,518}
Denton	15,415	15,566	15,737	15,777	16,007	(3,201)	[768]	{384}	16,245	(3,249)	[780]	{390}	16,489	(3,298)	[791]	{396}
El Paso	58,429	59,852	61,104	63,161	67,353	(13,471)	[3,233]	{1,616}	71,845	(14,369)	[3,449]	{1,724}	76,650	(15,330)	[3,679]	{1,840}
Ellis	5,190	5,229	5,229	5,229	5,277	(1,055)	[253]	{127}	5,326	(1,065)	[256]	{128}	5,377	(1,075)	[258]	{129}
Fort Bend	18,025	18,090	18,135	18,135	18,230	(3,646)	[875]	{438}	18,332	(3,666)	[880]	{440}	18,439	(3,688)	[885]	{443}
Galveston	12,910	12,979	13,023	13,078	13,209	(2,642)	[634]	{317}	13,352	(2,670)	[641]	{320}	13,509	(2,702)	[648]	{324}
Harris	165,252	165,967	166,545	167,331	168,678	(33,736)	[8,097]	{4,048}	170,091	(34,018)	[8,164]	{4,082}	171,571	(34,314)	[8,235]	{4,118}
Hidalgo	36,493	36,686	36,686	36,686	36,886	(7,377)	[1,771]	{885}	37,092	(7,418)	[1,780]	{890}	37,304	(7,461)	[1,791]	{895}
Johnson	3,972	4,006	4,007	4,007	4,037	(807)	[194]	{97}	4,067	(813)	[195]	{98}	4,096	(819)	[197]	{98}
Lubbock	21,319	21,746	22,184	22,323	23,138	(4,628)	[1,111]	{555}	23,999	(4,800)	[1,152]	{576}	24,909	(4,982)	[1,196]	{598}
McLennan	10,674	10,784	10,917	11,093	11,359	(2,272)	[545]	{273}	11,659	(2,332)	[560]	{280}	11,995	(2,399)	[576]	{288}
Montgomery	14,280	14,280	14,280	14,280	14,378	(2,876)	[690]	{345}	14,476	(2,895)	[695]	{347}	14,572	(2,914)	[699]	{350}
Tarrant	71,166	72,118	73,180	73,636	75,249	(15,050)	[3,612]	{1,806}	76,928	(15,386)	[3,693]	{1,846}	78,675	(15,735)	[3,776]	{1,888}
Travis	32,748	32,928	33,016	33,168	33,453	(6,691)	[1,606]	{803}	33,756	(6,751)	[1,620]	{810}	34,081	(6,816)	[1,636]	{818}
Williamson	9,815	9,848	9,848	9,848	9,909	(1,982)	[476]	{238}	9,971	(1,994)	[479]	{239}	10,034	(2,007)	[482]	{241}

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.