

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

Date: 8/7/20

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 8/7/20 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.

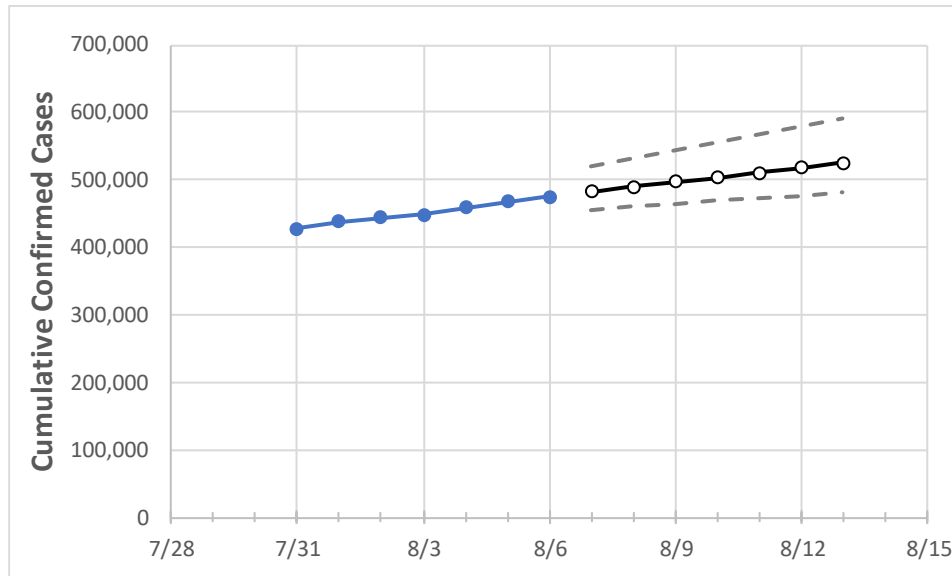
IEM's Modeling Lead

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:							
	8/3	8/4	8/5	8/6	8/7	8/8	8/9	8/10	8/11	8/12	8/13	
Texas	449,018	458,285	467,247	474,951	482,134	489,337	496,557	503,795	511,049	518,318	525,602	

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:							
	8/3	8/4	8/5	8/6	8/7	8/8	8/9	8/10	8/11	8/12	8/13	
Bexar	41,229	41,274	41,614	41,939	42,161	42,373	42,577	42,771	42,956	43,134	43,303	
Brazoria	6,732	6,810	6,887	6,988	7,091	7,195	7,299	7,405	7,510	7,617	7,724	
Brazos	3,922	3,936	3,953	3,973	3,993	4,013	4,033	4,051	4,070	4,087	4,105	
Collin	6,403	6,421	6,738	6,857	6,903	6,948	6,992	7,035	7,078	7,120	7,161	
Dallas	51,108	51,490	52,131	52,639	53,125	53,601	54,067	54,523	54,970	55,407	55,835	
Denton	6,938	7,032	7,127	7,257	7,357	7,456	7,556	7,655	7,754	7,853	7,951	
El Paso	14,914	15,142	15,427	15,596	15,783	15,969	16,154	16,338	16,521	16,703	16,884	
Ellis	2,521	2,545	2,691	2,739	2,768	2,796	2,825	2,853	2,881	2,909	2,936	
Fort Bend	7,191	7,287	7,867	8,559	8,687	8,820	8,959	9,104	9,255	9,411	9,575	
Galveston	8,825	8,999	9,106	9,168	9,241	9,311	9,379	9,446	9,510	9,572	9,632	
Harris	76,642	78,105	79,543	80,914	82,468	84,045	85,646	87,271	88,920	90,594	92,293	
Hidalgo	17,353	17,751	18,249	18,699	18,981	19,263	19,546	19,830	20,114	20,399	20,684	
Johnson	1,593	1,619	1,730	1,760	1,803	1,848	1,893	1,940	1,988	2,037	2,087	
Lubbock	5,593	5,652	5,751	5,811	5,867	5,923	5,978	6,032	6,086	6,139	6,191	
McLennan	4,436	4,571	4,694	4,748	4,811	4,875	4,939	5,004	5,068	5,133	5,199	
Montgomery	6,259	6,291	6,397	6,459	6,512	6,563	6,613	6,662	6,709	6,756	6,801	
Tarrant	29,054	29,357	30,162	30,227	30,555	30,878	31,198	31,514	31,825	32,133	32,437	
Travis	21,214	21,549	21,822	22,024	22,214	22,401	22,587	22,771	22,953	23,133	23,311	
Williamson	5,793	5,832	5,930	5,949	5,990	6,029	6,067	6,104	6,140	6,174	6,208	

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:											
	8/3	8/4	8/5	8/6	8/8			8/10			8/12					
Bexar	41,229	41,274	41,614	41,939	42,373	(8,475)	[2,034]	{1,017}	42,771	(8,554)	[2,053]	{1,026}	43,134	(8,627)	[2,070]	{1,035}
Brazoria	6,732	6,810	6,887	6,988	7,195	(1,439)	[345]	{173}	7,405	(1,481)	[355]	{178}	7,617	(1,523)	[366]	{183}
Brazos	3,922	3,936	3,953	3,973	4,013	(803)	[193]	{96}	4,051	(810)	[194]	{97}	4,087	(817)	[196]	{98}
Collin	6,403	6,421	6,738	6,857	6,948	(1,390)	[333]	{167}	7,035	(1,407)	[338]	{169}	7,120	(1,424)	[342]	{171}
Dallas	51,108	51,490	52,131	52,639	53,601	(10,720)	[2,573]	{1,286}	54,523	(10,905)	[2,617]	{1,309}	55,407	(11,081)	[2,660]	{1,330}
Denton	6,938	7,032	7,127	7,257	7,456	(1,491)	[358]	{179}	7,655	(1,531)	[367]	{184}	7,853	(1,571)	[377]	{188}
El Paso	14,914	15,142	15,427	15,596	15,969	(3,194)	[767]	{383}	16,338	(3,268)	[784]	{392}	16,703	(3,341)	[802]	{401}
Ellis	2,521	2,545	2,691	2,739	2,796	(559)	[134]	{67}	2,853	(571)	[137]	{68}	2,909	(582)	[140]	{70}
Fort Bend	7,191	7,287	7,867	8,559	8,820	(1,764)	[423]	{212}	9,104	(1,821)	[437]	{218}	9,411	(1,882)	[452]	{226}
Galveston	8,825	8,999	9,106	9,168	9,311	(1,862)	[447]	{223}	9,446	(1,889)	[453]	{227}	9,572	(1,914)	[459]	{230}
Harris	76,642	78,105	79,543	80,914	84,045	(16,809)	[4,034]	{2,017}	87,271	(17,454)	[4,189]	{2,095}	90,594	(18,119)	[4,349]	{2,174}
Hidalgo	17,353	17,751	18,249	18,699	19,263	(3,853)	[925]	{462}	19,830	(3,966)	[952]	{476}	20,399	(4,080)	[979]	{490}
Johnson	1,593	1,619	1,730	1,760	1,848	(370)	[89]	{44}	1,940	(388)	[93]	{47}	2,037	(407)	[98]	{49}
Lubbock	5,593	5,652	5,751	5,811	5,923	(1,185)	[284]	{142}	6,032	(1,206)	[290]	{145}	6,139	(1,228)	[295]	{147}
McLennan	4,436	4,571	4,694	4,748	4,875	(975)	[234]	{117}	5,004	(1,001)	[240]	{120}	5,133	(1,027)	[246]	{123}
Montgomery	6,259	6,291	6,397	6,459	6,563	(1,313)	[315]	{158}	6,662	(1,332)	[320]	{160}	6,756	(1,351)	[324]	{162}
Tarrant	29,054	29,357	30,162	30,227	30,878	(6,176)	[1,482]	{741}	31,514	(6,303)	[1,513]	{756}	32,133	(6,427)	[1,542]	{771}
Travis	21,214	21,549	21,822	22,024	22,401	(4,480)	[1,075]	{538}	22,771	(4,554)	[1,093]	{547}	23,133	(4,627)	[1,110]	{555}
Williamson	5,793	5,832	5,930	5,949	6,029	(1,206)	[289]	{145}	6,104	(1,221)	[293]	{146}	6,174	(1,235)	[296]	{148}

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.